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A PLANNING APPROACH TO INFORM FUNDING FOR PUBLIC HEALTH CARE SERVICES IN SOUTH AFRICA

BY

MARK STEPHEN BLECHER

THESIS PRESENTED FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

IN THE DEPARTMENT OF PUBLIC HEALTH

FACULTY OF HEALTH SCIENCE

UNIVERSITY OF CAPE TOWN

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This thesis is presented in fulfilment of the requirements for the degree of Doctor of Philosophy (PhD) in the area of Health Economics in the Department of Public Health, Faculty of Health Sciences, University of Cape Town. The work on which this thesis is based is original research and has not, in whole or in part, been submitted for another degree at this or any other university. The university is empowered to reproduce all or part of the contents for the purposes of research.

Mark Blecher
February 2007

ABSTRACT

This thesis examines the "supply" and "demand" for health care expenditure in South Africa's public sector health care services. In this context supply refers to the availability of funding and demand to the requirement for funding. The literature review focuses on health sector planning and its application to inform sector funding. A quantitative health sector planning model is developed and applied to inform the requirement for funding public sector health services. Uses of the model include simulation, forecasting and scenario planning.

Trends in public sector health service funding and expenditure are explored for the period from 1995/96 to 2008/09. Public sector funding is analysed within the context of government's broader fiscal and expenditure choices. The analysis shows that health care spending increases by an average of 3.8% in real terms annually from 1995/96 to 2008/09, but in three distinct phases, characterized by the fiscal policies of these periods. The first was a period of growth and reconstruction and salary improvements in the immediate post-apartheid period. The second was a period of fiscal constraint from 1996/97 to 1999/2000 associated with an internally imposed structural adjustment programme known as GEAR. The third has been a period of more expansionary budgets since 2000/01. A supply side model is developed to predict forward funding levels to 2010/11. The funding model predicts average annual real funding growth of 4.9% (3.9%-6.4%) for public sector health services from 2004/05 to 2010/11.

A situational and expenditure analysis is undertaken as a first step to planning. This shows that the additional R13.5 billion funding, which has been made available for health services from 1995/96 to 2005/06, has been more than consumed by the effects of population growth, the emergence of a large HIV/AIDS epidemic and the effects of rising unit costs of inputs. These have placed the sector under substantial pressure, aggravated by limited growth in health personnel numbers which have only recently reached levels of a decade ago (235 000). This is despite increases in need, an increase in primary care visits by 20 million (from 81.9 million to 101.8 million annually) and over 200 000 patients having been started on anti-retroviral treatment.

In order to model future scenarios for the national health care system a quantitative health sector planning model is developed, drawing in part on previous work by Denton, Wanless and Navarro, the Department of Health's Integrated Health Planning Framework and other techniques explored in the literature review. The model contains components such as for primary health care, hospital and emergency medical services. Each component contains a staffing model and provision for other inputs so that the model is able to generate costs, human resource and hospital bed requirements for the

sector and its component parts.

The model is applied to create a set of scenarios for the health service in 2010/11. The model finds that there will be at least three major groups of cost pressures. The first arises from increasing demand largely to address unmet need, such as for increasing AIDS treatment and primary care and hospital inpatient and outpatient visits. The second is to improve services and quality through better staffing and other aspects of improved resourcing. The third is through continued pressure on input costs such as wages. The combined effects of these is a "bust" scenario in which the health service over-spends by R15.5 billion (26.8%) in 2010/11. In contrast the "no change" scenario sees substantial additional funds expended on poorly controlled input costs and a partially ineffectual response to HIV/AIDS, with limited or no improvement in health services. The "efficiency gains" scenario sees spending on the public sector health system increasing strongly from R43.9 billion to R67.1 billion, a 53% real increase over the six year period from 1994/05 to 2010/11. This scenario demonstrates that efficiency gains will be essential to release funds to achieve service improvements and allow for higher levels of outputs.

Achieving positive scenarios will require substantial management capacity as there are powerful cost pressures and a range of unfavourable scenarios could easily emerge. Some of the critical factors to achieve the more successful scenarios include active pursuit of efficiency gains, successful motivation for higher funding options, strong effective management, early attention to strengthening human resource supply, properly functioning referral systems which reduce bypassing, a careful approach to input costs such as wage determination and a decisive and effective approach to HIV/AIDS.

The funding and quantitative planning models have allowed the availability and requirement for funding of public health services to be explored. The research is potentially of use contextually in this middle income country and with reference to the planning literature.

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ABBREVIATIONS

ASSA	Actuarial Society of South Africa
Bil or bn	Billion
CHC	Community health centre
COIDA	Compensation for Occupational Injuries and Diseases Act
CS	Community Service
DHIS	District Health Information System
DOH	Department of Health
GDP	Gross Domestic Product
GEAR	Growth, Employment and Redistribution policy
HST	Health Systems Trust
IHPF	Integrated Health Planning Framework
I$	International dollars; i.e. United States dollars adjusted for purchasing power parity
LOS	Length of stay
Mil	Million
MTS	Modernisation of Tertiary Services
NGO	Non-governmental Organisation
NHA	National Health Accounts project
NTSG	National Tertiary Services grant
OPD	Outpatient Department
PDE	Patient day equivalent
PHC	Primary Health Care
Provincial names	Eastern Cape (EC), Free State (FS), Gauteng (Gaut), Kwazulu-Natal (KZN), Limpopo (Lim), Mpumalanga (Mpum), Northern Cape (NC) and Western Cape (WC)
R	Rand
RAF	Road Accident Fund
SHI	Social Health Insurance
WCA	Workmen's Compensation Fund
WHO	World Health Organisation

National Health Council	Statutory Forum of national Minister of Health and provincial Members of Executive Councils responsible for health services
Patient day equivalent (PDE)	A composite measure of hospital workload, calculated as inpatient days + 1/3* (outpatient visits)
Real prices:	Prices adjusted for inflation (CPIX) – constant prices
Revenue or fund pooling	The degree to which collected funds are shared between contributors

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CHAPTER 1: INTRODUCTION

What level of funding is required to deliver an appropriate public sector health service and what is likely to be available? Hoffmeyer and McCarthy refer to these as the demand and supply sides of health care expenditure.[1] This thesis researches these questions within the context of South Africa, a middle income country with a high disease burden due to HIV/AIDS.

On the supply side the availability of health sector funding is dependant on the size of the national gross domestic product (GDP), government expenditure as a share of GDP and on the share of government resources allocated to health care. Funding depends on the effectiveness of revenue raising mechanisms, including taxation and dedicated financing mechanisms such as social health insurance and user fees, on the degree of resource pooling (i.e. the extent to which collected funds are shared between contributors), resource allocation methods and on political choices and priorities.

On the other hand, the requirement for funding depends on need and demand and on the nature of the health service and its costs. Need refers to the capacity to benefit from appropriate treatment or prevention.[1] The related concept of "wants" refers to perceived needs. Need varies, amongst others, with age and illness profile and such criteria are frequently included in resource allocation formulae.[2]

Where the availability of funding and the need for funding differ a gap exists. Hoffmeyer developed equations for supply and demand for health care expenditure and attempted to model the size of the funding gap over time in OECD countries.[1] When funding is less than required this may be associated with low quantity of services supplied such as rudimentary services in many undeveloped countries and rationing, unmet demand such as queues and waiting lists, or substitution by less costly service types or lower level workers.

AVAILABILITY OF PUBLIC FUNDING FOR HEALTH SERVICES

Levels of funding for health services vary substantially across countries, typically rising as a proportion of Gross Domestic Product (GDP) as GDP increases. It has been estimated that 90% of the world's health expenditure is consumed by 10% of the world's population.[3] In some of the least developed countries funding may amount to only a few dollars a year and less than 1% of GDP. For example Nigeria, a country of 120 million people, spent only $3 per capita per year on public health care or 0.8% of GDP.[4] In contrast OECD countries spend on average 9.9% of GDP on health services or around I$2347 per capita, even with an adjustment for purchasing power parity.[1,3] Even if overall levels of funding are adequate, inequities and inefficiencies may obstruct provision of services.

Developed economies such as OECD countries tend to have organized and collective systems of health care and health care financing such as National Health Insurance and National Health Service systems. These systems have a high degree of public financing and resource pooling, which makes them fairly equitable. In contrast many developing (and some developed) countries have very separate systems of public and private health care financing with little pooling across these streams.

Requirement for funding

Various approaches have been used to quantify need and cost the funding requirements of health services. What is an appropriate level of funding and how can this be determined?

There has been growing international interest in the costing and funding of a basic package of health services. The influential 1993 World Bank World Development Report applied the criteria of burden of disease and cost-effectiveness to develop an essential package of health services.[5,6] This package was costed and amounted to an average of US$12 per person per year for low income countries or $22 in middle income countries. The Commission for Macro-economics and Health more recently recosted a basic service package[7] and urged donor nations to increase support to the world's poorest countries unable to finance this with domestic resources. However such packages tend to comprise only a selected minimalist set of cost-effective services as opposed to comprehensively addressing health needs and so do not provide a good indicator for an appropriate level of funding, especially for a middle income country such as South Africa. These approaches are also influenced by an ideological underpinning that government provide only the most essential public sector health goods and that the private sector should be the main financer and provider of all but the most essential services.

Various approaches have been used over the past decade to estimate the funding requirements for component parts of the South African health service. Input based costing approaches identify and cost a set of resources required to produce desired outputs. For example the South African Hospital Strategy project costed various model hospital staff establishments in an attempt to derive affordable bed norms for the country.[30] A South African proposal for a national primary health care system attempted to define and cost a particular staff establishment in a health district with a population of 100 000.[8] Output based costing approaches focus on the quantity of services utilised by different

1 I$ or International dollars is a derived currency calculation which adjusts $US spending by a factor to take into account relative purchasing power across countries

groups and apply appropriate unit costs, often derived from particular settings or claiming patterns, sometimes adjusted for new interventions or efficiency gains. For example a recent costing of a new medical scheme for South African civil servants examined utilization and claiming patterns for different age, sex and family sizes (personal communication R. de Silva). An influential South African costing of a package of primary care services was based on utilization rates for component services (TB, maternal etc.) and the unit costs of each of these services.[9]

The cost of the health service and thus its funding requirements depends on the nature and mix of health service outputs and inputs and their unit costs. Health services differ greatly across countries, although globalisation no doubt facilitates sharing of lessons and experiences across countries. Services are located to various degrees in the homes of traditional healers, small rural clinics or large central hospitals. They may be delivered by village health workers, primary care nurses or medical super-specialists in a variety of combinations and staffing levels. Unit costs of labour and services vary substantially across countries. The quantity of services demanded may exceed what is needed, for example when clients use services for trivial conditions or when the quantity of service supplied is excessive, or may be less than need when services are poorly developed or not trusted. In health systems, demand is often strongly influenced by supply.

Funding and planning

Estimating the funding requirements of the health system as a whole without reference to the nature, structure and unit costs of a given health care system is likely to be simplistic. Segall argues that in the context of resource scarcity a planning approach is essential to guide allocative decisions.[10] He points to a common problem of countries, especially after structural adjustment, having difficulty keeping even existing services in operation, the problem of additional funds being overwhelmingly consumed by new facilities constructed without adequate attention given to their recurrent costs and the need to improve services through freeing up resources inefficiently used elsewhere. He calls for a quantitative process of health sector development planning that helps to set resource targets for specific services.

Health planning is the discipline that attempts to design the optimal configuration of health care services to meet needs and demand. Financial planning, budgeting, service and human resource planning must be closely aligned. Planning of public sector health services attempts to assess needs and demands and use inputs to produce outputs at efficient unit costs.

Health service funding is linked to planning in several ways. Health sector plans typically attempt to determine the optimal configuration of interventions and services required to meet health needs within given funding envelopes. A funding level provides a limit or constraint for a health service plan. Within this limit various combinations of inputs can be purchased and outputs produced. Choices must be made between funding hospitals, primary care services, ambulance services and so on. However sector needs and associated policies and plans in turn provide a motivation for those responsible for funding decisions to modify the funding limit. In a similar way to health authorities allocating resources between functions, treasuries and governments must allocate resources across sectors. There is thus a close and bidirectional relationship between funding and planning. The language of this relationship is expressed in terms such as needs, resources, value for money, effectiveness, technical efficiency, equity, allocative efficiency, outcomes, and so on.

South African health care financing system

The nature of sector financing and planning systems are influenced by the structure of the overall health care system within countries. Various typologies or approaches to classifying health systems have been developed.[11] In terms of Field's typology, South Africa is probably best classified as a pluralistic system, because of its extensive mix of public and private health sectors.[12] Roemer distinguishes between underdeveloped, transitional and modern systems, of which the latter include free enterprise, welfare state and socialist systems. In terms of Roemer's typology, the South Africa system might be seen as a transitional system, given it's changing from traditional to modern systems and potential evolution of new systems such as social health insurance.[13] Van Rensberg notes that pure free enterprise systems are rarely the predominant national system of health care, with the United States being one of the few. He demonstrates a spectrum of systems of financing and organization, ranging from the individual and personal to the organised and collective, with National Health Services and National or Social Health Insurance systems being common in developed states. The nature of planning differs somewhat in different systems, with varying roles of central planning, market forces, regulatory, competitive, licensing and other systems, which influence the nature and distribution of health services.

South Africa is a middle income country. Following centuries of racial and class discrimination it is one of the most inequitable countries in the world. South Africa's health care financing system is an example of a country with very different public and private financing components, with little revenue pooling across these major revenue streams.

Public financing is dominated by general tax revenue. The country has a strong Internal Revenue Service, the South African Revenue Service (SARS). Government is structured in three levels; national, provincial and local. Most revenue is collected by the national sphere and the intergovernmental financing system consists of a set of unconditional and conditional transfers of funds from the national to the nine provincial governments. Health services are largely a provincial function. Local government is predominantly self-funding through property rates and other revenue sources.

Private financing for the highest income quintile of population is dominated by private medical schemes, which cover 15% of the total population.[13] South Africa has comparatively high levels of private financing and middling levels of public finance, as judged by spending as a proportion of GDP against countries of a similar income level.[14]

South Africa has very limited contributory social insurance systems providing partial coverage for occupational injuries, unemployment insurance and road accidents. An ongoing domestic debate is whether to develop broader contribution-based social security systems.

The last complete review of health care financing flows in South Africa was the National Health Accounts project, which reported on financing and expenditure trends for the three years till 1998/99.[15,16] This study found, that in 98/99 R101.4 billion in 05/06 prices (R70.2 billion in 1999 prices) flowed through health sector financing intermediaries. These intermediaries are bodies such as medical schemes or government purchasers, which collect revenue from primary funding sources and use them to purchase services from provider groups such as hospitals and clinics (see methodology chapter). This comprised 8.8% of GDP, with private financing intermediaries constituting 59% of the total.

Problem

Are public health services in South Africa (SA) adequately and appropriately funded? How well does the requirement for funding match the availability of funding? Typically, the South African literature has considered the total level of health sector financing to be reasonably adequate, particularly in comparison to other middle income countries.[18] However almost 60% of this financing is private and benefits only a small proportion of the population.[18] Public sector funding levels are fairly average compared to other middle income countries[4] and given the country's particular needs and burden of disease should perhaps be higher. A different view, namely that the public health sector is substantially under-funded, is widely believed by clinical health professionals and organizations, and is extremely frequently portrayed by the media and many health care managers. These perceptions may arise partly from hopes for a better health care system after decades of deprivation and sub-optimal care under an apartheid system.

The last major review of health care funding in South, the National Health Accounts (NHA) project reported two phases of public health care financing in the 1990s, namely substantial growth in funding from 1992/93 to 1997/98 but expressed concerns about declines in funding in a second phase from 1998/99. Recent reviews[19,20,21] have shown a third phase of increasing funding resumed from 2000/01 but that overall per capita funding levels remained fairly flat over the first decade of democracy.

Questions have been raised around the adequacy of growth in public sector funding within the context of a domestic macro-economic stabilisation programme known as GEAR (often considered to be an internally imposed structural adjustment programme[22]) and given the pressures of population growth, HIV/AIDS, and the rising costs of inputs such as personnel. For example, the Department of Health in the Western Cape Province of South Africa downsized by 9282 personnel (27.9%) and closed 3601 hospital beds (24.4%) over 5 years in the late 1990s. More detail on the case-study of downsizing of health services in the Western Cape province is found in Appendix A.[23] At the same time provinces that were previously highly disadvantaged such as the Eastern Cape have not succeeded in significantly increasing health resources such as personnel. These kinds of problems raise important questions on appropriate levels of resourcing and how needs and demand should be met by health services.

Certainly, the burden of disease in South Africa is high and health outcomes such as infant mortality rate and life expectancy are poor, given the level of national GDP and health care funding. This is often attributed to gross inequities and poverty, partly based in the history of the discriminatory apartheid system, and to inefficiencies including excessive expenditure on expensive tertiary specialist care at the expense of basic primary care and pubic health needs. More recently the effects of the HIV epidemic have worsened population indicators, reversing many positive developmental reforms. The emergence of HIV/AIDS as a huge pandemic affecting the region has had a profound influence on the health sector. A number of authors, some working in collaboration with civil society advocacy groups have published work on financial aspects of interventions to address the rapidly expanding epidemic.[24,25,26]

Huge differentials in public and private sector financing with relatively limited revenue pooling have also stood out as an issue. While the majority of health care financing and expenditure is in the private sector, only 15% of the population has regular access to private health services, particularly hospitals. The great inequities in per capita expenditure between public and private health sectors (spending per medical scheme beneficiary was approximately 6.7 times public provincial and national Department of Health spending in 2005/06, R8057 vs. R1202 per capita, author's data) suggest potential for cross-subsidisation, with one of the potential new vehicles proposed being social health insurance.[27]

Some of the basis for relatively poor outcomes may result from inefficiencies as opposed to the adequacy of the level of funding. Much of the early post 1994 literature argued that severe allocative inefficiencies existed, with inadequate attention being placed on a sound foundation of basic primary health care services and over-emphasis on specialist tertiary health services.[28] However as resources after 1994 have been progressively shifted towards primary health care, hospital services have in some cases been compromised, leading to growing uncertainty around the correct balance to be achieved. Much of the work around allocative efficiency has been fairly simplistic. There has been relatively little work on normative approaches to inform appropriate levels of sector financing. Some work has been done in the area of primary health care (unpublished documents by Brijlal and Collins) and on hospitals, but these have in most cases not been implemented.[29] There has been relatively little published work done on technical efficiency in the South African health sector.[30] This has been a significant omission, since inadequate understanding of technical efficiencies has limited our knowledge of what funding is required to provide reasonable quality services of each particular type. Also limited understanding of cost structures and changes in the costs of inputs has sometimes led to mistaken or incomplete interpretations of budget or expenditure increases and technical efficiency.

There is also evidence of deficiencies in certain key inputs. Staff to population ratios for most categories of health professional have dropped over a decade in the public health service. The 2004 Annual Health Review highlighted substantial problems in human resources in the health sector, including the absence of a credible national human resources plan. [31] More recently there has been some progress in this area.[32] There are significant numbers of South African trained professionals registered in other countries. With a few notable exceptions, there has been surprisingly little work on health personnel financing and planning.[33,34,35]

The apartheid system within which health care services evolved in South Africa over many decades was structured around systematic inequities. A great deal of research has been undertaken documenting inequities in the South African health care system which undermine funding to particular provinces or districts regardless of the overall level of funding available.[36,37] However there has been limited academic analysis of the formulae and approaches used in the specific public funding streams for health. South Africa's intergovernmental funding system is based on an unconditional block grant and various special purpose conditional grants. The former is known as the equitable share formula and the latter include major conditional grants, such as the National Tertiary Services grant, the Health Professions Training and Development grant, the Hospital Revitalisation grant, the HIV/AIDS grant and the Hospital Management and Quality Improvement grant. Given that these financing streams underlie many of the inequities and service configuration of the sector it is somewhat surprising that they have not received wider academic attention.

PURPOSE

The purpose of the thesis is to better understand the availability of funding for public sector health services in South Africa and its basis in government fiscal and expenditure policy and to develop a quantitative health sector planning model to explore the requirement for funding and inform future allocations to the health sector.

OBJECTIVES

1. To describe and analyse trends in public sector health care funding in the context of government's fiscal and expenditure policy choices
1.1. To describe trends in funding of public health services over the past decade.
1.2. To analyse these funding trends within the context of government's fiscal and expenditure choices and compare funding of public health services in South Africa with other comparable middle income countries.
1.3. To develop a method to project potential available public funding for health services to 2010/11.
1.4. To analyse equity in allocations to public health services across provinces.
2. To develop a quantitative health service planning model to inform health sector funding requirements.
2.1. To collect selected baseline data which will inform the planning model including trends in public sector health expenditure by functional area and economic classification, linking this to outputs, unit costs, efficiency and equity.
2.2. To review some of the key goals of the South African Department of Health.
2.3. To develop a quantitative health sector planning model.
2.4. To apply the model to make projections about requirement for funding for the public sector health service in 2010/11.
2.5 To analyse and discuss the results of the research and make appropriate recommendations for reform.

OUTLINE OF THESIS

Based on the objectives detailed above, the thesis unfolds through the following chapters:

PART 1: INTRODUCTION AND LITERATURE REVIEW

- Chapter 1 is an introduction to the thesis

- Chapter 2 provides a literature review on health planning and its linkages to sector resource allocation and budgeting.

PART 2: AVAILABILITY OF FUNDING

- Chapter 3 is the first of two chapters detailing methods used in this research. This chapter presents the methodology used in the analysis of public sector health care funding.
- Chapter 4 (objectives 1.1 and 1.2) presents an analysis of public health care funding trends in the context of government's fiscal and expenditure policy choices as well as international comparisons.
- Chapter 5 (objective 1.4) takes forward the funding analysis of chapter 4 to focus on provincial funding trends and equity issues.

PART 3: REQUIREMENT FOR FUNDING

- Chapter 6 provides a situational analysis focusing on baseline expenditure patterns, outputs, unit costs and efficiency indicators for health services such as hospitals and primary health care services (objective 2.1).
- Chapter 7 reviews key goals of the Department of Health (objective 2.2).
- Chapter 8 is the second chapter on methodology and focuses on the development of a quantitative health sector planning model (objective 2.3).
- Chapter 9 contains results from applying the planning model and projections for sector funding requirements (objective 2.4).

PART 4: DISCUSSION AND CONCLUSION

- Chapter 10 brings together the preceding chapters in analytic discussion.
- Chapter 11 provides conclusions and recommendations

STATEMENT OF OWN CONTRIBUTION

The chapters dealing with the introduction (1), literature review (2), methodology (3), analysis of public sector health care funding (4), equity (5), expenditure and situational analysis (6), summary of sector goals (7), discussion (10) and conclusions (11) are entirely the author's own work. The development of the sector planning model (8) was initially done partly by a work group on the Integrated Health Planning Framework of the national Department of Health, with some of its modules drawing from a number of preexisting and specifically developed sector planning approaches. However the author played a key role in developing the model including creating its first functioning version and playing a significant role in its early design. This drew partly on a sector planning model, known as the normative model, developed and applied by the author in the Western Cape Province. The version of the model presented here has been extensively modified by the author and differs substantially from that currently used by the Department of Health, which has metamorphosed into a substantially different approach. Also the application of the model to provide insights on funding requirements (9) is the author's work.

CHAPTER 2: LITERATURE REVIEW

INTRODUCTION

The previous chapter introduced a number of approaches to assessing funding requirements for health services and the potential role for planning models in this regard. This thesis focuses on the availability of funding for public sector health services in South Africa and the development of a national health sector planning framework model to inform funding requirements.

This chapter argues that planning models drawing on quantitative techniques can play an extremely useful role in planning. The literature review deals with aspects of health sector planning and its links to need and demand on the one hand and funding and resource allocation on the other. Since the planning model to be developed deals with the overall health system, systems theory approaches, which focus on the whole as opposed to the constituent parts, are likely to be of use. Also since the focus is to develop a quantitative model, which can assist in scenario planning and setting norms or targets, quantitative planning techniques are of interest.

Planning approaches offer particular advantages to guiding funding decisions as they reflect the health sector's intentions for the period ahead and may incorporate many issues of relevance to funding. These include considerations of need, demand, norms and standards, costed service packages, the results of option appraisal and a range of policy, political, legislative and supply side reforms. In addition they may allow for complex scenarios which encompass changes in many variables including cost structures, care pathways and outputs. This perspective is supported by Segall who argues that any sensible determination of health sector funding must be guided by an appropriate sector plan.[1] He argues that in many countries health care provision is driven by demand (as opposed to need); in particular by the ability of patients to pay for private care, by powerful urban and political elites and by supply itself. New resources tend to be spent on recently commissioned capital projects and quality improvements in existing services and rural areas receive insufficient attention. He argues that strategic health sector planning is essential to redress this and should be informed by a diagnostic health sector review and result in the development of resource targets to guide funding allocations.

The chapter begins by outlining some broad approaches to planning. It goes on to consider the rational planning cycle and its various stages. I then present a number of techniques of use in planning, introduce the role of quantitative modelling and summarise a number of quantitative models of the health sector. The chapter then goes on to review certain specific aspects of planning namely for human resources, facilities, primary health care and hospitals. The last part of the chapter briefly reviews some of the linkages between planning and funding for health services.

BROAD APPROACHES TO HEALTH SECTOR PLANNING

At its simplest level planning is concerned with (i) Where are we (ii) Where we want to get to (iii) How to get there and (iv) How are we doing. Green defined planning as "a method of trying to ensure that the resources available now and in the future are used in the most efficient way to obtain explicit objectives".[2]

Before proceeding further it would be useful to identify a number of key concepts relevant to planning. Equity is a key consideration in planning and resource allocation. Horizontal equity occurs when persons with the same health needs receive the same health care. Vertical equity occurs when people with different health needs consume appropriately different types and amounts of health care.[3] Accessibility refers to the ability of individuals and groups to use and have their needs addressed by health services and includes many dimensions such as availability, distance, affordability, waiting times, language and cultural acceptability and physical access to disabled persons.[4] Technical efficiency refers to obtaining maximum service outputs or outcomes for a given level of inputs.[5] Allocative efficiency refers to the allocation of resources to the level or type of service which will produce the largest health gain. Allocative efficiency refers to the optimal balance of resources, health services or programmes to maximize the health of society.[4]

There are many types of planning including strategic, operational, business and project planning. Planning occurs at many levels within the health system from national and provincial levels to districts and facilities and within sub-systems such as human resources, medicines and for health programmes such as for maternal and child health, trauma and mental health. Because planning operates at multiple levels, planners often operate within the framework of higher level plans and the needs expressed in lower level bottom-up plans. Attempts to improve alignment of planning and budgeting have been emphasized in order to improve efficiency in developing countries.

Various broad approaches to planning have been described. Early approaches, such as the neo-classical method, tended to focus on capital projects. This approach of capital-led planning has become discredited, because of its frequent failure to consider the long term sustainability of recurrent funding sources necessary to operate services and its inadequate attention to equity.

Another fairly common and simple form of planning is incrementalism. This approach involves making incremental changes or improvements, tends to be limited in scope and lacking in overall goals. It tends to lack extensive data, relying more on common sense, local knowledge and political decision making and is low cost. Incrementalism has attracted both negative and positive critique. One author described many early health plans as amounting to a series of projects with an inadequate statement of objectives and priorities, poorly linked and lacking coherence – this he called "disjointed incrementalism"[6]. However other authors are less critical of incremental planning. In a classic text Hilleboe described this simple and practical approach to planning as the "pragmatic approach".[7]

The gold standard for planning is often considered to be Integrated or rational health planning. This envisages the development of a coherent structure of services, attempting to make decisions simultaneously around various combinations of service types. This approach is highly rational, broad ranging and data intensive. It tends to rely on extensive documentation and analysis of epidemiological trends, demand patterns and service analysis, detailed formulation of options along with their effectiveness and economic evaluation. Comprehensive sector or developmental planning takes into account an even wider range of developmental determinants. According to Reinke comprehensive planning "provides the general framework for development, it is particularly concerned with the problem of priorities and the relative stress to be given to various programs and projects... detailed planning then is at the program and project level."[8] The WHO methodology of Country Health Planning is similar in approach to comprehensive planning.[9] While the rational approach of comprehensive planning may be an optimal approach from various perspectives it may not always be practicable.

Because of substantial data limitations a more limited form of "mixed scanning" is sometimes used in which the focus is selectively on essential information required for implementation and subsequent iterations of the planning process.[10] Mixed scanning advocates a broad sweep or scan of the overall situation with rapid narrowing down to specific priority areas.[5] Spurgeon argues that even in developed countries the uncertainties and vicissitudes of the real world often make the comprehensive rational approach difficult or even inappropriate and that the process of making progressive marginal improvements is often preferable.[11]

The role of planning differs substantially between public and private sectors. In the private sector planning tends to be linked more to demand and profit than need and provision is significantly determined by the "invisible hand" of the market. A range of different models of competition and purchaser-provider arrangements have developed in different countries. However Perkins makes an interesting argument that economic factors driving medical reforms such as regionalisation and managed competition are leading to numerous commonalities across public and private sectors.[12] Hoffmeyer argues the cases for a universal health system prototype in which even within predominantly private health systems there is an important role for government to develop an overall framework to ensure mandatory health insurance for a basic benefit package and a framework for efficient competitive insurance and provision markets.[1]

PLANNING CYCLE

The planning cycle or spiral describes a succession of steps, which are likely to be common in many planning processes. These include situational analysis, objective setting, option appraisal, programming, implementation and evaluation.[5]

SITUATIONAL ANALYSIS

The situational analysis describes and analyses the baseline situation and its problems. It is a starting point for examination of needs and demand and an analysis of existing patterns of supply. The intention is to provide a wide range of useful information to understand the current situation, the successes and failures of existing services and the problems to be solved. Since planning deals with the future, some forecasting of future trends is often required.

Determining the population size, geographic and age distribution, growth rates, fertility, mortality etc. is important for planning.[13] The population to be served provides the basis for many planning calculations. For example young populations with high fertility and mortality rates have greater need for maternal and child services than older populations with a higher burden of chronic diseases. A recent South African analysis of the cost of providing prescribed minimum benefits to medical scheme beneficiaries analysed costs by age and gender and found the cost for a person of 70 years was more than eight times that of a child of 10 years.[14] As populations age the disease burden and cost can be expected to change. Population sizes, density and distribution have implications for planning.

Most planning approaches include an assessment of disease burden. Beyond basic epidemiological measures of disease various methodological techniques have emerged to assess and present information on burden of disease. A range of measures such as years of life lost (YLL), disability adjusted life years (DALYs) and quality adjusted life years (QALYs) have been developed in an attempt to provide standard measures of burden of disease across disease groups.[15] These are increasingly being used to compare disease burden across nations and regions.[16] An understanding of locally relevant disease burdens is important for ensuring the availability of specific interventions to address these problems. More recently renewed interest has emerged in the prevalence of risk factors for disease and in interventions to address these.[17]

While burden of disease provides an indication of underlying needs, many planning models focus more directly on the way these interface with health services as expressed through demand and utilization (sometimes with assessments of unmet need).[8] For example information on utilization and population served may be used to derive the quantity of health services and personnel required. In a useful article Lee argues that demand is a relevant consideration even in nominally "free" health services and outlines some of the factors influencing demand including price, income, tastes or preferences and substitutes.[18] Elasticity measures can be useful in predicting changes in quantity of services demanded under different conditions.[19] The quantity of services demanded may be inappropriate for need and demand management tools may be required. For example elites living in close proximity to higher level facilities may attempt to use them excessively, while poor rural populations may not make appropriate use of prevention and early effective interventions.

The situational analysis should describe and analyse the health services under consideration, their structure, inputs, outputs, efficiencies and so on.[5] Health services may be delivered in the community, at primary care centres of various types or in hospitals of various forms. Many developing countries deliver hospital care through different levels of hospitals[20], of which the lowest levels are the least expensive. The situation analysis should describe this configuration, how adequately services match needs and demand, their successes, problems and challenges and in this way lay a foundation for exploring options for improvement.

One of the key purposes of the situational analysis is to identify the critical problems which require attention. The "logical framework" approach to planning places particular emphasis on exploring the complex underlying causes of problems in an attempt to determine to the core problems which should be addressed.[21]

Goals, priorities and objectives

Planning is ultimately concerned with moving from the present to some improved vision for the future. This requires formulation of a broad vision and mission and setting of specific goals and objectives.

Objectives should include measurable targets and indicators. High level plans tend to focus on broader strategic objectives, where-as operational plans are usually far more focused on the detailed steps required for implementation within specific focus areas. Several planning approaches emphasise the need to formulate objectives precisely so that they are measurable and appropriate. The logical framework approach sets out a hierarchical set of measurable objectives from the broader strategic to the narrower operational, with each linked to a set of measurement indicators and targets and activities.

Setting goals and objectives requires prioritisation. A range of approaches to setting and prioritising goals are available including:

- Technical approaches including burden of disease, cost-effectiveness of interventions
- Expert group, Delphi techniques, decision analysis[22] etc.
- Political decision making
- Community involvement.[23] A systematic review of 42 studies of patient involvement in planning found that advantages included production of improved sources of information for patients, better access to services e.g. extended opening hours, improved access to disabled persons, patient transport and initiation of new services.[24]
- Consideration of a range of policies and legislation. Policy analysis and policy making are central to planning since plans are the practical articulation of policy and the key bridge between policy and implementation.

Political forces are important in setting of goals and priorities. Understanding the political forces underlying planning and resource allocation decisions can help to set and achieve goals and objectives. It has been argued that policies emerge as products of conflict from the assertion of special interests, resulting in various compromises.[10] Politics is "concerned with the relationships of power and influence……the political process should achieve a reasonable balance in the satisfaction of interests of multiple constituencies with complex value systems".[11]

Option Appraisal

Well constructed plans should generally consider a range of potential options or approaches to achieving the desired end point and evaluate these options against each other. A range of considerations and methodological techniques can assist in developing and appraising options. Rational approaches to decision making attempt to predict and compare the consequences of each alternate course of action and the likelihood of these occurring.[25]

Choosing interventions requires consideration of relative effectiveness and costs. Economic appraisal techniques can be of particular value in option appraisal.[5] Their broad intention is to weigh up the benefits that might arise from various options with their associated costs. Benefits may be measured in various ways, such as in financial terms (cost-benefit analysis) or as outcomes (cost-effectiveness analysis).

Beyond economic evaluation, option appraisal often needs to consider a range of other aspects of options, such as their technical and administrative feasibility, acceptability within a given cultural and political environment, whether resources required for the option are available and whether the option is sustainable.[5] Options may have different distributional and equity effects, developmental, gender, environmental or other effects.

Beyond the assessment on single interventions, option appraisal also extends more broadly to the configuration or design of health services, their location, staffing and nature.

Programming

Once options have been evaluated and the preferred option selected, the next stages of the planning cycle are programming, implementation or management and monitoring and evaluation.

Programming refers to a range of planning tools that have been developed to lay out the sequence of steps that need to be taken to implement the selected option. These include operational planning, charting action sequences and programme budgeting. Operational plans are short term plans, such as for one financial year. Operational plans should be very specific and detailed around detailed objectives, responsibilities, activities, outputs and timeframes (who, what, by when).[5] Sequencing of steps to achieve a particular goal may be laid out graphically in various ways such as by flow charts, bar (or Gantt) charts or critical path analysis.

Management and implementation

Management of implementation of the plan involves successfully bringing about change processes in organizations – a key function of management.[24] Managers are clearly critical stakeholders in planning and their level of involvement and commitment to the plan is key to the extent to which it is likely to be implemented. Sometimes simple pragmatic incremental plans that have involved managers are implemented where-as highly technical and data-intensive comprehensive plans without the buy-in of managers or politically powerful interest groups may be ignored.

A recent analysis provides useful insights of why services often fail poor people.[27] Sound accountability frameworks are critical including clear specification of objectives, appropriate delegation of responsibility along with adequate resources and enforceability based on information. Failures in public sector service delivery often involves inadequate institutional arrangements with poorly defined accountability arrangements (especially to poor users), poorly specified objectives and inadequate stipulations of service quality or quantity, no measurement of effectiveness or productivity, few rewards or penalties and limited enforceability. Adequate capacity of management teams is critical for successful implementation of plans and the planning process needs to consider how management may be strengthened.[26]

MONITORING AND EVALUATION

Monitoring and evaluation are essential parts of the planning cycle. Far too many plans sit on the shelf and are never implemented. Relevant indicators and information systems and processes need to be developed to be able to sensibly measure and report on progress of plans and successes and problems of implementation. Functional information systems are important for monitoring performance and ensuring accountability and control.[27]

PLANNING TECHNIQUES

This section covers a range of methodological techniques which are potentially useful at various points in the planning cycle. The techniques and issues discussed in the following sections are not mutually exclusive.

NEED VERSUS DEMAND APPROACHES TO PLANNING

Need- and demand-based approaches provide potentially very different approaches to planning and may result in significantly different approaches to funding, resource allocation and budgeting.

Needs-based planning approaches typically examine issues such as demography, mortality and morbidity, risk factors, occupation, class, income, geographical factors and so forth.[95] A recent analysis of the effect of aging on health sector costs provides interesting perspectives on the relationship between mortality and morbidity and the contribution of cost for the 5-7 years before death on overall costs irrespective of age.[28] Health services should ultimately attempt to address need and maximize health gain for resources allocated. Needs based approaches often use population-based planning (see below), with adjustments made in service plans and linked resource allocation formulas for other indicators of need.

In contrast demand-led planning is based on the actual number of persons who consume health services. Many human resource planning processes are effectively of this type in that they attempt to match human resources to workload, such as in the World Health Organisation's Workload Indicators of Staffing Need (WISN) approach.[29]

Each of these approaches has advantages and disadvantages. Demand tends to be strongly influenced by supply in health systems, so that demand-driven planning tends to perpetuate inequities. For example rural poor populations, despite having great needs, may underutilize health services. On the other hand population based planning may not match the actual utilisation of services well and associated workloads. It is sometimes difficult to accurately assess drainage populations and cross-border flows.

There is a case to argue that the approaches should be linked and the challenge planners face is to appropriately balance and address both need and demand. For example Navarro talks of beginning from demand, which he calls "the tip of the iceberg of need" and from there progressively advancing to address need. A recent South African costing of primary health care used a similar approach suggesting that the existing utilisation and unit cost of a primary care visit was 2.4 per capita (demand) and R61 respectively, but that these should be increased over a period to the level of 3.8 visits per capita (need) at a somewhat higher unit cost.[30]

Demand management consists of a set of interventions that may be used to influence consumer demand for health services. Information and education to consumers and telephone advice lines on appropriate self-care and how to access services can reduce inappropriate visits to health facilities. Careful design of referral systems and transport systems can help to control demand at different levels of care. User charges are sometimes used to influence demand and discourage bypassing of lower level facilities, but may reduce access to poorer households. Understanding patient treatment seeking behaviour and trust in the health system can help to strengthen system design to provide appropriate care at the right level.[31] In developing countries people may bypass lower level facilities because of quality considerations. Placing some basic specialists in district hospitals may incur some short term costs but substantially reduce bypassing.[19]

Preventive and public health interventions are important in improving population health and reducing demand for costly long term health care interventions. The Wanless Commission of Inquiry in the UK placed renewed emphasis on population and public health based approaches.[32] Burden of disease studies and more recently risk factor analysis help to guide both public health and health system interventions.[33,34]

Population-based planning

Population-based planning is a useful needs-based technique because it allows a range of input, output and epidemiological measures to be modelled with reference to particular base populations and compared against other similar geographic areas. A useful South African example of a population based planning approach was a national Committee of Inquiry into primary health care, which costed personnel and other resources required for a model district with a population of 100 000.[35] This planning approach resonates well with resource allocation approaches using formulae driven by needs indicators.

Forecasting

Given that many planning decisions such as for facilities and human resource supply have long term implications, forecasting techniques are potentially useful. On the demand side forecasts may be developed through modelling of changing demographic profiles (such as population growth) and modifying demand to reflect need and improving access. Demographic transition with larger older populations typically places an increased load on health systems. These effects can be calculated through the use of age specific utilisation rates and demographic projections.

On the supply side many forces are driving shifts in health care systems. New technologies medications, rapid diagnostic tests and minimally invasive surgery are leading to progressive shifts to primary, outpatient and day case treatment.[37] The discovery of anti-psychotic and anti-TB medications led to an emptying of hospital wards in their time and increasingly effective treatment for AIDS could have similar effects.[81] Preventive and public health interventions to improve health of populations are likely to receive renewed attention. New approaches to genetics and health of individuals and populations may to lead to earlier prediction and management of disease. Individuals will become more knowledgeable and involved in their care and many current treatments will be found relatively ineffective and replaced by newer innovations.

"Logical framework" approach to planning

The logical framework approach to planning is a widely used method of developing and presenting plans.[20] This approach emphasises the identification of strategic and operational objectives and their expression in clear and measurable formats along with documented linkages to actions, outputs, inputs and indicators. Focus is placed on the careful exploration of the problem to identify underlying causes and the formulation and articulation of appropriate objectives to address these problems.

Choosing interventions

Planners often face a bewildering array of potential approaches to addressing problems. Evidence based health care provides a modern scientific basis for assessing appropriate interventions.[37] Demonstration of effectiveness of interventions preferably through randomized control trials (RCT) has become the critical gold standard to assess whether interventions should be utilized. A range of other methodological approaches are available where RCTs are not possible. The scope of evidence based analysis of health interventions is expanding well beyond pharmaceuticals or procedures to complex policy and management decisions.[38] Meta-analysis, systematic reviews, the Cochrane collaboration and other such approaches have made great strides in supporting effective health care delivery. Many existing health service activities are of limited or doubtful effectiveness, which has opportunity costs and this suggests that possibilities exist to improve efficiency. In some cases preventive and public health interventions may be particularly effective e.g. tobacco control and lung cancer, safe water supplies and gastro-intestinal diseases.

Beyond effectiveness, interventions need to be cost-effective and affordable. Costing and economic evaluation of health care interventions consist of a set of economic techniques for assessing interventions. The best known of these include cost-effectiveness evaluation, cost-benefit analysis and cost-utility analysis.[39] The World Health Organisation's "Choice" programme provides useful recent approaches to cost-effectiveness methods and data.[40,41]

Costing

Costing is a key tool in assessing the affordability of any plan or intervention as well as in understanding baseline expenditure distribution and efficiency and for comparing the costs and benefits of options.[41] Various approaches to costing may be appropriate in particular contexts. The most basic form costs the basket of inputs required to produce a certain service. Cost modelling often involves demand or utilization assumptions and unit costs. The costs of inputs required to deliver a particular quantum of service outputs at a reasonable degree of technical efficiency can be determined and used as a basis for calculating unit costs and fee schedules. Average or marginal costs may be more appropriate in particular situations and an understanding of short and long run cost curves for specific services can assist with understanding technical efficiency.

Technical efficiency is important to planning because understanding the optimal mix of inputs and minimal cost of producing a given output is a key consideration. Benchmarking of costs over a range of similar facilities (preferably with similar case mixes and providing a reasonable quality of service) may provide useful data on the average cost of facilities and outliers. Modelling of the production function may provide insights. Lee describes a simple production function with outputs being cases per week in a clinic-type setting and two inputs namely doctor and nurse hours. The outputs produced by various combinations of these inputs can be portrayed in a production curve. This is set against the budget line, which portrays the different combination of inputs that can be purchased for a given budget. The intersection of these provides an indication of the most efficient point. As the costs of these inputs vary, for example through differential wage changes, the optimal efficiency mix shifts. More complex approaches include multiple regression and other econometric approaches. Analysis of long run cost curves of hospitals has been used to provide evidence for the optimal size of hospitals.[42]

Developing service packages

Debates around vertical as opposed to horizontal structuring of health services raged in the literature for some years. Vertical initiatives attempt to focus very specifically on particular health problems with high cost-effectiveness. Although this focus on key burden of disease areas is attractive from certain perspectives, in general this approach has become discredited because of the inefficiencies of parallel administrative and personnel structures. The horizontal approach which sees a package of services delivered from a given health institution is generally preferred. However within this model attention needs to be given to squeezing out of preventive and effective activities.

A range of approaches have been used to rank and group cost-effective interventions into service packages. Cost-intervention league tables attempted to rank interventions, but have limitations for which they have been criticized on several grounds. The PAHO-CENDES method for health planning attempted to order diseases in this way and to focus on interventions in a highly targeted manner. However the latter method is widely considered to have been extremely difficult to apply. A key problem was huge informational requirements and the difficulty in attempting to allocate resources to single diseases as opposed to services or facilities.[7]

A number of other important international attempts have been made to develop service packages. Reference was made earlier to packages developed by the World Bank and Commission of Macro-economics and Health.[43,44] The Oregon research on Medicaid led to the development of a set of the most cost-effective diagnosis – treatment pairs being selected for funding within the context of a large social health insurance scheme.[45,46] This type of conceptual approach inspired the development of the Prescribed Minimum Benefits for South African medical schemes.[47] A recent reform in the Italian National Health Service defined a health benefit basket with a positive list (inclusions), a negative list (exclusions) and a third list of partially covered benefits in particular circumstances.[46] However these are specified in fairly broad categories not in highly detailed diagnostic and treatment codes.

Rationing less cost-effective interventions or not providing them at all is a potential implication of this approach.[50] Explicit rationing is much less common than implicit rationing, given the political and humanitarian difficulties of denying care.

ASPECTS OF HEALTH SERVICE DESIGN

Even when service packages are not explicitly defined, interventions are typically grouped around specific facility types and settings. For example clinics, district hospitals and central hospitals will typically offer different types of services, using specific types of personnel, equipment and medicines and may be considered building blocks of the health system. Standardisation of these through explicit definitions of facility types and functions, development of licensing and accreditation criteria, admission and discharge criteria and location in the referral system are examples of mechanisms which attempt to group functions to improve quality.

In tiered systems, which become progressively more expensive at higher levels, a basic principle is to treat persons at the lowest level which quality care can be provided. Where-as specialisation and competitive advantage are basic principles in economic theory, specialist medical services tend to be more expensive than lower level generalist services and the right balance between generalist and specialist services needs to found for each context.

Creative initiatives continually attempt to redefine the possibilities of organizing service delivery. Different approaches towards many aspects of health service delivery across countries provide immediate examples of options.[50] In designing services and attempting to find the best way to achieve a particular objective a range of options arise which may be evaluated. For example:

- Should a regional hospital only contain 6-8 standard specialities or should other specialities be added in certain cases for example ophthalmology, intensive care? These kinds of question may be informed by the disease burden (need), workload (demand), marginal cost analysis (is the workload sufficient to meet thresholds for deploying a specialist of that category and the use of specialist equipment items), relative costs of generalist as opposed to specialist services, funding availability, quality considerations (what are minimum thresholds to achieve quality services e.g. a specialist unit with at least three specialists), travel times and densities (access) amongst other considerations.
- Different models of staffing of facilities or availability of particular equipment, medications or

other interventions may change the role and function of facilities with efficiency, cost, access and quality implications.

- Renewed focus on public health and preventive interventions attempt to prevent diseases before they occur. Public health interventions for coronary heart disease may provide a cost-effective partial alternative to scaling up of coronary care intensive care treatment facilities.
- New approaches to hi-tech procedures on a day surgery basis are reducing the classical role of hospitals, with lengths of stay progressively declining. Use of admission and discharge planning and case management tools can help to make hospital use more appropriate.

A wide range of specific problems in the organization and planning of health services can be aided through health systems research techniques. Operations research techniques include a range of methods for quantitative analysis and decision making around specific problems. Techniques include queue theory, design of distribution systems, optimizing location of facilities, optimizing resource mixes, optimizing bed numbers and linear programming.

USING AND DEVELOPING PLANNING NORMS

Norms and standards are a common feature of planning particularly on the supply side and have conceptual linkages to normative economic approaches. The use of norms tends to be greater in health systems with central planning, such as in the old Soviet health system (design standards or normativ in Russian).[51,52]

Norms and standards are a common tool in planning and may be useful for budgeting and funding since they provide quantitative targets. In South Africa the Financial and Fiscal Commission, a statutory body established to advise on resource allocation, has argued for a costed norm approach to be used as a basis for sector funding.[53] Other authors have emphasised the potential role for norms and standards including quality considerations to inform funding decisions.[54,55]

The use of inputs to produce outputs is a common conceptual approach in production systems.[56] Input-based planning and norms focus on the component resources required to build up the health system. Typical norms include bed: population, nurse: bed or area per bed ratios. Input based approaches are useful in that they focus on the essential ingredients required to build health systems and allow for comparison across jurisdictions. They are also useful in providing standards to improve quality in health systems.

Output norms focus on productivity targets such as obstetric inpatients or visits per general practitioner per day. Output based norms are conceptually linked to demand-based planning and can help to incentivise productivity and better match resources to workload. They are particularly useful in contracting situations, purchaser-provider splits and similar arrangements. Arguments for output based planning include the need to provide flexibility to the provider to find the optimal means to produce the required outputs.

Norm-based planning has important limitations.[57] A norm is in effect a portrayal of an optimal position derived in a particular context. However as funding levels, needs, relative costs of inputs etc. change the stated "norm" may become a sub-optimal solution. For example bed and staffing "norms" would clearly vary in different funding scenarios. Norms are often used too rigidly and mechanistically and need to be used with discretion. Inappropriate use of such systems has contributed to poor perceptions of central planning and has perhaps fuelled the shift from centrally planned to social insurance based health systems in several countries, most obviously in central Europe over the past decade.

Sizing and scoping: decentralization versus critical mass

Achieving an optimum balance between access (more but smaller facilities) and the critical mass required in order to achieve quality of care is an area that merits greater attention. Decentralisation is a key theme in health service planning particularly for primary care services which must be located in close proximity to where people live.[58] Access involves issues such as travelling times, queues, waiting times, affordability and acceptability.[59] On the other hand increasing evidence is emerging that outcomes and quality for specialised services are better in specialist centres with a critical mass of human and infra-structural resources and systems. Factors promoting a shift to centralizing specialised hospital services include increasing overhead costs, shortening length of stays, the need for larger staff numbers to deal with reductions in long hours worked by doctors and increasing requirements for accreditation and training standards.[60] More centralized parts of the health system also tend to have a greater role in planning for highly specialised services.[61]

Scheduling and queue theory

The section on demand-led planning above referred to techniques to estimate patient flows through the health system. However these flows are often not linear and uniform and a range of modelling, operations research and mathematical techniques are available to assist planning of patient flows through various specific parts of the health system, whether for hospital or intensive care beds or emergency ambulance services. [62,64,81,83] The distribution of cases tend to follow particular distributions whether it be trauma admissions on Saturday nights, poisson or normal distributions. Queue theory and simulation techniques can be used to inform redesign of services to improve flow and decrease waiting times.[63]

QUANTITATIVE MODELLING OF THE OVERALL HEALTH SYSTEM

Many of the techniques discussed above can be incorporated into quantitative models of the health system. Modelling and forecasting can play an important part in planning processes. Models can be used to describe or simulate particular systems in order to improve understanding of the way systems operate and to forecast or predict the implications of different scenarios, policies, programmes or projects.[25] Models are simplified representations of real world situations. However they can potentially help to make sense of extremely complicated phenomena and provide important insights. Quantitative models may be used for various purposes including scenario planning, optimization, simulation, prediction and development of planning norms.

Although the results of quantitative modelling of various component parts of the health system have been published, published models of the entire health system are scarce and have mainly emerged in developed country settings. Denton, in developing a Canadian planning modelling system, conducted a Medline search and was unable to find any other examples of systems planning frameworks for the entire health system.[66] Systems theory approaches attempt to examine systems as a whole rather than only its constituent parts, because of the inter-relationships between these parts. The author has found four examples of quantitative health system planning models which cover the whole health system rather than only some of its parts.

Navarro argued for a systems approach to health services, with its components being viewed as interdependent parts of a unified whole. He argued that there were two broad approaches to modelling the health care system. In the structural production approach inputs are transformed to outputs in the most efficient way possible. In the performance effectiveness approach the measures used pertain to improvement in health state such as reduction in deaths, disability and discomfort. Navarro argued that the first type of systems modelling is more feasible given uncertain effectiveness in much of the health care system. He developed a stochastic model based on the first approach using a Markov chain and used it for prediction, simulation and goal seeking.[64] In the model there is a probability of each person entering a particular care pathway, an average number of visits on that pathway and a further probability of referral to another care state. The health planner attempts to influence the use of these pathways e.g. by decreasing use of hospitalization and increasing use of primary care. Referral rates affect the probability of using different pathways.

Denton developed a systems based model for Ontario called System for Health Area Resource Planning (SHARP).[65] The SHARP model is constructed as follows: Module 1 is demographic and examines population size, migration, fertility and mortality. Module 2 deals with demand and shows utilization of a range of services by age e.g. general practitioner (GP) visits or hospital bed days. Modules 3-5 are supply side modules for various personnel types incorporating training outputs, retention, immigration, participation rates etc. Module 6 deals with hospital bed supply with eleven types of hospital bed. Module 7 is where the demand and supply modules come together. The changing demographic profiles (total population size and aging) impact on demand and (assuming constant workload ratios) thus increase the requirement for personnel and beds. Putting this together with the supply modules shows where imbalances are likely to occur, which will require changes to the supply system including modifying human resource and bed availability.

More recently an influential UK model by a team co-ordinated by Wanless developed an approach which appears to have significantly affected funding for health services in that country.[32] This model incorporated a long term supply and demand model which allows for scenario building. On the demand side a strong feature of the model is a much improved public health intervention approach, which would lead to changes in demand over the long term. Provision was made for changing demography particularly aging. On the supply side it encompassed, amongst others, improving services to decrease waiting times, strengthening five high priority service areas (e.g. cancer, coronary heart disease, diabetes), improved health information systems, a long term infrastructure model and provision for improved clinical governance. Changes were modelled by examining their effects on utilization and unit costs for particular services. Workload outputs were then entered into a workforce planning model to determine their requirements for additional personnel.

Smith describes the rise and fall of a quantitative Balanced Care approach in the UK in the 1970s.[66] This model encompassed a computerised planning and operations research methodology to allocate financial resources between competing claims. In the model the population was subdivided into a number of client groups and for each a set of care options and costs was included. These attempted to make explicit some of the choices and trade-offs managers faced. The approach appears to have ultimately had only limited usefulness partly because of its complexity and difficulty to use and partly because politicians and managers found the explicit nature of trade-offs and resultant rationing of care to certain groups difficult to accept. Smith argues that "big ideas" drive health systems, but that in contrast to the planning and operations research approach, the accounting and control "big idea" of performance indicators and the economic approach of internal markets have been more enduring.

PLANNING SPECIFIC RESOURCES AND INPUTS

While planning for specific inputs such as personnel, medicines, capital such as facilities and medical equipment, transport are important, increasing attention is being placed on integrated planning of inputs to avoid lack of co-ordination in these activities.

CAPITAL PLANNING AND THE LOCATIONING AND DIMENSIONING PROBLEM

Planning of health facilities is particularly important because of their long lifespan and ensuing many years of recurrent spending implications, which follow construction. Excess capital stock can lead to inefficiency as services do not operate at the right scale. Useful data on costs of hospital construction can often be obtained from actual costs incurred in building other recent hospitals in that country. Hospital planning typically involves assessing requirements for hospital beds and other features, given regional needs, patterns of admission and length of stay, the spatial design of the various components of the hospital, wishes of health workers and costing the proposals. Various techniques are available for annualizing capital costs.[67,68]

Facility planning needs to take account of population size, distribution and levels of likely service utilisation, considering actual future need and historical demand patterns. These need to be considered along with criteria of access such as travel times and distances, given the hierarchy of facility types. Some South African researchers have suggested that clinics in dense urban areas, such as Soweto, should be located within 2km radius from users, so that walking time would not exceed half and hour.[69] The number of planning units, in this case consulting rooms in clinics, can be calculated from the population served, utilisation targets and the daily workload which can be managed in each consulting room.[70]

An interesting approach to geographic positioning of facilities has been used in regional hospital planning in Sweden.[7] The approach attempts to minimize travel cost and studies this by superimposing population density maps with contours of equivalent travelling times (isochrones) and equivalent travel costs (isodapan). A recent South African plan for tertiary hospital services used a computerised geographic information system and travel times based on conditions of the national road network.[50] The idea is firstly to determine drainage areas of facilities, which minimize travel time and also to guide decisions for locating new facilities. It was suggested that drive times to tertiary hospitals should in general not exceed two hours and one hour for regional hospitals.[35]

Persons incur costs travelling to health facilities to receive treatment and visit patients. Having fewer larger facilities decreases capital costs for the health service, but increases the cost of households. Khan conducted a cost minimisation exercise for emergency obstetric facilities in Bangladesh and in that context found that an optimal radius was 10km, minimizing the total cost to the health service and consumers.[70]

Human resource planning: determining staffing requirements

Health systems are personnel intensive with personnel costs comprising a significant proportion of sector expenditure. Personnel have a long lead time to train so that countries should develop proper manpower planning systems to ensure adequate supply of health personnel. A range of good texts lay out basic approaches to human resource planning, potentially of great use to South Africa.[29,71]

Central to human resource planning is analysis and modelling of the supply and demand sides. Supply side analysis includes an assessment of outputs from training courses, their duration and nature and loss of personnel through retirement, death, illness, migration etc. Demand side analysis examines health service requirements for particular categories of employees, affordability and availability of posts.

Population based human resource planning typically involves target or normative personnel to population ratios. A useful South African example was a committee of inquiry into primary care services.[72] This used proposed staffing levels in a model district of 100 000 persons as a basis for costing the funding requirements for the national primary system. However there are some disadvantages to this approach. The approach does not guide the distribution of staff across facilities of various types. It also does not take into account local variations for example in utilization, access, wants etc.

Another approach is to distribute personnel according to workloads. According to Lee some of the greatest successes he has experienced in planning come from better matching of personnel distribution to workloads.[17] In the Workload Indicators for staffing need (WISN) approach an workload activity standard for each type of activity e.g. a doctor doing medical outpatients can be expected to treat x patients per day or an average case will take y time. Depending on the average number of working hours available these are then converted into standard annual workloads. This demand based approach may be modified by incorporating a need based target of a planned future health service. The standard workload norms may also be modified to take into account improved professional standards, changed conditions of employment, new training, equipment or medical practice policies and so forth. It is recommended that countries invest in developing workload standards of local relevance.

PLANNING FOR SPECIFIC PARTS OF THE HEALTH SERVICE

DISTRICT AND PRIMARY HEALTH CARE PLANNING

The important Alma Ata declaration provided an important global stimulus for reorientating health systems towards primary health care. [73] Primary care facilities are the first and preferred point of entry into the health system and are centrally important in the health of populations. Primary care services should therefore be planned to allow for easy access to user populations should offer cost-effective relevant services and should be sufficiently trusted and resourced to avoid unnecessary bypassing to entry at inappropriate levels of the system. Typically clinics and health centres or general practitioner services are the major sites for primary care services. Patterns of delivery of primary health care services vary across different countries from general practitioner services in the United Kingdom to over a million community health workers in China.[52,74]

With global trends towards decentralisation in health care delivery, the role of planning in decentralized levels of the health service has become increasingly important. Decentralisation of planning to the district, area, county of other locality allows for community based primary health care, with greater flexibility to local needs, community participation and area based planning.[75]

A range of public health and other community interventions outside the health facility also play a broader role in primary health care. In developing countries nutrition, water and sanitation, immunization, malaria control and so forth are critical in improving health status. In developed countries too, public health interventions such as reduced smoking and cardiovascular prevention have been key to population health.

Primary care centres and their component units, such as consulting or examination rooms, are often planned based on parameters such as drainage population, utilisation rates, geographical proximity and workload norms.[7] Lee presents a useful example of the use of marginal cost curves in assessing the relative role of mobile vs. fixed clinics for the performance of PHC functions. Using immunization as an example he shows that marginal costs of producing services rise above a certain level of coverage as rural and dispersed individuals become progressively more expensive to cover. At particular levels along the curve outreach units and subsequently mobile clinics have a lower marginal cost than fixed clinics.[77]

Although there is some variability in models of PHC provision across countries, models are increasingly converging along with globalisation. Different combination of health professionals (e.g. nurses vs.

doctors) lead to different cost structures, but have potential quality implications. Lee discusses the substitutability of these personnel inputs in a primary care context.[76]

Hospital planning

Abel-Smith argues that hospitals are the most expensive part of the health system and need to be planned according to the number of patients who cannot be satisfactorily and economically treated elsewhere.[77] An overview of planning of hospitals in developing countries is the classic by Barnum and Kutzim.[19] A review of the Zambian hospital system points out that, despite consuming a high proportion of health expenditure, many sector policies and reforms largely ignore hospitals despite great problems of inequity, infrastructural and maintenance backlogs and poorly functioning referral systems.[78] The policy intent to prioritise primary health care services is frequently pursued with inadequate conceptualisation or planning for hospital reform or rationalization, often resulting in an unsustainable, poor quality hospital system. The authors emphasise the need to ensure a sustainable and equitable hospital platform, with appropriate referral chains and adequate attention to infrastructure and the maintenance and the recurrent costs implications of capital programmes.

In many countries hospitals are organized in different levels, such as district (primary), regional (secondary) and central (tertiary) hospitals, in order to aggregate more costly and complex procedures in a smaller number of institutions. In principle patients should enter at the lower less costly end, but they often bypass to higher level more costly tertiary facilities. Improving quality at lower level hospitals, e.g. through locating specialists there, may help to address this problem.[19] Understanding community perceptions of care options can help to reduce bypassing and unnecessary upward transfers.[79]

Given that hospitals comprise such a high proportion of health expenditure it is important that hospital systems be planned to operate efficiently. Low bed occupancy, productivity and bed turnover rates and unnecessarily long length of stays associated with poor quality of care indicators indicate potential problems. Lengths of stay have reduced considerably internationally over recent decades. There is considerable scope for day surgery and it is estimated that a third of surgery patients in the United Kingdom could be effectively managed in this way.[78] Abel-Smith summarises evidence for planning to limit private hospital beds in insurance systems (e.g. licensing, certificate of need), to control the problem of cost escalation.

Bed numbers can be modelled through their mathematical relationship with admission rates, bed occupancy and length of stay. International comparisons should be used with caution because bed provision is declining globally along with shortening length of stay, greater use of day surgery and outpatient procedures and better admissions management. Where overall bed occupancies rise above 85% the risk of not having any beds open during periods (e.g. seasonality) of high use becomes significant.[80] Where admission rates vary over time more complex mathematical and statistical tools may be useful in modelling bed requirements. Modelling by Baghurst showed that at 85% bed occupancy an average hospital would be short of beds on four days a year at 90% there would be regular bed crises.[81]

Given that inpatient care is expensive admissions should clearly be appropriately used. One review found 1-27% of admissions and 14.6%-61% of bed days to be inappropriate.[81] Strategies to manage admissions include improved skills at primary care level, better cooperation between general practitioners, specialists and hospitals, day surgery, improved admission and discharge planning, subacute care and patient hotels.

There is variability across countries in the choice of disciplines, services, personnel and medical equipment located in different facility types. A decision on which level of hospital should perform particular types of service (e.g. plastic surgery, thoracic surgery, neurology, dermatology etc.) may be informed, amongst others, by information on nature, quantity and distribution of diseases requiring in-patient or outpatient treatment, hearings with representatives of specialized expert groups, notions of minimum unit sizes required to achieve quality and cost implications.

Hurst provides a useful summary of approaches to examining hospital costs and what they ought to be including through econometric studies to explore determinants of costs, derivation of long and short run cost functions, accounting studies within individual hospitals and engineering approaches of building up production and costing norms for specific activities.[42] Shephard provides examples of how improved understanding of hospital cost structures can improve planning and management within the institution.[69]

Planning for hospital services also needs to consider institutional frameworks which promote sound governance and management. These include proving adequate responsibility and accountability for hospital managers. Attention to quality of care initiatives and measurement of hospital productivity and efficiency measures is required.[82]

Emergency Ambulance Services

Beraldi presents an operations research approach to planning emergency ambulance services.[83] He describes approaches to assessing demand patterns e.g. uncertain events in a Poisson distribution, approaches to questions of location of service sites and modelling vehicle number requirements, in the process modelling likelihood of being occupied when an emergency arises and the extent to which service areas should overlap to address this problem.

HEALTH CARE FUNDING AND PLANNING

The second part of this literature review examines some of the linkages between health care planning and funding. Chapter 1 introduced the notion of the supply and demand sides of health care expenditure, where supply refers to the availability of funding and demand to the requirement for funding.

APPROACHES TO DETERMINING FUNDING REQUIREMENTS

Where-as the main focus of this chapter has been on the use of planning approaches and methods to determine public sector health service funding requirements, other approaches exist and can be used as a form of comparison.

One set of approaches focus on need. Considerations of need can be used to inform funding for example trends in chronic disease, communicable diseases such as HIV/AIDS and other measures of mortality and morbidity. A substantial literature exists around making widely available interventions, which can effectively address widespread health problems at low cost. The excellent text by Jamieson on disease control priorities in developing countries is a formidable example.[84] The compelling case for tackling particular disease control priorities has at times led to the development of vertical programmes also stimulated by donor funding and at times by global organizations in an attempt to address pressing public health problems.[85]

Hoffmeyer used a simple bivariate approach to model need for health care expenditure in OECD countries, using an equation relating need to age, with progressively greater weightings for older ages and time (a marker for technological advances and progressive quality improvements).[86]

$\text{Ln } HCE/DEM = a+bT+\text{residual},$

$DEM = Pop<65 + 2(pop\ 65\text{-}75)+4(pop\ 75\text{-}80) + 8(pop>80 years),$

where HCE= health care expenditure, DEM is a population weighting and T is time.

Another approach focuses on the developing and costing service packages. The vertical programme approach received much criticism and a subsequent development was to group cost-effective interventions into minimum benefit packages for national health systems. The influential World Bank

1993 World Development Report applied the criteria of burden of disease and cost-effectiveness to develop an essential national package of health services.[43,44] This package was costed at about US$12 per person per year in low income countries or $22 in middle income countries. The Commission for Macro-economics and Health more recently costed a basic service package.[44] Such approaches tend to focus on a limited set of vertical interventions rather than a comprehensive health service.

Another approach to funding is based on demand. Funding for public sector services are frequently linked to outputs, and as levels of outputs are shown or forecast to increase this can be a potent motivator for funding. Linking funding to outputs occurs particularly in certain types of budgeting methodologies such as performance based programme budgeting.

A further set of approaches are based on policies, political forces and priorities and perceptions of key stakeholder groups.

Health care funding

The supply of funding for health care expenditure is dependent on the mix of financing mechanisms used and their effectiveness. Finances raised provide an upper limit or envelope for the plan and thus directly impact on the nature of the health service and what can be planned for. For example at particular funding thresholds varying combinations of services become possible e.g. regional versus district hospital care or doctor vs. nurse-based primary health care services. The form of a health system is influenced significantly by the financing mechanisms used; for example social insurance systems tend to invoke particular forms of arrangements between funders and providers.

Various authors have noted the powerful relationship between GDP and health funding.[87] Newhouse reported that GDP accounted for 90% of the variation in health spending across OECD countries and Poullier reported an income elasticity of 1.5, i.e. that a 1% increase in GDP is on average associated with a 1.5% increase in health expenditure. Hoffmeyer derived a predictive equation for the supply side of funding, based virtually exclusively on GDP.[86]

$\ln HCE = a + a_1 \ln GDP + u$,
where HCE is health care expenditure and a and u are constants.

While total health care funding is closely related to GDP, public sector funding as a ratio of the total varies substantially across countries[88] and is dependant on the financing mechanisms used, their effectiveness and the degree of pooling of resources.

South Africa's public health system is extremely dependant on tax funding, with national transfers to provinces comprising 97% of funding to provincial health departments (although provincial governments have discretion on allocations across departments). McIntyre has argued that a positive feature of introducing social health insurance would be to reduce this dependence on a single financing source. User fees are often considered problematic in the South African context because of their undesirable potential to compromise access to health among poorer households. Internationally greater resource pooling and income linked contributions are typically seen as desirable to achieve equity, but user fees are sometimes used as a tool for demand management and revenue generation. Social or national health insurance systems are widely used financing mechanisms internationally and are being explored in South Africa.

RESOURCE ALLOCATION AND PLANNING

The term resource allocation is used here to refer predominantly to the allocation of funds across geographic regions. Resource allocation has several inter-linkages with planning. The approach to determining need in the resource allocation formula should ideally resonate with the approach used in planning to allow for consistency in funding and planning.

South Africa uses a formula-based approach, known as the "equitable share formula", to divide the main unconditional block grant allocation to provincial governments. This formula is based on several indicators of need including population, medical scheme enrolment, school enrolment and the distribution of the school age population and other measures.[89] Some authors have suggested that this formula does not sufficiently address disadvantage or promote vertical equity and have suggested modifications to improve the formula.[90,91] In the South African context, as will be seen in later chapters, the resource allocation process leads to substantial variation in funding levels between provinces, such as Western Cape and Limpopo, with resultant widely different service configurations. Large funding inequities have existed for many years[92,93,94]

Need based approaches are particularly useful for techniques for allocating resources across geographic regions. For example the UK Resource Allocation Working Party (RAWP) formula is based amongst others on population (adjusted for cross-boundary flows) and standardised mortality rates.[95] Mortality rates were used as a proxy for morbidity. An interesting recent South African example of a partially needs based funding approach is the emerging Risk Equalisation Fund formula, derived to equalise funding for a prescribed minimum benefit package according to risk in medical schemes, based on variability in profiles of age and chronic illness.[96]

Mays and Bevan argue that the introduction of a resource allocation formula had major implications for planning and in particular the decentralization of planning.[95] Where-as central levels of the NHS previously made substantial planning decisions, often in an incremental way and to the excessive benefit of London teaching hospitals, the introduction of RAWP meant that at that time Regional Authorities now would take on more responsibility for planning, given that higher levels no longer controlled the budget.

INTER-GOVERNMENTAL TRANSFERS

Decentralisation is an important instrument of government to increase local accountability. From an economic perspective its rationale includes allocative efficiency, with decentralized management potentially being more aware and responsive to local needs.[97] In many jurisdictions, including South Africa, expenditure and revenue functions have been differentially assigned resulting in vertical imbalances, which are typically addressed through intergovernmental financial transfers. The form and nature of intergovernmental transfers will directly influence the type of health services that are delivered and their planning.

Bird and Vaillancourt argue that unless intergovernmental transfers are carefully designed they may lead to various problems including poor performance, inequities, increased costs and macro-economic instability.[98] The authors differentiate between the more centralised "fiscal federal" model and the highly decentralized "federal finance" approach. For developing countries the authors prefer the former in which national policy objectives are more dominant, there is a strong redistributive role for national government. More use is made of guidelines, support and monitoring and requirements are often imposed that funds be spent in specific sectors in this approach. Transfers to address horizontal imbalances need to take account of differential revenue raising capacity. In a linked paper[99] the authors argue that conditionality (in grant funding) is often desirable to ensure funds are spent on the desired area (e.g. health services) and that some basic levels of performance are achieved. Matching grants are one possible approach to incentivise lower levels to address particular national priorities. However a common problem in many countries is deficiencies in information systems to adequately monitor performance.

FINANCIAL PLANNING AND BUDGETING

A key principle of planning is that health service, human resource and financial planning should as far as possible be integrated or closely aligned. This often does not occur and leads to multiple plans that do not articulate well. Certain types of budgeting link particularly well to planning, such as performance based programme budgeting.

CONCEPTUAL FRAMEWORK

The conceptual framework developed from the literature reviewed and the research methods detailed in chapters 3 and 8 inform the development of the planning model.

The literature suggests firstly that the planning approach and health sector plans are useful if not essential in informing the process of funding allocations and budgets. Secondly the literature illustrates that quantitative planning models can play an important role in planning, understanding the health system and predicting future scenarios. In the work which follows I develop and use a quantitative planning model of the South African public sector health system for simulation, forecasting and scenario planning. This provides insights into sector funding requirements and informs budgets, planning and resource allocation decisions. It assists in guiding a path to a health service that is equitable and accessible, efficient from technical and allocative perspectives and sustainable.

In developing the conceptual framework I have used several planning approaches which offer particular advantages to determining sector funding requirements. The planning cycle provides a number of useful constructs for planning. I focus on the first three steps of the cycle, namely situational analysis, goal setting and option appraisal. The situational analysis identifies key areas of need and demand and aspects of supply including baseline expenditure patterns. Analysis of goals and objectives will reflect largely on key priorities and goals identified by the Department of Health. However the particular focus is on a tool for option appraisal, namely an overall quantitative planning framework model for the health system. This draws on approaches encompassing the overall health system and the inter-dependant flows between the constituent parts, such as clinics, community health centres, district and regional hospitals. Examples of quantitative planning models of overall health systems, which will inform the modelling, include work of Denton[66], Wanless[32] and Navarro[65].

The model attempts to adequately match demand and supply in a way that is sustainable and efficient. On the demand side, both need (aging, mortality and morbidity trends, HIV) and demand are important concepts for planning. Navarro's argument that demand based approaches or what he refers to as structural production approaches are much more amenable to modelling whole systems, because of the wide range of diagnoses and uncertain effectiveness in much of the health care system, is accepted.[65] Using this broad conceptual approach I examine baseline demand levels and attempt to forecast future levels by modifying these for unmet need (i.e. need not reflected by demand patterns), in most cases making provision for higher levels of utilisation. Allocation of workload in varying combinations across different levels of care and facility types is explored.

On the supply side a set of facility types is defined each operating within a referral system and with an appropriate user population. Various approaches are used to cost the inputs required to produce service outputs of each given type. An examination of what an optimally resourced technically efficient component of each facility type requires is explored, with associated staffing, equipment, medicine and other inputs. Particular attention will be given to human resources given their importance in the health system. Planning and costing the inputs required to produce particular outputs will also help to develop linked human resource targets and hospital bed plans which are linked to the overall service plan.

Spending requirements for particular health services are determined through bringing together relevant demand measures and their associated unit costs. Once existing and potential future demand patterns and costs of specific services are understood, option appraisal is undertaken. This entails the development of a set of scenarios which examine combinations of various levels of the key supply and demand variables. Scenarios are considered successful if they include elements of improved access, better resourcing (e.g. staffing at normative levels), contain various efficiency gains and are sustainable.

The scenarios may be used to develop norms for the sector and to inform funding, provided they are considered to meet reasonable criteria of technical efficiency, access and sufficient resourcing to enable quality services. Costed scenarios are compared with existing and projected funding availability and the resultant gaps used to inform reforms to funding and plans.

CONCLUSION

This chapter outlines the importance of planning as an approach for informing the funding requirements of health systems. Planning techniques are potentially valuable because they allow for consideration of a wide range of factors and scenarios, including varying options for delivery of services in response to need and demand. Various approaches to planning and a range of planning techniques are described. Quantitative modelling and forecasting can play a very useful role in planning, both in understanding the existing situation and in scenario planning. A number of inter-relationships between planning, financing and resource allocation are explored. The planning techniques described here are used in later chapters to design a national quantitative health sector planning model. This model is applied to exploring sector funding requirements.

CHAPTER 3: METHODOLOGY PART 1

PUBLIC SECTOR HEALTH CARE FUNDING IN THE CONTEXT OF FISCAL AND EXPENDITURE POLICY

The introductory chapter (1) outlined the key aims of this thesis. This chapter deals with methodology and is itself subdivided into two parts. The first part of the chapter deals with objectives pertaining to health care funding, namely objectives 1.1, 1.2 and 1.3 as described in chapter 1.

The second part of the chapter begins to set the foundation for the planning model in Part B. It covers the methods for objectives 2.1 and 2.2. A subsequent chapter will present the methods for the remaining objectives.

TRENDS IN PUBLIC SECTOR HEALTH CARE FUNDING AND EXPENDITURE

A virtually complete set of financial publications of the National Treasury from 1995-2006 was assembled and used to compile a database of public expenditure and funding trends across the whole of the national and provincial spheres of government, including the health sector and other government expenditure areas over a decade. Documents from which data was collected were the annual Budget Review series, Intergovernmental Fiscal Reviews and Estimates of National Expenditure. These provide a fairly unique dataset of the national finances, covering all provinces and national departments over a decade.

Data on key fiscal measures, such as total government revenue, spending, debt and GDP are drawn largely from a series of Treasury publications documenting the budget over the past decade.[1-8]

Expenditure trends for provinces including provincial Departments of Health and other sectors such as Social Services and Education have been drawn largely from National Treasury's Inter-governmental Fiscal Review publications over the period.[9-13] In addition the latest available databases of the National Treasury have been used. The Treasury publications and databases are compiled in turn from audited financial statements and published budgets of all departments in all provinces and adjusted for function shifts and certain other changes. Expenditure figures from Treasury sources for all years up to 2005/06 are drawn from final audited reports. Data for 2006/07 to 08/09 are taken from provincial MTEF budgets.

Expenditure from national government departments over the decade has been taken from the Estimates of National Expenditure and National Expenditure Survey publications, which provide detailed financial information on national departments, such as the national Department of Health, Defence or South Africa Police Service.[14-20] These publications in turn draw on audited financial statements of national departments as shown in their annual reports.[21-23] Data for the South African Revenue Service and the Secret Service have been excluded because data for these was not published separately for the entire period from 1995/96 to 2006/07.

Conditional grant allocations have been drawn from the gazetted Division of Revenue Acts[25,26] and Treasury databases. Local government own funding revenue has been estimated from a research study by the Health Economics Unit[27] and data collected by the national Department of Health (personal communication 2005) and cross-checked against data collected by National Treasury (personal communication 2004) and the Department of Provincial and Local government. Analysis has also been taken of the detailed formulae used in the derivations of the Equitable Share Formula and the conditional grants.

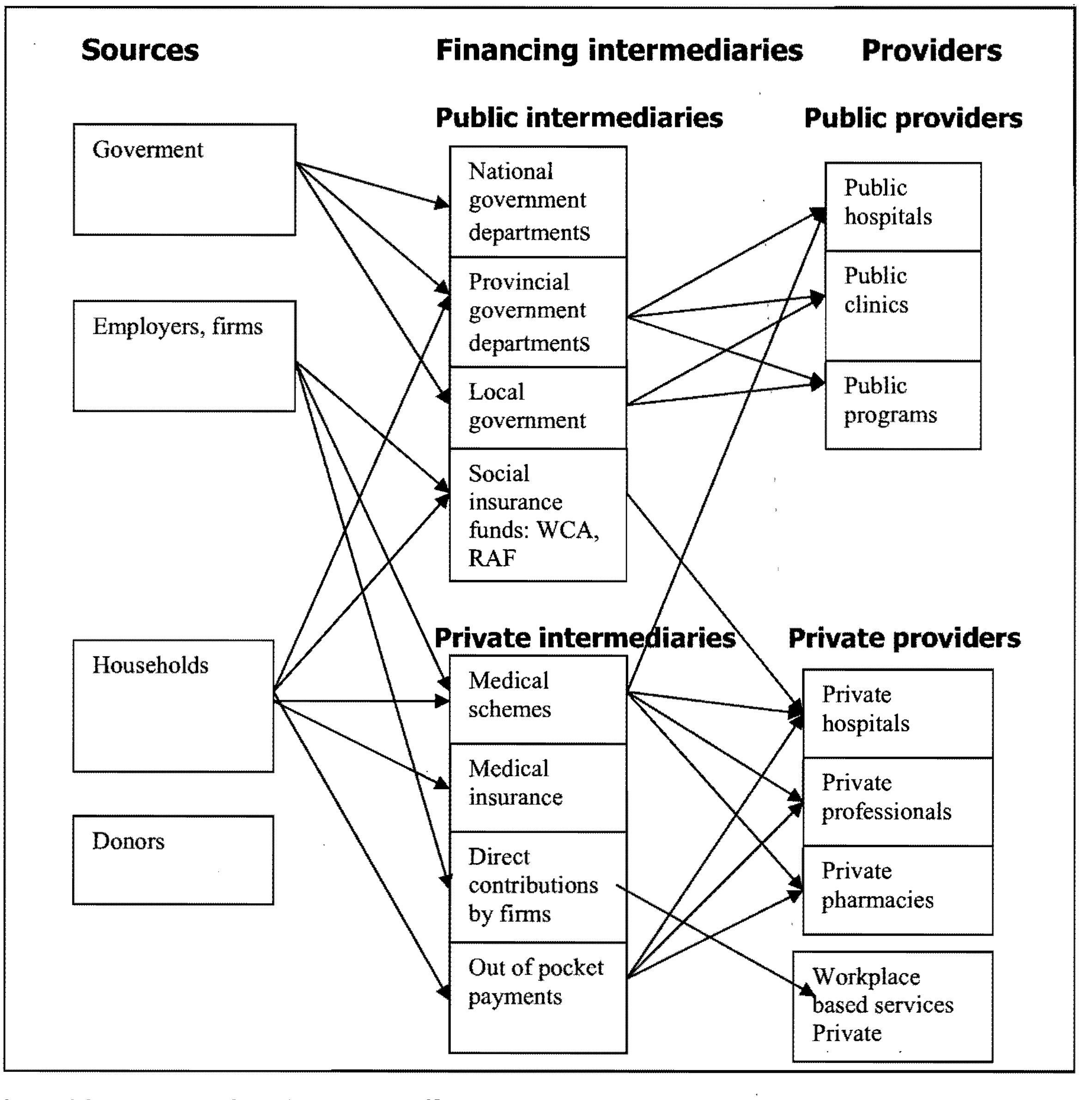
These financial databases are supplemented by findings from academic research, particularly the National Health Accounts report.[28,29] The level of public health expenditure in 1992/3 is included as a base comparison and is drawn from the Health Expenditure Review.[30]

RAPID ANALYSIS OF TOTAL HEALTH SECTOR FUNDING FLOWS

For the rapid analysis of the overall funds flowing through financing intermediates, the basic structure of the National Health Accounts (NHA) project was used[28], but the data was extensively updated from the sources cited above. Expenditure data on social security funds, namely the Compensation Fund for Occupational Injuries and Disability (COIDA), the Road Accident Fund and the Unemployment Insurance Fund, has been sourced from National Treasury databases and unpublished reports of these funds. Data on private sector medical scheme financing is drawn mainly from reports of the Registrar of Medical Schemes, including the recently published 2004 report.[31,32,33,44] The greatest uncertainty lies in the area of out-of-pocket expenditure. Reserve Bank data series of consumption of medical services, medical and pharmaceutical products and durables used in annual calculations of national GDP have been used to estimate out of pocket expenditure. The estimates derived using this approach are significantly lower than those of the NHA report. Expenditure on health insurance products regulated under the insurance industry (as opposed to the medical scheme industry) have been derived from reports on the long and short term insurance industries by the Financial Services Board, their national regulatory authority.[34]

For the rapid analysis, a classification of financing streams used in the National Health Accounts project was used.[35] In this, third party insurers or government purchasers are considered as financing intermediaries and may be public or private, as shown in the depiction of financing flows in figure 3. Funding flows are shown on the left side of the figure from funding sources to financing intermediaries. Some options on the allocation or purchasing function are shown in the right side of Figure 3, from financing intermediaries to providers.

Figure 3.1. Financing flows through intermediaries



Adapted from National Health Accounts[35]

Data analysis

All prices have been converted to real values, with the adjustment for inflation made for financial years (commencing 1 April annually) using the CPIX index (consumer price index less mortgage interest).[36] This is a key national inflation measure regularly updated by Statistics South Africa. Data on the CPIX is also published annually by the National Treasury in its Budget Review publication. However this index only commenced in 1997, and real comparisons prior to this have been constructed based on the consumer price index (CPI).[36] Data on the Medical care and health care products component of the CPIX and CPI has been obtained from Statistics South Africa (Personal communication: Statistics South Africa).

Obtaining reliable demographic data for provinces for use in per capita calculations has been surprisingly difficult, given discrepancies between official estimates and uncertainties around migration and differential mortality effects of HIV/AIDS across provinces. The following approach has been adopted. Demographic data has been drawn from the 1996 and 2001 censuses[37] and years between 1996 and 2001 recalculated based on an exponential function. In some cases the use of the 2001 census makes a significant difference to previous estimates of population and impacts on analyses of health financing per person and equity, as will be shown. For the years from 2001 to 2005 annual mid-year population estimates of Statistics South Africa have been used.[38,39,40] Other approaches used in the sensitivity analysis include estimates from the Abt group and from the Bureau for Market Research (personal communication).

In most calculations requiring provincial population denominators, the uninsured population has been used as derived through subtracting the insured population from the total. Total numbers of persons with insurance coverage by medical schemes is taken from data from the Registrar of Medical Schemes.[31,41] The inter-provincial distribution of these members has been drawn from the 1995 and 1999 October Household Surveys and more recently the General Household Surveys.[42,43] The decision to use the 1999 and subsequent surveys has been based on their closer approximation of beneficiaries to data from the Registrar of Medical Schemes[44] and recent data from Census 2001 and the Income and Expenditure survey showing significant growth of the population in low income quintiles in Gauteng.[45]

Data has been presented graphically showing trends over the period. Annualised growth, real and real per capita growth rates have been calculated using the formula (((a/b)^(1/n))-1, where a and b are the initial and final value, ^ is the exponent and n the number of years).

Equity analysis has focused on real per capita expenditure trends across provinces. This has been supplemented by data on personnel inputs and outputs such as primary care visits and hospital admissions.

Key indicators of fiscal analysis which were used were trends in revenue, expenditure and non-interest expenditure as a proportion of GDP. Various indicators of fiscal sustainability have been calculated e.g. conventional deficit, interest as a proportion of government expenditure, interest as a proportion of GDP, debt as a proportion of GDP.

The expenditure prioritization analysis across government focused on departments spending in excess of R5 billion annually by the end of the MTEF budget period. These large departments selected spend approximately 90% of total government (non-interest) expenditure annually. Again data trends have been presented graphically and by real annualised growth rates.

Data validity and reliability for overall historical budget and spending data for individual Departments is considered to be high for all years up to 2005/06. All spending data is collected from audited financial statements and for 2005/06 from pre-audited statements. Data validity was checked by comparing spending from the consolidated databases against the National Health Accounts (NHA) project, which made a detailed study of all sources of financing for public sector health services for the years 1996/97 to 1998/99.28 It reported on three financing levels: narrow (national and provincial departments of health), core (narrow plus local authorities and public works departments) and full (core plus other government departments and funds). For the purpose of this model the core level is considered the most relevant. The NHA level was close to the level used above, being on average 0.2% lower than the Treasury data over the three years. Historical spending data used for this study has been drawn from final audited figures and is therefore likely to have a high degree of accuracy. In contrast, forward budget projections over the medium term are likely to somewhat under-estimate future health service budgets, since additional funds tend to be added to baseline forward budgets in each budget year.

Inter-relationships between health care funding and key fiscal and expenditure variables were explored through reviewing Treasury policy documents[2,3,4,5,57,58], bivariate and multivariate regression analysis and super-imposing graphic patterns of the key variables to examine common patterns or phases in the course of the period. The regression analysis was done using the statistical package STATA.[46]

International comparative analysis

A comparative analysis of funding for public sector health services in middle income countries was undertaken. Data on health spending and other related fiscal and expenditure variables has been drawn from various primary and secondary sources, particularly the annual World Health Organisation's World Health Report series.[47-54] Countries have been selected from 192 countries in the WHO database of 2006 covering the period 1999-2003[54]. For most analyses the 2003 data has been used. Those with a total population of less than one million were excluded leaving 148 countries. These were grouped into low, middle and high income groups in terms of GDP per capita by the World Bank.[55,56] A smaller subset of middle income counties was selected for more detailed analysis by including those with a population greater than 10 million, except for African countries which were not subjected to this size criterion. Comparative expenditure levels are expressed in term of United States dollars ($). Where adjustments have been made for purchasing power parity (PPP) across countries, the WHO adjustments[47] have been used and these adjusted figures are shown as international dollars (I$). Spending on public and total health services as a proportion of GDP and as a proportion of total general government expenditure is presented. For each variable the median and mean (weighted for population size) was calculated.

Projecting funding availability to 2010/11

An approach is developed to predict future public funding levels for health services to 2010/11. This is required for the planning model in the second part of this thesis. It should be noted that this module focuses on the availability (or "supply") of funding, whereas the planning model in Part C of this thesis, focuses on the requirement (or "demand") for funding.

The method utilised by the author to model the future funding envelope was as follows. The latest published fiscal, budget and expenditure projections of the National Treasury was used for all years to 2008/09.[57] Three forward funding projection options were modelled: low, medium and high. The module was constructed based on several key variables and policy choices that underpin the budget. These are as follows.

Firstly economic growth as measured by GDP is a key factor in overall budgets. The growth projection of the National Treasury is used up to 2008/09 (and 2009/10 for the more optimistic model), which are based on a sophisticated econometric model.[57] The years beyond the Treasury projections of growth up to 2008/09 were modelled as moderating to 3.5% per year (sensitivity analysis 1.5%-5%). This estimate is more conservative than government's attempts to reach a growth target of 5% per annum. As a crosscheck of forward real growth, the modelled figure was compared against various commercial bank estimates of forward real growth in GDP. In the higher funding option the more positive economic growth projections up to 2009/10 from the most recent Medium Term Budget Policy statement were used.[58]

Secondly three key summary measures of fiscal policy were used pertaining to revenue, deficit and expenditure policy. These measures are the total revenue to GDP ratio, the deficit to GDP ratio and the expenditure to GDP ratio on the main national budget.[57] The revenue to GDP ratio is a summary measure that reflects the overall effects of tax policy choices, efficiency of revenue collection, broadening of the tax base and the extent to which government wishes to tax the economy after considering benchmarks with comparable countries and other macro-economic implications. In baseline budgets the revenue to GDP ratio increases gradually from 22.3% to 26.1% in the period from 1995/96 to 2008/09 (chapter 4). The Treasury estimates of revenue to GDP ratio on the main budget was used up to 2008/09, when it is projected to be 26.1%.[57] Beyond 2008/09, this is projected to remain at 26% over the forward period in the main option. Although National Treasury previously indicated a target of 25% (personal communication National Treasury), strong and repeated revenue overruns and expenditure growth suggest a higher proportion will be maintained. In the optimistic scenario developed here the revenue to GDP ratio is modelled to rise to 26.4%.

Projections of the fiscal deficit have been based on Treasury projections until 2008/09 when the projection is 1.2%.[57] After 2008/09 a moderate rise in the deficit target to 2% by 2010 is projected in the main scenario. This approach is based on previous Treasury policy around the deficit which expressed comfort with deficit targets reaching to 3%.[1] A modest increase in the deficit appears a reasonable assumption and is used in the main scenario. Very recent Treasury policy documents published after the main modelling for this thesis has been completed suggest that if strong revenue over-runs continue bringing the revenue to GDP ratio above 27% then as part of a counter-cyclical fiscal stance a very low deficit or even a budget surplus may be run.[58,59] This was tested in an alternate scenario.

Total expenditure (including interest payments and the contingency reserve) in the module is calculated as the sum of total revenue and the additional funds obtained through deficit financing. The value of interest payments has been calculated based on national debt levels (baseline plus annual deficit) at existing interest rates paid by the National Treasury. Non-interest expenditure is calculated from total expenditure less interest expenditure.[57]

Thirdly the share of total non-interest expenditure allocated to the health sector is modelled. In the main option the baseline trend of a declining share is selected to continue. The share of funds allocated to the health sector (provinces and national department) is anticipated to decline progressively over the Medium term Expenditure framework to 12.2%. It is projected that this declining trend continues to 12% in 2010. The basis for the decline is an increased share to other basic needs, such as social security, local government, water, sanitation and strong emphasis in current budgets on infrastructure and budgetary measures to promote economic growth.[57,58] In the higher funding option provision is made for a reversal of this trend (noting also the Abuja Declaration target of 15%).

These relationships are partly summarized by the following equations:

Revenue = GDP * (Revenue to GDP ratio)

Expenditure = Revenue + deficit

Debt in year y = Debt in year (y-1)+deficit in year (y-1)

Annual interest payment = Debt * average interest rate

Non-interest expenditure = Expenditure – interest payment - contingency reserve

Health services expenditure = a * non-interest expenditure (Where a is % allocated to Health)

An illustration of results of the main funding module is shown in Table 3.1. This suggests that funding for public sector health services will grow by R14.5 billion, from R43.6 billion in 2004/05 to R58.4 billion in 2010/11. Sensitivity analysis is presented in chapter 4.

Table 3.1. Funding module to project health service funding to 2010/11

Rand billion	2001/02	02/03	2003/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11
GDP real 05/06 prices	1,317	1,366	1,385	1,465	1,560	1,645	1,731	1,833	1897	1964
GDP growth		3.7%	1.4%	5.7%	6.5%	5.5%	5.2%	5.9%	3.5%	3.5%
Revenue/GDP	23.7%	23.3%	23.4%	24.8%	26.4%	26.0%	26.1%	26.1%	26.0%	26.0%
Revenue real 05/06 prices	312	319	325	363	411	428	452	479	493	511
Revenue growth		2.1%	1.9%	11.6%	13.4%	4.2%	5.5%	5.9%	3.1%	3.5%
Deficit /GDP	-1.4%	-1.1%	-2.3%	-1.5%	-0.5%	-1.5%	-1.4%	-1.2%	-1.7%	-2.0%
Deficit	-18	-15	-32	-21	-8	-25	-25	-21	-32	-39
Expenditure	330	334	357	384	419	454	477	500	526	550
Expenditure growth		1.0%	6.9%	7.7%	9.1%	8.3%	5.1%	4.8%	5.2%	4.6%
Debt	535	477	481	491	481	487	500	508	541	580
Interest %	11.6%	11.1%	10.8%	10.7%	10.7%	10.5%	10.1%	9.9%	9.8%	9.7%
Interest	60	54	50	51	51	50	49	49	53	56
Contingency						2	5	7	7	7
Non-interest expenditure	271	280	306	333	368	401	423	444	466	487
Non-interest growth		3.5%	9.4%	8.7%	10.4%	9.1%	5.5%	4.9%	4.9%	4.5%
Non-interest expenditure -% of GDP	20.5%	20.5%	22.1%	22.7%	23.6%	24.5%	24.7%	24.6%	24.5%	24.8%
% spent on health services (provincial and national health departments)	14.1%	14.0%	13.7%	13.1%	13.1%	12.6%	12.4%	12.2%	12.1%	12.0%
Health services expenditure	38.23	39.14	41.86	43.65	48.00	50.71	52.50	54.11	56.33	58.39
Health services expenditure growth		2.4%	7.0%	4.3%	10.0%	5.6%	3.5%	3.1%	4.1%	3.7%

The results of this funding module was compared against the result of the linear regression model described earlier in this chapter and in chapter 4 which relates health expenditure to various fiscal variables.

The second part of this chapter goes beyond the area of funding and deals with two objectives that begin to lay the groundwork for the development of the planning model in Part B of this thesis.

SITUATIONAL ANALYSIS

As a first step towards model development, a situational analysis of a number of key areas was undertaken with particular emphasis on existing baseline and historical spending patterns. Several measures of need, demand and supply are also briefly reviewed.

With respect to measures of need, demographic and mortality data and trends are sourced from the Medical Research Council (MRC) and Statistics South Africa (SSA).[60-64] There are some differences between the MRC and SSA estimates of mortality, particularly with respect to HIV/AIDS and the presentation of various sources provides some indication or variability among estimates.

With respect to demand, output data for hospitals and primary care output have been sourced from the national district health information system (DHIS) and its predecessors. This was considered likely to be best available information source despite problems of both sub-optimal validity and reliability. Its main advantage is that it is the only standardized information system that provides information for all provinces over a multiyear period. There is a degree of consistency of information across years, which suggests reliability. However cross-checks of data submitted by individual provinces to the National Treasury within specific years as part of the Quarterly Reporting System frequently show discrepancies against the DHIS which suggest problems of reliability. Thus in general, caution needs to be exercised in interpreting output trends and improving national systems of performance reporting is an important priority.

Expenditure trends for provincial Departments of Health have been drawn from the latest available databases of the National Treasury and the Inter-governmental Fiscal Review series of publications over the period.[65-69] The Treasury publications and databases are compiled in turn from audited financial statements of all departments in all provinces and adjusted for function shifts and certain other changes and on published budgets. Expenditure figures from Treasury sources for all years up to 2004/05 are audited; those of 2005/06 are final pre-audited figures. Data for 06/06 to 08/09 are drawn from provincial MTEF budgets.

An analysis was undertaken of composition of provincial expenditure by functional area (e.g. primary care, hospitals) and by economic classification (e.g. personnel, capital). This analysis is useful to demonstrate what the sector is spending its money on and how and to what extent this has changed given stated policy priorities and how additional funding has been spent. The new budget classification system adopted since 2002/03 provides a more detailed breakdown of hospital types than previously for the years since 1999/00. Separate budget sub-programmes have been defined for district, general (regional), central, provincial tertiary, TB, psychiatric, sub-acute, step-down and rehabilitation, chronic and other specialized hospitals. The new structure separates out functional areas more distinctly than previously and is shown in table 1 consisting of eight programmes, each with a number of sub-programmes. Programme 2 contains primary care services, but also includes the HIV/AIDS programme and district hospitals. Programme 3 covers ambulance services. Programme 4 and 5 contain the bulk of hospital services. Programme 6 contains a number of training functions and programme 7 contains a limited number of support services. Capital works projects such as construction and upgrading of health facilities are shown in programme 8 and not in the service programmes.

Table 3.2: New budget programme structure implemented from 2002/03

1. Administration	**5. Central hospital services**
1.1.Office of MEC	5.1. Central hospital 1
1.2. Management (Head Office)	5.2. Central hospital 2 etc.
2. District Health Services	**6. Health Sciences Training**
2.1. District management	6.1. Nursing Training Colleges
2.2. Clinics	6.2. Ambulance Training Colleges
2.3. Community Health Centres	6.3. Bursaries
2.4. Community based services	6.4. Primary health care training
2.5. Other Community health services	6.5. Training Other
2.6. HIV/Aids	**7. Health Care Support Services (Only where centralised)**
2.7. Nutrition	7.1 Laundries
2.8. Coroner services	7.2. Engineering
2.9. District hospitals	7.3. Orthotic & Prosthetic services
3. Emergency health services	7.4. Medicine Trading account
3.1. Emergency transport	**8. Health facilties**
3.2. Planned patient transport	8.1. Administration
4. Provincial Hospital Services	8.2. District health services
4.1. General hospitals	8.3 Emergency medical
4.2. T.B Hospitals	8.4 Provincial hospitals
4.3. Psychiatric/mental hospitals	8.5. Central hospitals
4.4. Chronic and sub-acute medical hospitals	8.6. Health science training
4.5. Dental training hospitals	8.7. Support services
4.6 Other specialised Hospitals	

The validity of expenditure data at the budget subprogramme level is dependant on the accuracy of classification of expenditure within each province's financial information system. Expenditure has been audited at the subprogramme level since 2003/04 and is likely to be reasonably valid and reliable from that period. Historical reclassification of subprogramme expenditure by provincial Departments of Health for the period from 1999/2000 to 2001/02 may have led to some limited misclassification in some provinces particularly between primary care and district hospitals. For the period from 1995/96 to 1998/99 Treasury data was only available by budget programme. As a check of validity this was compared for the period 1996/97 to 1998/99 with the findings of the National Health Accounts Project and a high degree of consistency was found[28].

Expenditure on HIV/AIDS has been drawn from actual expenditure on conditional grants and a model of AIDS expenditure constructed by the author. The latter is based on projections of hospital workloads arising from AIDS derived by the Abt group (personal communication: Abt group) applied conservatively by adjusting 30% downwards for home based care and costing at typical public sector hospital cost structures (unit costs described in this chapter). This approach was cross-checked against another approach using data on AIDS cases by stage derived from the Actuarial Society[70] and utilisation data from a South African cohort (personal communication: S. Cleary, University of Cape). The approaches were found to be comparable.

Unit costs have been calculated by bringing together the expenditure and performance data described above. The financial systems in most South African hospitals do not separate between inpatient and outpatient cost centres. Unit costs for hospitals were estimated through an approach using patient day equivalents (PDEs), in which the cost of an inpatient day is assumed to be equivalent to three times the cost of an outpatient visit. This approach was used to calculate the cost per PDE and from this the cost of an inpatient admission and outpatient visit. This approach is useful because of its simplicity and practicability. The 3:1 ratio was used because it is the standard South African convention (personal communication Department of Health) and because it was found to accord reasonably with local and international studies. Local studies have reported ratios from 2.4-3.5[71,72] and internationally ranges between 3 and 4 are common.[73] Variations in this ratio will affect the distribution of hospital costs between the inpatient and outpatient components.

Data on personnel numbers such as filled posts has been drawn from the Vulindlela information system and other reports over several years. Vulindlela draws personnel data from the PERSAL system, the main personnel information system used by the South African public service. For some provinces, where data was incomplete for 95/96 or 96/97 (Free State, Limpopo) constant post numbers have been assumed in these years.

Relationships between health care expenditure and a selected limited number of variables were explored through the use of a linear regression model. The regression model was based on data from the nine provinces for the years 2000/01 to 2005/06. Data sources are those cited where these data are presented in chapters 3 and 6.

Textbox 1. Variables in regression model

Province	Population uninsured (thousand)
Year 2000/01 to 2005/06	Total population (thousand)
Primary care visits (thousand)	Population weighted for medical insurance
Primary care visits per capita	Females 15-45 years
Outpatient visits (thousand)	Children<5 years
Outpatient visits per 1000 population	Elderly > 65 years
Admissions (thousand)	Proportion female 15-45 years
Admissions per 1000 population	Proportion children <5 years
Health expenditure (R million)	Proportion elderly >65 years
Health expenditure per capita	GDP (national or provincial)
National Tertiary Services grant (NTSG)	GDP per capita
NTSG allocations per capita	HIV antenatal sero-prevalence
HIV antenatal sero-prevalence(%)	AIDS stage 4 cases
Personnel numbers public sector	AIDS stage 4 cases per capita
Personnel per 1000 population	Population density
Personnel unit cost (rand)	Educational performance (matric pass rate)
Doctors public sector	
Doctors per 1000 population	
Nurses public sector	
Nurses per 1000 population	

HEALTH SECTOR PRIORITIES

The planning literature presented in chapter 2 highlighted the importance in the planning cycle of determining future goals and priorities. A wide range of health sector policy documents, plans and budget documentation were reviewed to examine the major strategic priorities of the health sector. These included several major multi-year planning documents of the Department of Health.[74-77] The policy intent of recent budgets of the national Department of Health was reviewed in the context of budget statements published in the Estimates of National Expenditure series.[14,78,79]

This chapter has been the first of two chapters focusing on methodological aspects of the work undertaken. This main part of the chapter described the methodology used to analyse the availability of funding for public health services. The last part of the chapter dealt with two introductory parts to the planning framework, namely the situational analysis and sector goals and priorities. Subsequent chapters with present the methodological development of the planning framework and its application to determine sector cost requirements.

CHAPTER 4: PUBLIC HEALTH CARE FUNDING IN THE CONTEXT OF FISCAL AND EXPENDITURE POLICY CHOICES

INTRODUCTION

This chapter presents the results and analysis of public sector health care funding trends over a thirteen year period from 1995/96 to 2008/09 within a context of government's broader fiscal policy and expenditure choices across sectors. The analysis in this chapter provides an important basis for understanding the available funding envelope for public health services in South Africa and its potential for growth in the period ahead.

The objectives of this chapter are to undertake a rapid analysis of the total level of funding of public and private health services in South Africa. Public health care expenditure and budget trends for provinces and the national Department of Health are presented for the thirteen year period from 1995/96 to 2008/09. The level of public health care funding is explored with reference to trends in government's fiscal and expenditure choices. South Africa's public sector funding level is compared with other middle income countries. Drawing from the analysis a module is developed to project health care funding for the period to 2010/11, which is of use in the planning model presented later in this thesis.

RESULTS

Rapid analysis of total level of health care funding in South Africa

Given that the National Health Accounts (NHA) report[1], although possibly the most thorough review of health sector financing in South Africa ever undertaken, is now somewhat outdated, the author has conducted a rapid analysis using more recent, but slightly less complete data. Flow of funds through financing intermediates are shown in Tables 4.1, 4.2 and 4.3 and suggest financing flows of around R125.8 billion in 2005/06, or 8.1% GDP in 2005/06. Around 42.7% of funds flow through public sector intermediaries, 56.5% through private sector intermediaries and 0.8% through NGOs or donors (Table 4.1). The slightly lower estimate of spending as a proportion of GDP by the author appears to be due partly to upward revision of historical estimates of national GDP[2] and a higher estimate of out of pocket expenditure by households having been used in the NHA project.

Table 4.1: Estimate of flows through financial intermediaries 2005/06

	Rand billion	%	% of GDP
Public	53,765	42.7%	3.4%
Private	71,086	56.5%	4.6%
Donors and NGOs	947	0.8%	0.1%
Total	125,797	100.0%	8.1%

Of the R53.8[2] flowing through public sector intermediaries, the majority goes via provincial departments of Health (Table 4.2), while medical schemes are the major contributor to private financing intermediaries (Table 4.3).

Table 4.2: Public sector financial intermediaries 2005/06*

Financing intermediary	Total (R mil)
Local government#	2,445
Provincial Departments of Health and Works#	45,717
National Departments of Health, Defence and Correctional Service, Education	3,840
Workmens Compensation Fund	1,414
Road Accident Fund	349
Total public*	53,765

* Excluding contributions to medical schemes of employees
\# Transfers from provincial to local governments are included under local government and excluded from provinces

Table 4.3: Private financial intermediaries 2005/06

Private financing intermediary	Total (R mil)
Medical schemes*	56,388
Out of pocket#	11,804
Medical insurance	1,958
Employer private	936
Total private	71,086

* Includes public sector contributions to medical schemes of employees
\# Out of pocket expenditure is largely derived from Reserve Bank estimates of consumption and is the largest area of uncertainty

Table 4.4 shows the sources of financing for the financial intermediaries shown above. Medical schemes, for example, have as their sources employer and employee (or household) contributions. Approximately R8.3 billion of government expenditure in 2005/06 is spent on employer contributions to current and retired employees' medical schemes. The table shows that government is the source of around 46.8% of funds for health sector financing but comprises only 42.7% of funds through financial intermediaries (Table 4.1).

Table 4.4. Estimate of sources of funds for health services 2004/05

	Rand (bil)	Percentage (%)	% of GDP
Government	58,900	46.8%	3.8%
Employer	23,444	18.6%	1.5%
Households	42,506	33.8%	2.7%
Donors and NGOs	947	0.8%	0.1%
Total	125,797	100.0%	8.1%

PROVINCIAL AND NATIONAL HEALTH CARE EXPENDITURE TRENDS

Whereas the section above provides a rapid analysis of a broad perspective on health care financing, the sections which follow provide a more detailed focus on spending by provincial and national Departments of Health. These have been selected because they provide a useful indicator of total public health care spending, are the main locus for public services and because we have been able to source accurate expenditure or budget data for a period of thirteen years. Provincial Departments of Health control by far the largest proportion of public health finances, around 82% including Works Departments (2.7%).[2] An examination of their spending trends will tell us much about the overall pattern of public sector health care expenditure.

Table 4.5 shows trends in provincial spending and forward budgets from 1995/96 to 2008/09 stated in real 2005/06 prices (alternate years are shown because of space limitations). Overall, expenditure on health services has grown significantly. From 1995/96 to 2008/09 this growth will amount to R20.8 billion or 3.8% annually. However the size of the 1996 wage settlement somewhat skews this picture and a better summary figure is possibly that from the 1996/97 peak to 2005/06, for which period annual growth was 2.1% annually or R8.2 billion over a nine year period. After a reduction of health care expenditure of R4.1 billion between 1996/97 and 1999/2000 health care expenditure has recovered by R12.1 billion from 1999/00 to 2005/06.

Table 4.5: Trends in provincial and national health care expenditure (constant 2005/06 prices) R million

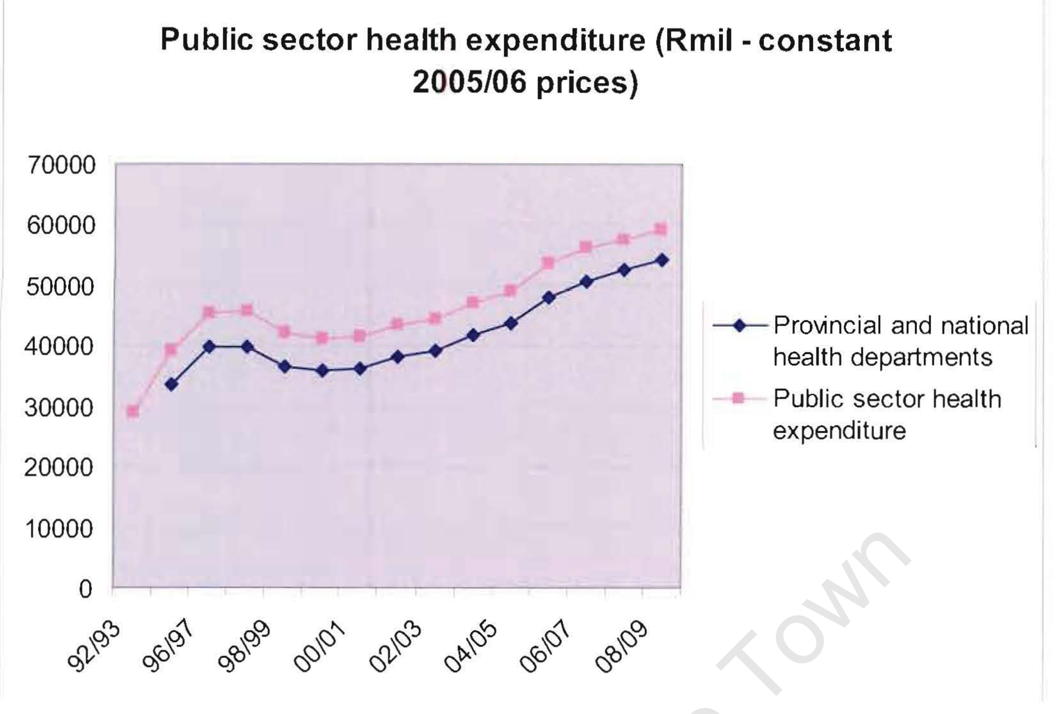
	95/96	97/98	99/00	01/02	03/04	05/06	07/08	08/09	Growth annual 95/96-08/09	Total real growth
National Department of Health (less conditional grants)	913	889	746	793	1,005	1,159	1,189	1,189	2.1%	276
Provinces	32,533	38,973	34,918	37,436	40,853	46,845	51,422	53,044	3.8%	20,511
Subtotal	33,446	39,862	35,665	38,229	41,857	48,004	52,499	54,109	3.8%	20,787

*Including relevant Works Department expenditure in Western Cape.
Works expenditure in other provinces has already been included in the Health vote for several years
A provincial breakdown of these trends is provided in chapter 5.

Figure 4.1 shows this trend graphically and highlights three phases of real expenditure growth:

- A substantial increase from 1995/96 till 96/97 or 97/98 averaging 9.2% annually, with the main increase being in the 1996/97 year (18.9%). For comparison purposes the level of public health care expenditure in 1992/03 is also shown in the graph.
- A phase of decreasing expenditure from 97/98 to 99/00 averaging –5.4% per year.
- Finally re-establishing an upward trend from 2000/01, with annual real growth amounting to 5.2%. By 2008/09 spending is expected to be R18 billion higher than in 2000/01 in real terms. However the peak reached in 1997/98 was only achieved again and surpassed recently in 2003/04.

Figure 4.1: Provincial health care expenditure trends



POPULATION GROWTH

The positive effect of growth in real funding levels over the period has been partially offset by several factors, some discussed in later chapters, including:

- Growth in the population dependent on publicly funded services through a combination of overall population growth and declining medical scheme coverage
- Rising wage costs and other causes of health inflation exceeding CPIX
- The effects of HIV/AIDS

Overall population growth over the period, combined with a declining proportion of the population covered by medical schemes, has placed a larger load on government. Real per capita expenditure trends are shown in Figure 4.2. This shows that projected expenditure levels in 2005/06 exceed those of 95/96 but have only just reached the 96/97 peak. However real per capita growth continues until 2008/09 at which point the funding level (of provincial and national Departments of Health) will reach R1325 per capita in real 2005/06 prices. When funding does not match increases in the population dependent on the public sector as it has not until recently, then public health services are bound to be squeezed and quality compromised. It is probably worth noting that the 1996/97 peak was associated with high wage increases, once-off severance costs (payouts to personnel voluntarily exiting the service during downsizing), over-expenditure, and three provinces being placed under national supervision (section 100 of the constitution, imposed by national government on provinces considered to have poor financial controls). However, the subsequent dip was not simply a correction of this, but also a reflection of reducing finances for provincial departments over that period.

Figure 4.2: Per capita public health care expenditure (Rand real 2005/06 prices)

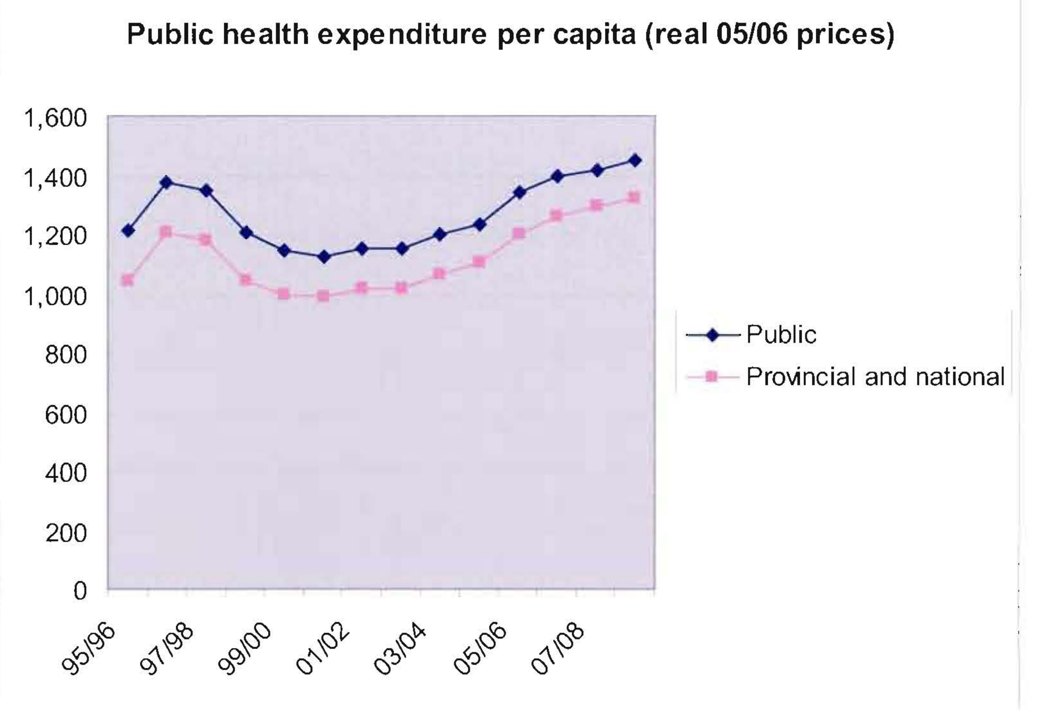


Table 4.6: Provincial public health care expenditure per capita (real 05/06 prices)

	95/96	97/98	99/00	2001/02	2003/04	05/06	07/08	08/09	Annual growth (%)
Public health care expenditure (provincial and national departments)	1,043	1,177	997	1,015	1,063	1,202	1,296	1,325	1.9%

Real funding growth has been largely offset by population growth (Table 4.7). While total population growth over the period is projected to average 1.5%, the uninsured population is projected to grow by 8.2 million from 1995 to 2008 at a rate of 1.7% annually. Stagnant medical scheme coverage has increased the proportion of the population dependant on public sector cover. Real growth of 3.8% annually in total health care expenditure associated with growth in the uninsured population of 1.7% has resulted in real per capita growth of 1.9% annually (Table 4.6), or only 1.1% annually from the peak in 1997/98.

Table 4.7: Uninsured population

	1995	1997	1999	2001	2003	2005	2007	2008	Annual growth
Total population	39,477	41,153	42,826	44,574	46,171	46,933	47,706	48,097	1.5%
Medical aid population modelled*	6,800	6,965	6,989	7,025	6,925	6,999	7,114	7,173	0.4%
Uninsured population actual*	32,677	34,188	35,837	37,549	39,246	39,934	40,592	40,925	1.7%

Sources: Statistics SA, Actuarial Society, Registrar of Medical Schemes

WAGE GROWTH

From 1995/96 to 2005/06 personnel expenditure grew in real terms by R6.2 billion while personnel numbers declined from approximately 235 000 in 1995/96 to a low of 215 727 in 2001/02 before recovering to 227 495 in 2005/06 (Table 4.8). The average cost of a health sector employee increased by 36.7% over the period from 1995/96 to 2005/06. Given this, it is possible that as much as 52.6% (R7.6 billion) of the R14,6 billion overall increase for the period till 2005/06 (table 4.5) was comprised by higher costs of labour. If this is correct then the remaining growth (i.e. excluding higher costs of labour) amounted to R6.9 billion for the decade from 1995/96 to 2005/06 or 1.9% annually, fairly close to the rate of population growth.

Table 4.8 Increasing wage costs

	95/96	97/98	99/00	01/02	03/04	05/06	Average annual change	Total change
Filled posts	235,182	228,248	222,701	215,727	216,251	227,495	-0.3%	-3.3%
Personnel expenditure (R million 05/06 prices)	19,414	23,573	22,326	22,318	22,739	25,668	2.8%	32.2%
Average salary	82,547	103,277	100,252	103,454	105,150	112,827	3.2%	36.7%

HEALTH CARE FINANCING IN THE CONTEXT OF FISCAL POLICY

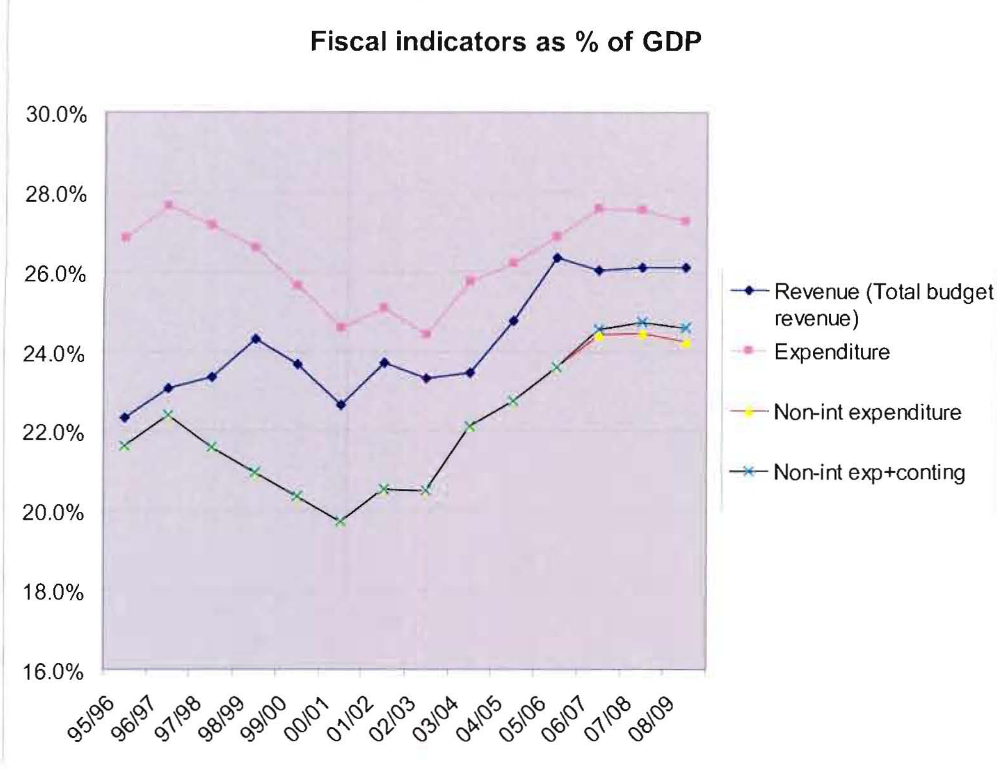
Three phases of fiscal policy

The three phases of health care spending were associated with three phases of fiscal policy.[3] In the sections which follow some of the policy aspects, statistical analysis and graphic representation of the relationships will be presented.

The first phase, in which health care spending increased in real terms from the early 1990s to 1997/98[3], occurred within the immediate period of the democratic transition of 1994 in which the core discriminatory features of the apartheid system were being dismantled and new provincial governments were being established. The Reconstruction and Development programme was being implemented attempting to develop and improve services in the early years of the new democratic government. In 1996/97 large wage increases involving rank and leg promotions were negotiated in the Central Bargaining Chamber. In the South African public sector, salary scales are divided into 16 levels or ranks and each of these is subdivided in turn into a number of levels called legs. These were an attempt to equalize wages and improve remuneration across the public sector and generally involved a movement upwards across salary bands. The period was characterized by rising expenditure, insufficient revenue and high deficits.[3]

The second phase was associated with the macro-economic stabilisation (GEAR) policy and real budgets declined over the period 1997/98 to 1999/00 as government sought to stabilise the macro-economy. By 1996/97 interest payments were exceeding 20% of the budget, expenditure exceeded revenue by over R50 billion per year with the fiscal deficit coming close to 5% of GDP. A new fiscal constraint policy (effectively an internally imposed structural adjustment programme), known as GEAR, was initiated. A focus of this policy was to decrease interest payments as a share of expenditure, through reducing debt and the deficit. Some of these indicators are shown in Figure 4.3. While revenue continued to rise, government expenditure was reduced fairly steeply till 1999/00, by which time the deficit was lower. It was during this period that health care expenditure reduced and downsizing occurred in provincial health services that were historically well resourced, such as the Western Cape.

Figure 4.3 Fiscal indicators as a percentage of GDP



In the third phase a more expansionary fiscal stance was adopted from the latter part of 2000/01. Following three years of fiscal austerity associated with reduced expenditure and a much improved debt position (Figure 4.4), improved debt management and lower interest rates (which declined from an average of 11.6% to 9.3%), a more expansionary third phase of spending recovery commenced in 2000/01 and persists to the end of the period under review (2008/09). This phase is also characterized by rising expenditure, a higher revenue to GDP ratio and economic growth. Some of the policy issues underlying the third phase were seen as success of the second phase in controlling debt costs and the need to address a wide range of spending priorities. There is also evidence of some re-examination of the potential role for expansionary fiscal policy to stimulate economic growth, with fiscal multipliers for (infrastructure) investment (0.9-1.6 in Treasury simulations) being considered of relevance.[3]

Figure 4.4 Indicators of sustainability of fiscal position: Debt, interest payments and deficit as a proportion of GDP

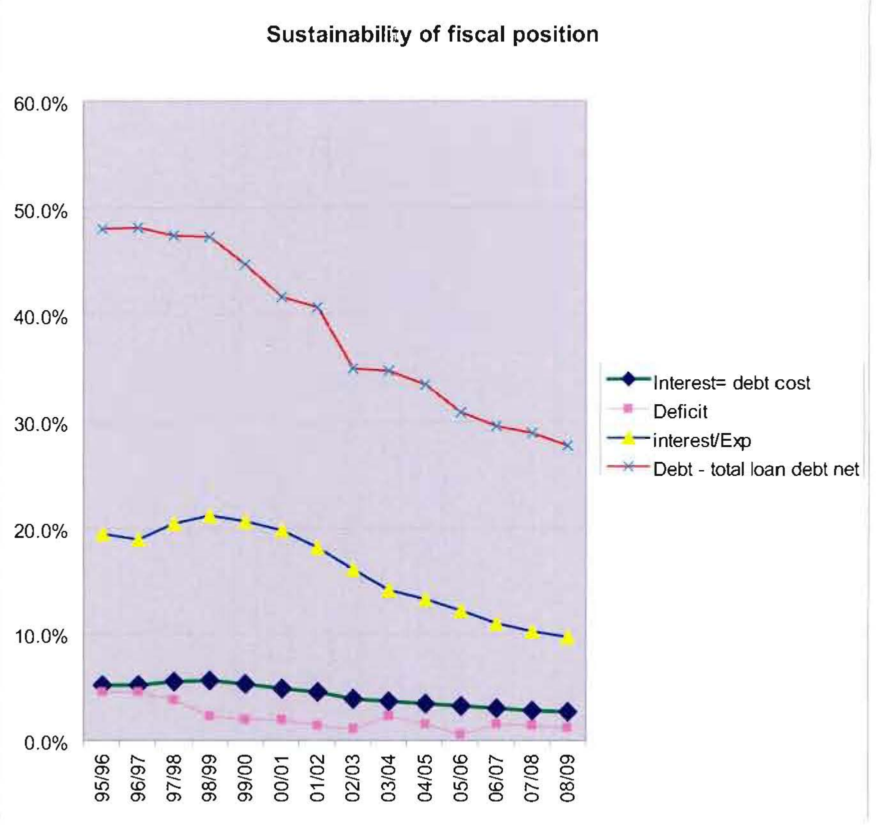
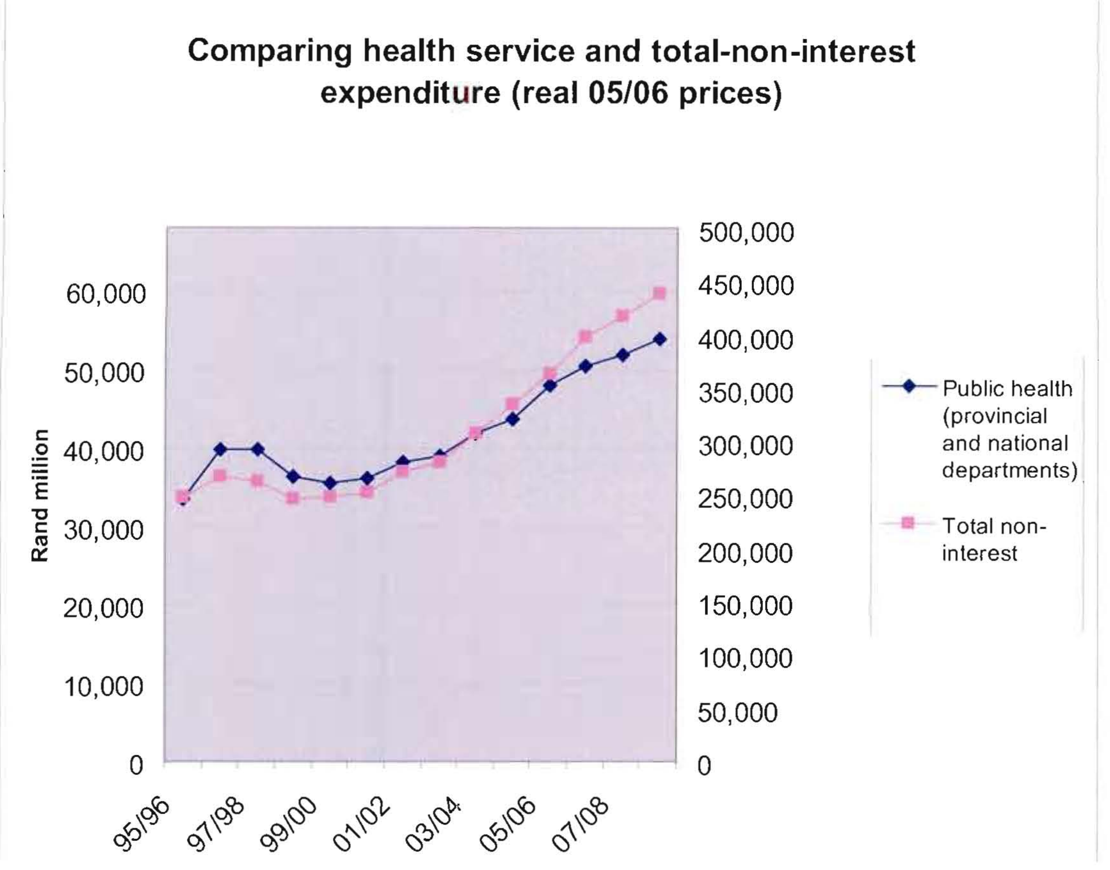


Figure 4.5 super-imposes health care expenditure on total non-interest government expenditure. The three phase pattern of health care expenditure demonstrated above is broadly similar to a three phase pattern of total non-interest expenditure. However health service expenditure rose proportionally more than total expenditure in the 1996/97 wage increases, but ends the period at a slightly lower level.

Figure 4.5 Superimposing health care expenditure and total non-interest expenditure



Total non-interest expenditure of government is presented within the context of a number of key fiscal measures and indicators in the main budget in Table 4.9 and Figures 4.3 and 4.6. These present the data as a percentage of GDP and in constant terms (real 2005 prices).

Total government tax revenue for the main budget is projected to increase in real terms by 4.9% annually over the thirteen year period from 1995/6 to 2008/09 or by R220 billion in real terms over the period. This revenue increase was achieved partly through increasing revenue as a proportion of GDP from 22.3% to 26.1% of GDP (Figure 4.7) and through real annual GDP growth of 3.7%. The former was achieved partly through improved revenue collection and widening of the tax base. Revenue growth was constrained by relatively low economic growth particularly in the first two phases in which it barely exceeded the population growth rate.

Non-interest expenditure increases by 4.6% per year annualised over the thirteen year period, an increase of R194 billion. However unlike revenue which increased more steadily, this took place over three distinct phases which broadly match the three phases of health care expenditure. The three phases of fiscal policy are shown in Table 4.10.

Table 4.9: National Revenue fund (Main budget; constant 05/06 prices)

Rand billion	95/96	97/98	99/00	01/02	03/04	05/06	07/08	08/09	1995/96 - 08/09 annualised	Growth 95/96- 08/09 Rand billion
GDP	1,139	1,212	1,208	1,316	1,384	1,560	1,706	1,819	3.7%	680
Revenue (Total budget revenue)	255	283	286	312	324	411	445	475	4.9%	220
Expenditure	306	329	310	330	356	419	470	496	3.8%	190
Contigency reserve	0	0	0	0	0	0	5	7	0.0%	7
Expenditure less contigency reserve	306	329	310	330	356	419	465	489	3.7%	183
Non-interest expenditure	247	262	246	270	306	368	417	441	4.6%	194
Non-interest expenditure plus contingency reserve	247	262	246	270	306	368	422	447	4.7%	201
Interest= debt cost	59	67	64	60	50	51	48	48	-1.5%	-11
Debt - total loan debt net	547	574	540	535	480	481	493	505	-0.6%	-42
Deficit	-51	-46	-24	-18	-32	-8	-25	-21	-6.6%	30

Figure 4.6 Trends in fiscal framework

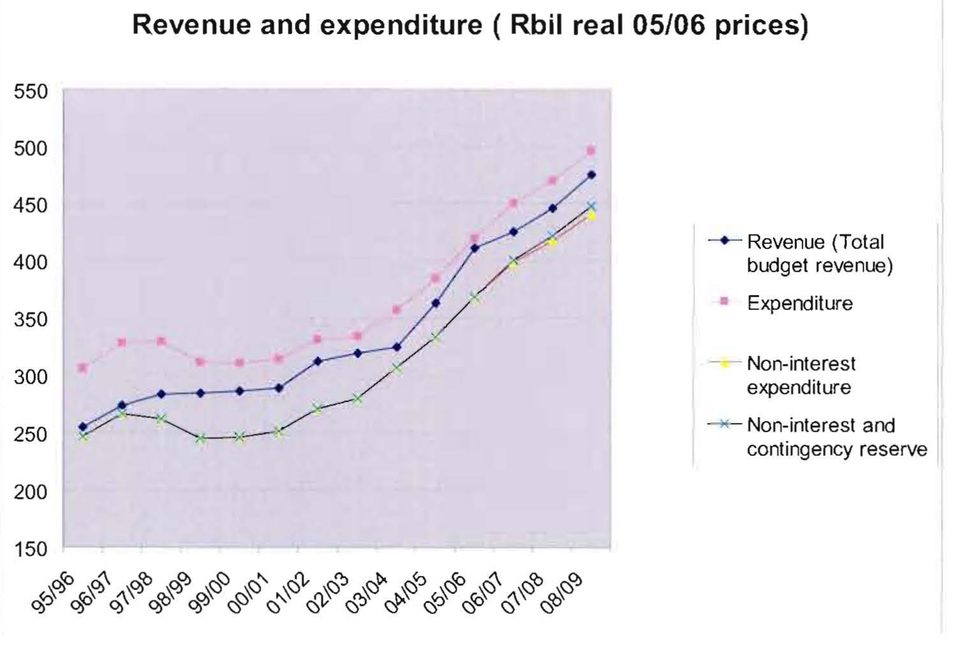


Table 4.10 Three phases of fiscal policy

	1995/96-1996/7	1996/97 - 1999/00	1999/00-2008/09
GDP change annual	4.2%	0.6%	4.7%
Revenue change annual	7.5%	1.5%	5.8%
Revenue/GDP at beginning and end of period	22.3%-23.1%	23.1%-23.7%	23.7%-26.1%
Expenditure change annual	7.2%	-1.8%	5.4%
Non-interest expenditure	7.8%	-2.6%	6.7%
Interest growth annual	4.5%	1.1%	-3.1%
Interest/expenditure at beginning and end of period	19.4%-18.9%	18.9%-19.8%	19.8%-9.8%
Debt growth annual	4.3%	-1.8%	-0.8%
Debt/GDP at beginning and end of period	48%-48.1%	48.1%-44.7%	44.7%-27.7%
Deficit/GDP at beginning and end of period	4.5%-4.6%	4.6%-2%	2%-1.2%
Health expenditure growth annual	9.2%	-3.1%	5.1%
Health expenditure growth real Rand million	6,309	-4,093	18,190

Per capita analysis

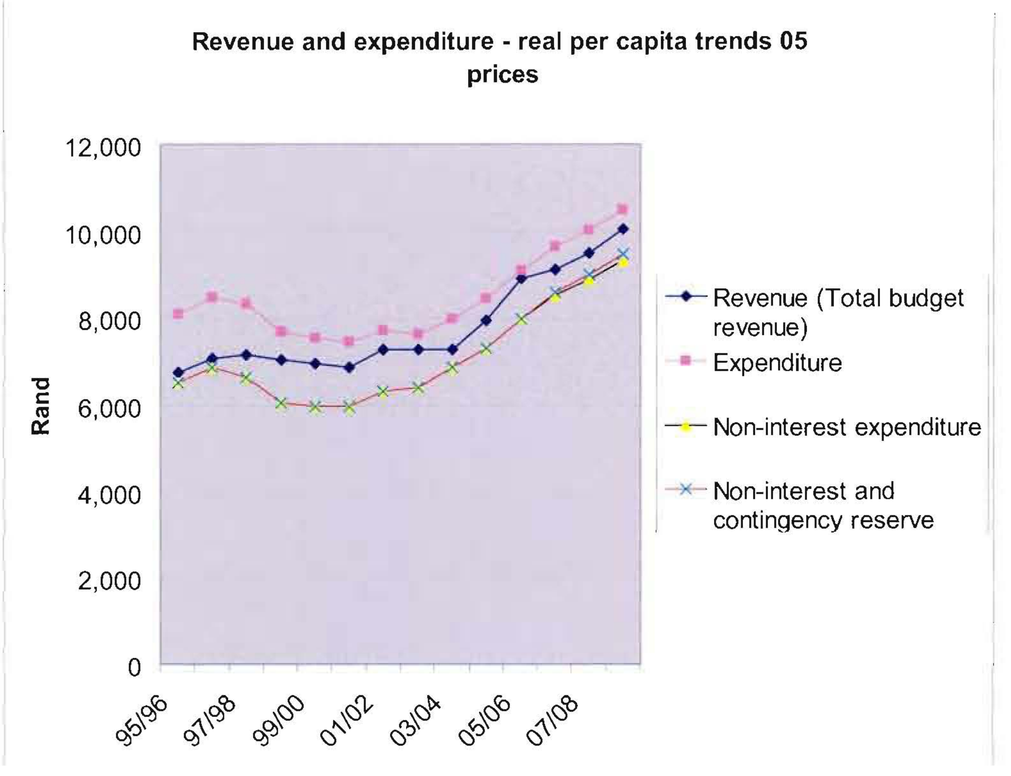
While total non-interest expenditure has increased by 4.6% over the period, real per capita growth in non-interest expenditure is projected to average only 2.8% annually over the thirteen years. This small increase has been possible because of a 3.1% annualised revenue increase, despite a relatively small 1.9% annual per capita GDP growth over the period.

Table 4.11: Fiscal framework expressed real per capita 2005/06 terms (total population)

National Revenue fund (Main budget)	95/96	97/98	99/00	01/02	03/04	05/06	07/08	08/09	13 year 95/96 -08/09 annualised
GDP	30,218	30,720	29,385	30,757	30,906	33,778	36,835	38,622	1.9%
Revenue (Total budget revenue)	6,753	7,174	6,955	7,286	7,247	8,904	9,615	10,082	3.1%
Expenditure	8,112	8,341	7,537	7,716	7,954	9,074	10,146	10,527	2.0%
Non-interest expenditure	6,540	6,636	5,983	6,319	6,833	7,966	9,006	9,353	2.8%
Interest= debt cost	1,572	1,705	1,554	1,396	1,121	1,108	1,042	1,027	-3.2%
Debt - total loan debt net	14,511	14,548	13,134	12,503	10,729	10,418	10,646	10,712	-2.3%
Deficit	-1,359	-1,166	-582	-430	-707	-171	-531	-446	-8.2%

* Because of space considerations only every second financial year is shown

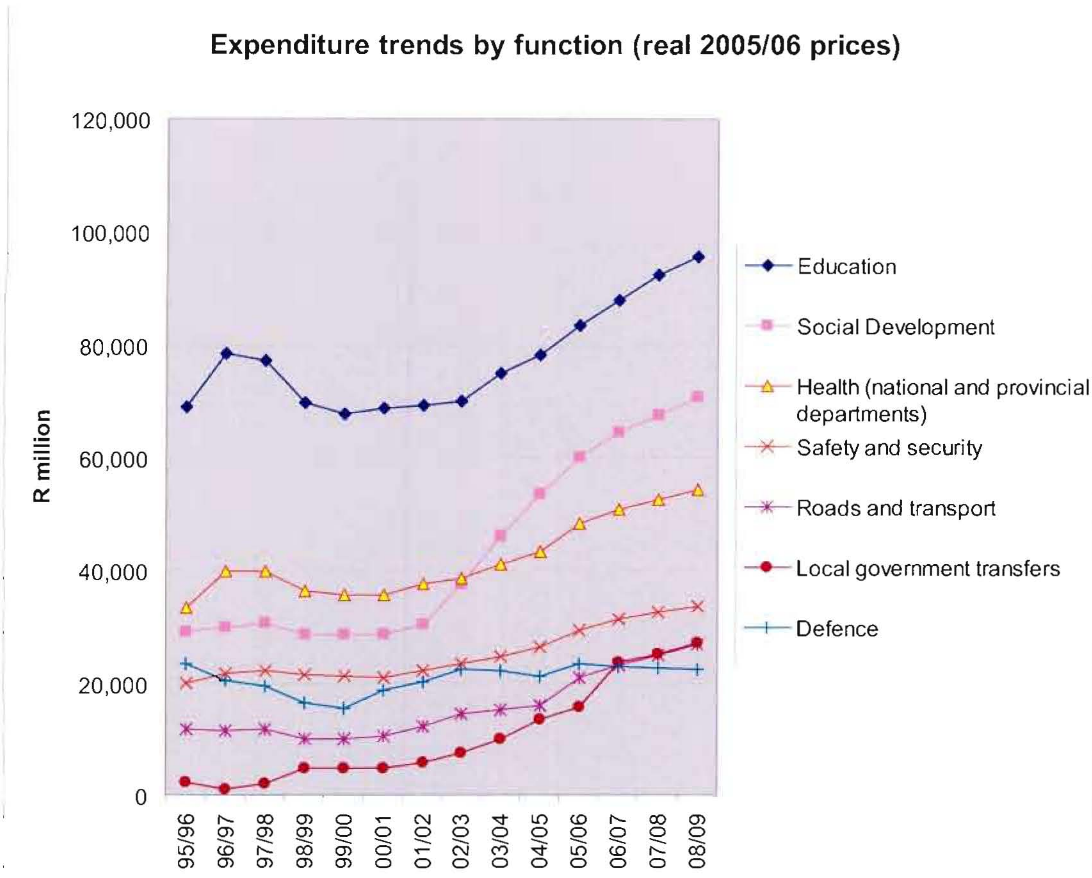
Figure 4.7: Fiscal parameters per capita total population



HEALTH CARE SPENDING IN THE CONTEXT OF EXPENDITURE PRIORITISATION

Figure 4.8 and Table 4.12 show trends in expenditure across the largest national and provincial departments from 1995/96 to 2008/09 in real 2005/06 prices. This shows that increases in Social Development spending have been the key feature of the decade and this sector has overtaken health services. Increases in transfers to local government have also grown markedly.

Figure 4.8: Expenditure prioritisation trends across departments



4.12: Expenditure trends across largest departments- real 2005/06 prices

	95/96	97/98	99/00	01/02	03/04	05/06	07/08	08/09	Change annual
Education	68,990	77,080	67,799	69,232	75,001	84,497	92,251	95,650	2.5%
Social Development	29,103	30,680	28,601	30,261	46,137	60,292	67,377	70,651	7.1%
Health (narrow)	33,446	39,862	35,570	37,679	41,117	47,028	52,610	54,233	3.8%
Safety and security	19,843	22,264	21,047	22,210	24,615	29,361	32,656	33,658	4.1%
Roads and transport	11,726	11,711	9,864	12,315	16,856	23,317	30,374	31,828	8.0%
Local government transfers	2,160	1,925	4,769	5,669	10,042	15,705	25,234	27,190	21.5%
Defence	23,485	19,380	15,479	20,167	22,242	23,516	22,652	22,508	-0.3%
Prov other	3,522	9,747	8,526	8,798	12,330	16,003	10,640	11,495	9.5%
Correctional services	5,556	6,834	7,431	8,232	8,515	9,769	10,807	10,890	5.3%
Housing	5,252	7,309	4,496	5,118	6,577	7,821	9,836	10,266	5.3%
Justice	3,084	3,830	4,033	4,108	4,595	5,456	6,386	6,724	6.2%
Public works	8,771	9,001	7,167	7,547	5,466	6,472	7,646	7,944	-0.8%
Agriculture (prov+nat)	5,962	5,849	3,581	3,949	4,495	5,944	6,027	6,145	0.2%
Land affairs	325	723	989	1,227	1,774	2,963	5,214	5,243	23.8%
Economic Affairs, tourism	3,484	3,358	3,143	3,074	3,524	2,827	3,279	4,604	2.2%
Water Affairs	277	2,818	1,927	2,549	3,206	3,590	3,912	4,396	23.7%
Trade and industry	5,982	4,281	2,639	2,153	2,548	3,146	3,635	3,785	-3.5%
Subtotal	230,968	256,652	227,062	244,288	289,041	347,706	390,537	407,208	4.5%
Total non-interest expenditure	246,741	261,969	246,207	270,641	306,270	367,816	423,229	443,923	4.6%

Table 4.13 shows the size of increasing allocations over the 13 year period in descending order. Social Development has received by far the largest proportion of the increase (R41.5 billion or 21.1% of the total). This has been associated with a substantial increase in government's social assistance programmes (social grants). In particular the a new grant to address child poverty, the Child Support grant was initiated, and will alone cost over R16 billion by the end of the period and disability grant expenditure has increased by over R9 billion over the period, partly due to HIV/AIDS and TB. Increases in

educational expenditure, which is the largest single sector, although large in absolute amount are well below average in rate and the share of the Education sector has been reducing through the period. The focus of additional expenditure has been particularly on complementary learner support materials, especially school books and on capital expenditure to build sufficient classrooms. Increases in local government transfers have been substantial in absolute and percentage terms. These have been aimed particularly at building up infrastructure of basic municipal services, particularly water, sanitation and electricity and more recently through subsidization of free basic services, to provide a minimal level of these services to households unable to pay user charges. Health services have received the fourth largest increase in real terms of R20.8 billion, which amounted to 10.5% of the total increase in non-interest expenditure over the period.

Table 4.13: Allocation increases across departments over period 1995/96-2008/09 (real 2005/06 prices)

	Change 95/96 - 08/09 Rand million	Distribution of additional funds	Change annual %
Social Development	41,548	21.1%	7.1%
Education	26,659	13.5%	2.5%
Local government transfers	25,030	12.7%	21.5%
Health (narrow)	20,787	10.5%	3.8%
Roads and transport	20,103	10.2%	8.0%
Safety and security	13,816	7.0%	4.1%
Provices other	7,973	4.0%	9.5%
Correctional services	5,334	2.7%	5.3%
Housing	5,013	2.5%	5.3%
Land affairs	4,917	2.5%	23.8%
Water Affairs	4,119	2.1%	23.7%
Justice	3,640	1.8%	6.2%
Economic Affairs and tourism	1,120	0.6%	2.2%
Agriculture	183	0.1%	0.2%
Public works	-827	-0.4%	-0.8%
Defence	-977	-0.5%	-0.3%
Trade and industry	-2,197	-1.1%	-3.5%
Sub-total	176,240	89.4%	4.5%
Total non-interest expenditure	197,182	100.0%	4.6%

* Health narrow refers to the National and Provincial Departments of Health only

Table 4.14 shows the annualised percentage increase in descending order. When examined in this manner, the rate of growth in health care expenditure (3.8%) annualised is slightly below the average (4.6%) but similar to the average excluding social development (4%). The largest growth has been in land affairs (23.8%), water affairs (23.7%) and transfers to local government (21.5%). This reflects increasing prioritization of very basic local services, such as water and electricity distribution to poor households. Somewhat surprisingly the protection services (Safety and Security, Correctional Services and Justice) have received slightly higher increases than health services. Economic services (e.g. Agriculture, Trade and Industry) received fairly low increases, despite fairly slow economic growth over the decade. Further analytic discussion of these expenditure choices is presented in the discussion section. For example, although health sector allocations have been fairly close to the average, several of the sectors receiving large allocations such as local government, water and social development could impact positively on health status, given linkages between poverty, water and sanitation and health etc.

Table 4.14: Annualised expenditure increases from 1995/96 to 2008/09

	Change annual 1995/96-08/09	Change total %
Land affairs	23.8%	1511.3%
Water Affairs	23.7%	1487.5%
Local government transfers	21.5%	1159.0%
Provincial other	9.5%	226.3%
Roads and transport	8.0%	171.4%
Social Development	7.1%	142.8%
Justice	6.2%	118.0%
Correctional services	5.3%	96.0%
Housing	5.3%	95.4%
Total non-interest expenditure	4.6%	79.9%
Safety and security	4.1%	69.6%
Health (narrow)	3.8%	62.2%
Education	2.5%	38.6%
Economic Affairs and Tourism	2.2%	32.1%
Agriculture	0.2%	3.1%
Defence	-0.3%	-4.2%
Public works	-0.8%	-9.4%
Trade and industry	-3.5%	-36.7%

Figure 4.9 shows the composition of government expenditure. The top three functions (education, social development and health) cumulatively comprise 51.8% of expenditure and the top seven functions exceed 70% of expenditure.

Figure 4.9 Composition of government expenditure (excluding interest)

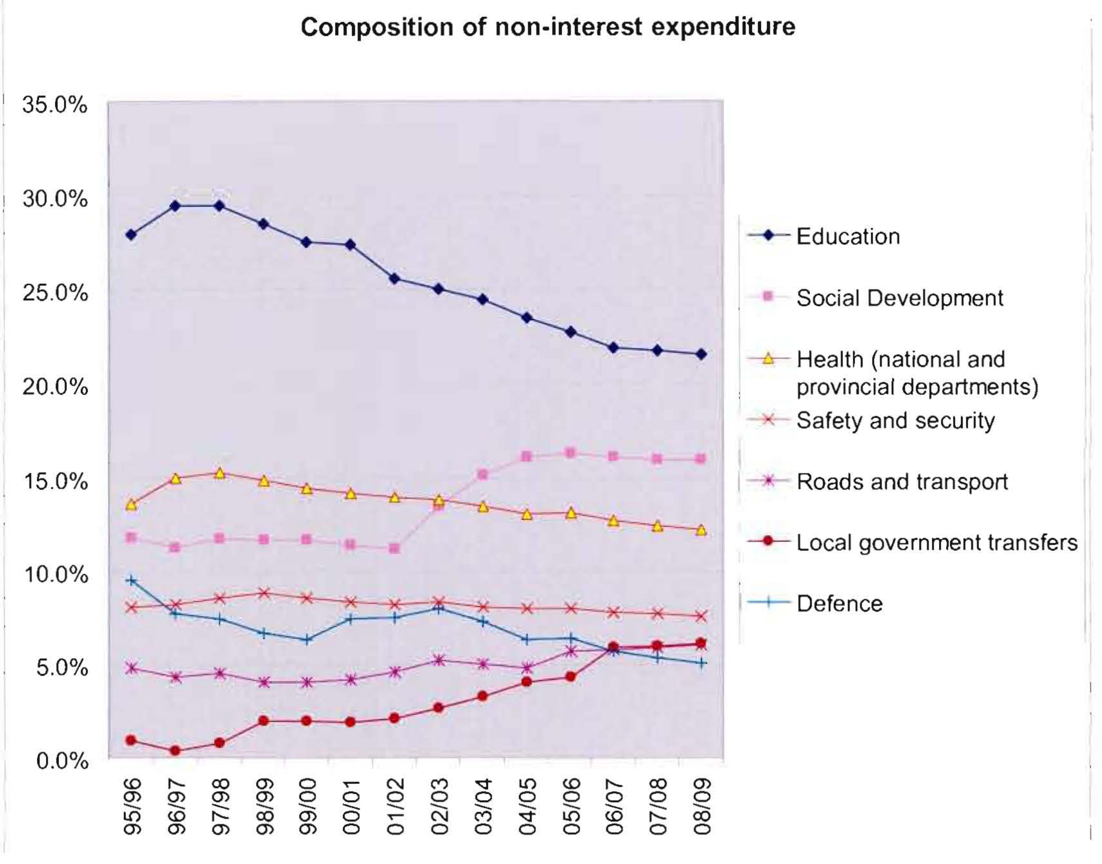


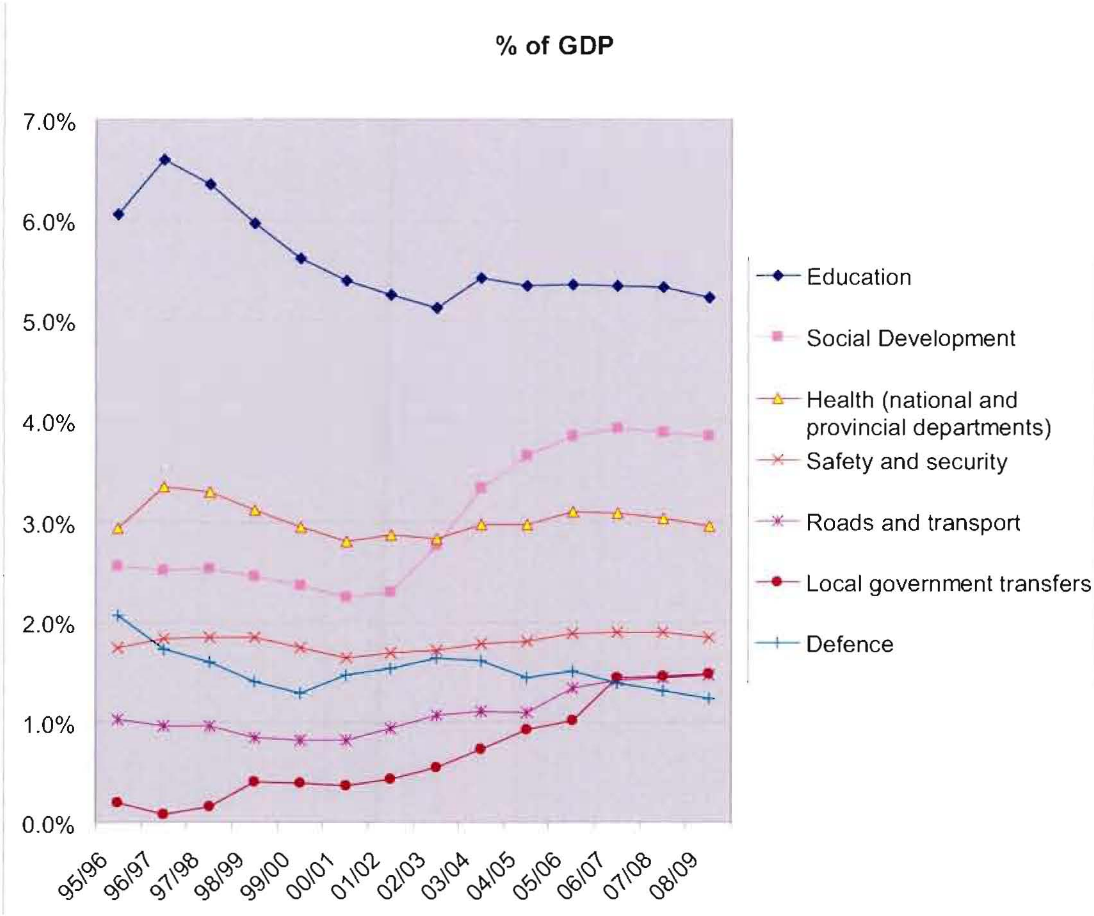
Table 4.15 Composition of government non-interest expenditure (national and provincial)

	95/96	97/98	99/00	01/02	03/04	05/06	07/08	08/09
Education	28.0%	29.4%	27.5%	25.6%	24.5%	22.7%	21.8%	21.5%
Social Development	11.8%	11.7%	11.6%	11.2%	15.1%	16.3%	15.9%	15.9%
Health (provincial and national Departments)	13.6%	15.2%	14.4%	13.9%	13.5%	13.1%	12.4%	12.2%
Safety and security	8.0%	8.5%	8.5%	8.2%	8.0%	8.0%	7.7%	7.6%
Roads and transport	4.8%	4.5%	4.0%	4.6%	5.0%	5.7%	5.9%	6.0%
Local government transfers	0.9%	0.7%	1.9%	2.1%	3.3%	4.3%	6.0%	6.1%
Defence	9.5%	7.4%	6.3%	7.5%	7.3%	6.4%	5.4%	5.1%
Provincial other	1.4%	3.7%	3.5%	3.3%	3.3%	2.7%	3.8%	3.7%
Correctional services	2.3%	2.6%	3.0%	3.0%	2.8%	2.7%	2.6%	2.5%
Housing	2.1%	2.8%	1.8%	1.9%	2.1%	2.1%	2.3%	2.3%
Justice	1.2%	1.5%	1.6%	1.5%	1.5%	1.5%	1.5%	1.5%
Public works	3.6%	3.4%	2.9%	2.8%	1.8%	1.7%	1.8%	1.8%
Agriculture	2.4%	2.2%	1.5%	1.5%	1.5%	1.5%	1.4%	1.4%
Land affairs	0.1%	0.3%	0.4%	0.5%	0.6%	0.8%	1.2%	1.2%
Economic Affairs and Tourism	1.4%	1.3%	1.3%	1.1%	1.2%	0.8%	0.8%	1.0%
Water Affairs	0.1%	1.1%	0.8%	0.9%	1.0%	1.0%	0.9%	1.0%
Trade and industry	2.4%	1.6%	1.1%	0.8%	0.8%	0.9%	0.9%	0.9%
Sub-total	93.6%	98.0%	92.2%	90.3%	93.1%	92.1%	92.3%	91.7%

Figure 4.10 shows government spending as a proportion of GDP. Again, this shows marked increases in Social Development spending and on transfers to Local Government. Education spending has declined significantly as a share of GDP (its previous high levels were fairly high as compared internationally). Health care spending, after the 1996 wage increases has returned to the baseline around 3% of GDP.

(Note this narrow definition includes only spending in the national and provincial Departments of Health). However its share of total expenditure is declining (figure 4.9).

Figure 4.10: Spending by departments as a proportion of GDP



FURTHER INTERRELATIONSHIPS BETWEEN HEALTH CARE FUNDING AND FISCAL AND EXPENDITURE POLICY

The section on fiscal analysis above including Figure 4.3 began to explore interrelationships between health care funding and fiscal policy. Table 4.16 summarises some of the key health care funding parameters. Public sector health care expenditure has fluctuated over the period beginning at 2.9% of GDP rising to 3.3% (Figure 4.11) and then falling back to 3%. Health care expenditure as a proportion of total government spending rose from 13.6% to 15.2% but has fallen back to 12.2% (Figure 4.12). This table shows the narrow definition including only provincial and national Departments of Health.

Table 4.16: Public sector health care spending trends compared to total expenditure*

	95/96	97/98	99/00	2001/02	2003/04	05/06	07/08	08/09
Nominal R million	16,549	22,996	24,627	29,978	37,906	47,028	57,287	62,007
Real 05/06 prices	33,446	39,862	35,570	37,679	41,117	47,028	52,610	54,233
%GDP	2.9%	3.3%	2.9%	2.9%	3.0%	3.0%	3.0%	3.0%
Real per capita	1,024	1,166	993	1,003	1,048	1,178	1,296	1,325
% of non-interest expenditure	13.6%	15.2%	14.4%	13.9%	13.4%	12.8%	12.4%	12.2%

* Narrow definition used includes only national and provincial Departments of Health

Figure 4.11 Public health care spending as a share of GDP

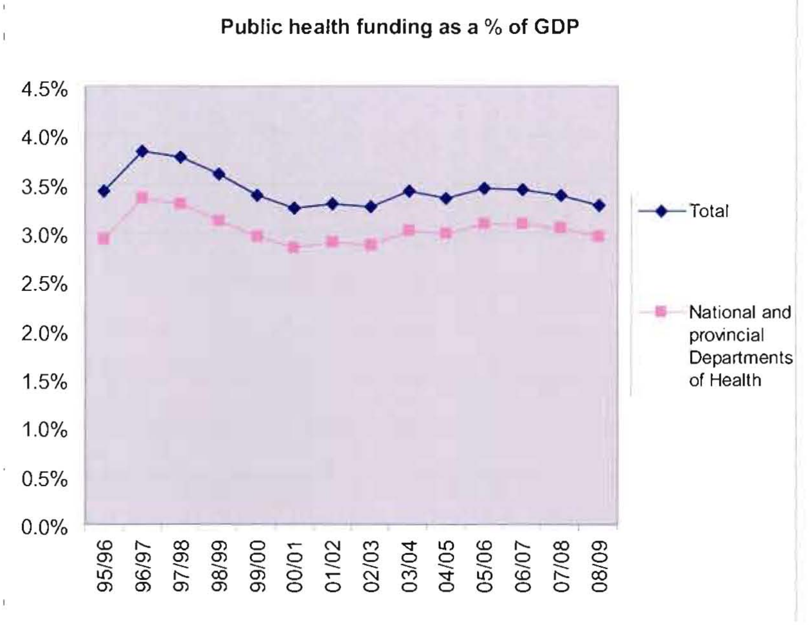


Figure 4.12 Health care spending as a proportion of total non-interest expenditure

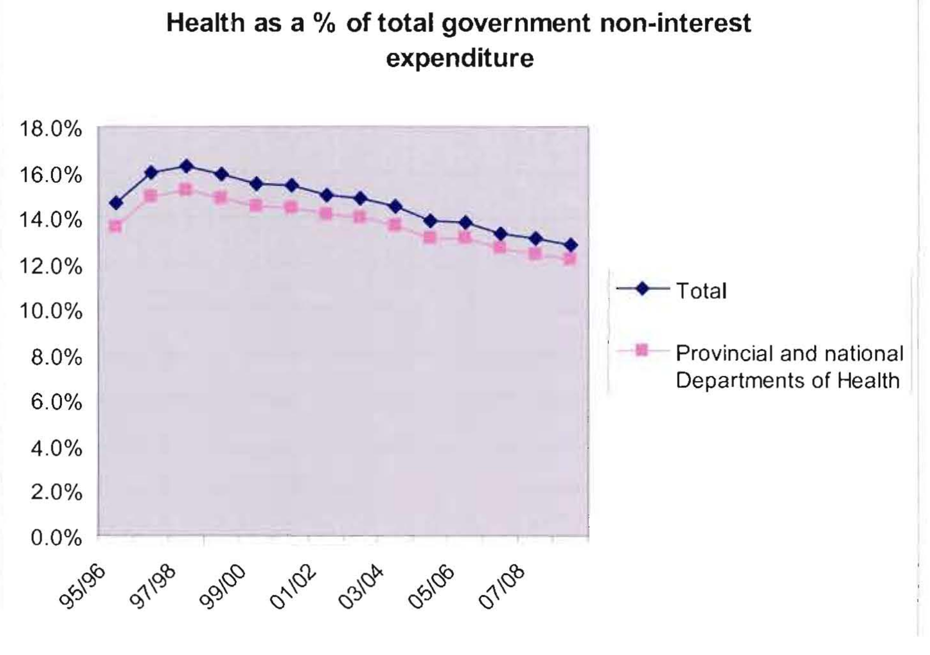


Figure 4.5 superimposed the graphs of total health care expenditure and total government non-interest expenditure on the main budget. The two graphs show a similar progression through three phases. The policy intent underlying these three phases has also been discussed in the sections above.

The relationship between health care expenditure and key fiscal and expenditure variables was also examined statistically using correlation and regression analysis. The results of bivariate regression analysis is shown in Table 4.17. Public sector health care expenditure was significantly associated with GDP, total government revenue, expenditure and total non-interest expenditure.

Table 4.17. Linear regression of health service expenditure against fiscal variables*

	GDP	Revenue	Expenditure	Non-interest expenditure
R 2	0.93	0.95	0.98	0.97
p value	<0.001	<0.001	<0.0001	<0.0001
Beta and 95% confidence limits	0.03 (0.025-0.035)	0.092 (0.078-0.011)	0.102 (0.092-0.112)	0.09 (0.086-0.105)

*Health care expenditure is defined narrowly here as expenditure by national and provincial departments of health

The multiple linear regression model which best predicted (R^2=0.98) health service expenditure was of the form (all variables in Rand billion):

Health care expenditure =0.102*(expenditure)*+4.63.

The relationship between health care expenditure (Rand million) and GDP (Rand billion) was of the form:

Health care expenditure = 0.03 GDP + 0.54

Not surprisingly non-interest expenditure was strongly associated with total expenditure R^2= 0.99 ($p<0.0001$) regression co-efficient β=1.13(95% confidence interval: 1.05-1.22). Similarly expenditure and revenue were closely associated, with regression statistics R^2= 0.9147 ($p<0.0001$) β=0.75(0.58-0.93). Revenue and GDP were also closely associated R^2= 0.944 ($p<0.0001$) β=0.326 (0.266-0.385).

GLOBAL COMPARISONS IN LEVELS OF HEALTH SECTOR FINANCING

Given the limited financing for health services in South Africa[4,5] it would be useful to compare a range of funding and fiscal indicators with other countries to provide an international perspective.

Of particular interest are comparative levels of health sector financing, relative prioritisation of health care as opposed to other sectors and influences of different health system structures and financing systems.

While comparisons of health care expenditure as a percentage of GDP across countries have been made fairly frequently, recent data that has been made available allows for a greater depth of analysis. These include the work of a dedicated unit in the World Health Organisation in Geneva which is compiling and analysing global health care expenditure trends,[6,7,8] the growing use of National Health Accounts to document the picture of health care financing within countries[9], improved data compilation by global regions (e.g. EU, OECD)[10] and improving data on global expenditure trends across sectors by bodies such as the International Monetary Fund.[11] The recent reports of the Commission of Macro-economics and Health[11] has also focused new international interest on the level of health care financing in developing countries, linked also to new challenges such as HIV/AIDS.

Table 4.18 compares public sector health care funding in South Africa with other middle income countries. The countries in the table are ordered by level of public sector health care funding as a proportion of GDP. South Africa's ratio of total health care spending to GDP (8.4%) is second highest in the group. This relatively high total health care spending to GDP ratio is largely attributable to high levels of private expenditure, which serves a minority of the population. Public (government) expenditure as a proportion of GDP at 3.2% is virtually identical to the median (3.2%) and weighted mean (3.4%) of the group. In Table 4.19 South Africa is located squarely in the middle income group of countries in terms of public health care expenditure. The proportion of health care expenditure spent by government (38.6%) is relatively low (58.6% median). The proportion of general government expenditure spent on health care (10.2%) is the same as the median for the group.

Table 4.18 Comparative analysis of health care expenditure in middle income countries

	GDP per capita	Government expenditure on health / GDP	Population	Total expenditure on health as % of GDP	Government expenditure on health as % of total expenditure on health	General government expenditure on health as % of total government expenditure	Per capita government expenditure on health (US$)	Per capita government expenditure on health at international dollar I$ rate
Colombia	1,816	6.4%	44 915	7.6%	84.1%	20.5%	116	439
Cuba	2,890	6.3%	11 245	7.3%	86.8%	11.2%	183	218
Turkey	3,382	5.4%	72 220	7.6%	71.6%	13.9%	184	378
Poland	5,446	4.5%	38 559	6.5%	69.9%	9.8%	248	521
Namibia	2,266	4.5%	2 009	6.4%	70.0%	12.4%	101	252
Argentina	3,427	4.3%	38 372	8.9%	48.6%	14.7%	148	518
Romania	2,607	3.8%	21 790	6.1%	62.9%	10.9%	100	340
Brazil	2,789	3.4%	183 913	7.6%	45.3%	10.3%	96	270
Algeria	2,171	3.3%	32 358	4.1%	80.8%	10.0%	71	150
Russian Federation	2,982	3.3%	143 899	5.6%	59.0%	9.3%	98	325
Botswana	4,143	3.3%	1 769	5.6%	58.2%	7.5%	135	218
South Africa	**3,512**	**3.2%**	**47 208**	**8.4%**	**38.6%**	**10.2%**	**114**	**258**
Iran	2,015	3.1%	68 803	6.5%	47.3%	10.3%	62	235
Chile	4,623	3.0%	16 124	6.1%	48.8%	12.7%	137	345
Mexico	6,000	2.9%	105 699	6.2%	46.4%	11.7%	172	270
Mauritius	4,649	2.2%	1 233	3.7%	60.8%	9.2%	105	261
Malaysia	4,289	2.2%	24 894	3.8%	58.2%	6.9%	95	218
Guatemala	2,074	2.1%	12 295	5.4%	39.7%	15.3%	44	93
Peru	2,227	2.1%	27 562	4.4%	48.3%	10.7%	47	112
Thailand	2,303	2.0%	63 694	3.3%	61.6%	13.6%	47	160
Kazakhstan	2,086	2.0%	14 839	3.5%	57.3%	9.0%	42	180
Venezuela	3,244	2.0%	26 282	4.5%	44.3%	6.4%	65	102
Ecuador	2,137	2.0%	13 040	5.1%	38.6%	8.7%	42	85
Total	3,257	3.4%	999 682	6.4%	54.1%	11.0%	112	N/A
Median	2,936	3.2%		5.7%	58.6%	10.3%	103	256

Source: World Health Organization, World Health Report 2006.[13]

The analysis is now briefly extended to lower and higher income countries, while noting that comparison beyond countries with similar income may not be useful, given the well-described relationship between national income and health care expenditure expressed as a proportion of GDP. Public health care expenditure as a percentage of GDP varies from a low of 2.1% of GDP in Pakistan to 8.7% in Germany. Low income countries spend a median of 1.5% of GDP on public health services, middle income countries largely fall between 2%-5% (median 3.2%) and high income countries exceed 5.5% (median 6.3%). A level of 3.2% is shown for South Africa. This matches Figure 4.11 in which the figure rises to 3.4% if health care spending of other government departments and social security funds is included.

Table 4.19: Median values for selected financing indicators

Country	Population 2003 (000)	GDP/ capita US$	Public health expend / capita US$	Public health care expenditure / capita I$ PPP	Public health care expenditure / GDP	Health spend / government expenditure	Total government expenditure / GDP	Total health care expenditure / GDP	% public
Low income	2,742,065	405	10	64	2.1%	8.0%	24.2%	4.7%	41.8%
Middle income	2,601,148	2,936	103	256	3.2%	10.3%	32.2%	5.7%	58.6%
South Africa	47,208	3,512	114	258	3.2%	10.2%	31.8%	8.4%	38.6%
High income	991,573	28,865	1,766	1,818	6.3%	13.7%	47.5%	8.9%	74.7%

The level of public health care expenditure in a country is a factor of total government expenditure and the proportion of government expenditure spent on health. Total government expenditure as a proportion of GDP tends to be higher in the high income countries with the highest in this group being France at 54.3% and the lowest Ireland at 33.3%. It is lowest in the low income group (median 24.2%), rising in the middle income countries to a median of 32.2%, while government expenditure in high income countries has a median of 47.5%. South Africa's government expenditure as a proportion of GDP is 27% for the main budget, but around 31.8% of general government expenditure including local government.

The proportion of total government expenditure spent on health varies from 2.6% (Pakistan) to 20.5% (Columbia). Middle income countries spend a median of 10.3%, high income countries 13.7%, while low income countries spend a median of 8%. South Africa spends 10.2% (note this differs slightly from figures presented earlier as it includes government interest payments).

There is a huge variation in annual health care expenditure from US$1 per capita in Congo (DRC) to US$2148 in the USA. Countries in the low income group have extremely low levels of public health care expenditure with a median of $10 per capita per annum. These low income countries tend to be partially dependent on donor funding (median 11.8% of total health care funding). A high proportion of health care expenditure is private (58.2%), largely paid for by out-of pocket expenditure (91.7%), with little private expenditure being pre-paid (8.3%).

In contrast, in the high income countries, public sources of financing are most common with a median of 74.7% of total health care funds compared to 41.8% for the low income countries. In South Africa a relatively low proportion of total health care financing is from public sources (38.6%) compared to several of the other middle income countries shown and certainly compared to the high income countries. In higher income countries financing tends to be a mix of social security and tax funded systems with limited out of pocket expenditure.

Despite its funding levels, with respect to outcomes South Africa's life expectancy (50.7 years) is lower than the median of low income countries (54 years) and is far below other middle (median 69.5 years) and high income countries (79 years). Table 4.20 shows that life expectancy at birth is 18.8 years lower than the median of the countries surveyed. Its mortality rate for female children less than five years (81/1000) is better than the median of low income countries (126/1000). However it is considerably higher than other middle (29.5/1000) and high income countries (median 6/1000).

Table 4.20 Health outcomes

Country	Life expectancy at birth (years)	Under-five mortality rate (females)
Cuba	77.1	7.0
Chile	76.3	8.0
Poland	74.7	8.0
Argentina	74.4	16.0
Mexico	74.4	24.0
Venezuela	73.4	21.0
Columbia	71.8	19.0
Malaysia	71.7	11.0
Morocco	70.8	41.0
Turkey	70.0	47.0
Algeria	69.4	43.0
Thailand	69.3	26.0
Belarus	69.0	11.0
Iran	68.9	42.0
Brazil	68.9	34.0
Phillipines	68.3	33.0
Egypt	67.1	39.0
Russia	64.8	16.0
Kazakstan	62.5	45.0
South Africa	**50.7**	**81.0**
Namibia	49.3	93.0
Botswana	40.4	102.0
Median	69.5	29.5

Source: World Health Organization[14]

MODEL FOR FUTURE FUNDING

The method used to project public sector funding for health services was described in Table 3.1 in the previous chapter. The results suggest health care expenditure will rise by an annual average rate of 4.9% per annum above inflation from 2004/05 to 2010/11. This will provide a total increase in funding of 33.2% or R14.5 billion by 2010/11. This is the main financing option used later in Chapter 9. This model compared well with the application of the linear regression model described earlier. The best fitting regression model produced a heath expenditure result for 2010/11 which was 2.8% higher than the result of the model shown in Table 3.1.

An alternate high end funding option is shown below in Table 4.21 below. In this option the stronger economic growth cycle persists for longer, the revenue over GDP ratio continues to increase gradually over 26%, the deficit rises but remains at moderate levels and the health sector's share of total government expenditure begins to rise, reversing a declining baseline trend. The option produces additional real growth of R19.7 billion by 2010/11 above the 2004/05 baseline, providing real growth of 6.4% per annum over the period. A further scenario based on the very recently published Budget 2007[15] with a higher revenue to GDP ratio, reaching 27% and with a small temporary budget surplus produced a similar outcome for health services expenditure.

Table 4.21 Higher funding scenario

	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11
GDP real 05/06 prices	1,316	1,365	1,384	1,463	1,560	1,631	1,706	1,819	1892	1964
GDP growth		3.7%	1.4%	5.7%	6.6%	4.6%	4.6%	6.6%	4.0%	3.8%
Revenue/GDP	23.7%	23.3%	23.4%	24.8%	26.4%	26.0%	26.4%	26.4%	26.4%	26.4%
Revenue real 05/06 prices	312	318	324	362	411	425	450	480	499	518
Revenue growth		2.1%	1.9%	11.6%	13.5%	3.3%	6.1%	6.6%	4.0%	3.8%
Deficit /GDP	-1.4%	-1.1%	-2.3%	-1.5%	-0.5%	-1.5%	-1.4%	-1.2%	-1.7%	-2.0%
Deficit	-18	-15	-32	-21	-8	-25	-25	-21	-32	-39
Expenditure	330	333	356	384	419	450	475	501	532	558
Expenditure growth		1.0%	6.9%	7.7%	9.2%	7.4%	5.6%	5.5%	6.1%	4.9%
Debt	535	477	480	490	481	483	507	528	560	600
Interest %	11.6%	11.1%	10.8%	10.7%	10.7%	10.5%	10.1%	9.9%	9.8%	9.7%
Interest	62	53	52	52	52	51	51	52	55	58
Contingency						2	5	7	7	7
Non-interest expenditure	268	280	304	331	367	397	419	442	470	493
Non-interest growth		4.5%	8.6%	8.8%	10.9%	8.0%	5.7%	5.5%	6.3%	4.9%
Non-interest expenditure -% of GDP	20.4%	20.5%	22.0%	22.6%	23.5%	24.3%	24.6%	24.3%	24.8%	25.1%
% spent on health services (prov+nat)	14.1%	14.0%	13.7%	13.1%	13.1%	12.7%	12.5%	12.5%	12.5%	12.8%
Health services expenditure	37.893	39.178	41.608	43.408	48.016	50.189	52.392	55.256	58.717	63.051
Health services expenditure growth		3.4%	6.2%	4.3%	10.6%	4.5%	4.4%	5.5%	6.3%	7.4%
Health expenditure/ GDP	2.9%	2.9%	3.0%	3.0%	3.1%	3.1%	3.1%	3.0%	3.1%	3.21%
Increase in health expenditure over baseline					4.608	6.780	8.984	11.848	15.309	**19.642**

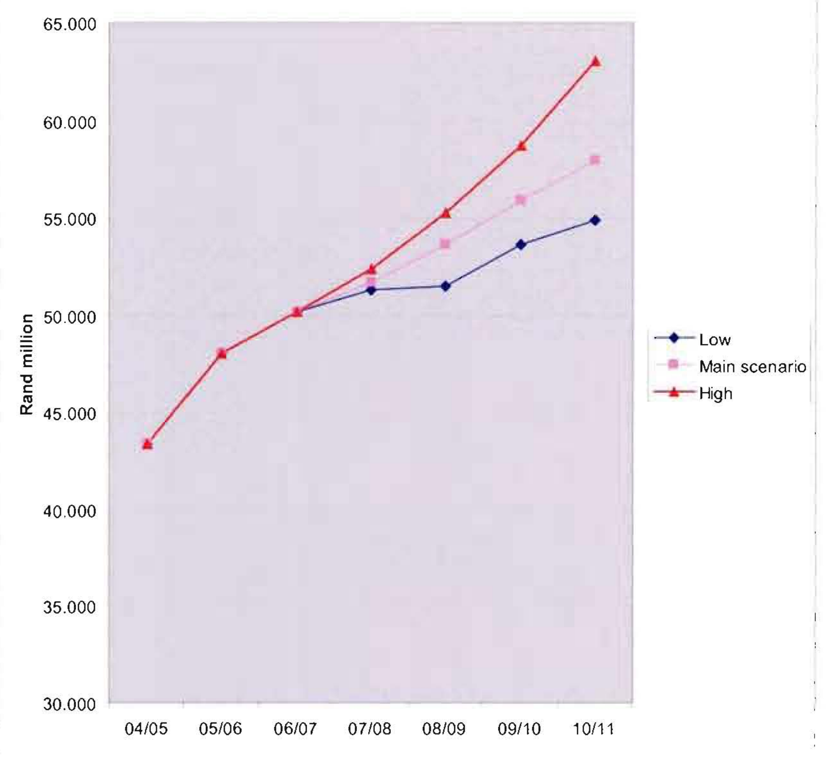
A less positive funding scenario is shown in Table 4.22. In this option economic growth slows to 3% in the outer years, revenue to GDP ratio is maintained at 26%, a fairly low deficit is maintained and health's share of non-interest expenditure reduces to 12%. This option provides an additional R11.1 billion by 2010 or 3.9% real growth per annum.

Table 4.22 Low end funding option

	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11
GDP real 05/06 prices	1,316	1,365	1,384	1,463	1,560	1,631	1,706	1763	1821	1881
GDP growth		3.7%	1.4%	5.7%	6.6%	4.6%	4.6%	3.3%	3.3%	3.3%
Revenue/GDP	23.7%	23.3%	23.4%	24.8%	26.4%	26.0%	26.0%	26.0%	26.0%	26.0%
Revenue real 05/06 prices	312	318	324	362	411	425	444	459	474	490
Revenue growth		2.1%	1.9%	11.6%	13.5%	3.3%	4.6%	3.3%	3.3%	3.3%
Deficit /GDP	-1.4%	-1.1%	-2.3%	-1.5%	-0.5%	-1.5%	-1.4%	-1.2%	-1.7%	-1.7%
Deficit	-18	-15	-32	-21	-8	-25	-25	-20	-31	-32
Expenditure	330	333	356	384	419	450	469	479	505	522
Expenditure growth		1.0%	6.9%	7.7%	9.2%	7.4%	4.2%	2.2%	5.4%	3.3%
Debt	535	477	480	490	481	483	507	527	558	590
Interest %	11.6%	11.1%	10.8%	10.7%	10.7%	10.5%	10.1%	9.9%	9.8%	9.7%
Interest	62	53	52	52	52	51	51	52	55	57
Contingency						2	5	7	7	7
Non-interest expenditure	268	280	304	331	367	397	413	420	443	457
Non-interest growth		4.5%	8.6%	8.8%	10.9%	8.0%	4.1%	1.7%	5.5%	3.2%
Non-interest expenditure -% of GDP	20.4%	20.5%	22.0%	22.6%	23.5%	24.3%	24.2%	23.8%	24.3%	24.3%
% spent on health services (prov+nat)	14.1%	14.0%	13.7%	13.1%	13.1%	12.7%	12.4%	12.3%	12.1%	12.0%
Health services expenditure	37.893	39.178	41.608	43.408	48.016	50.189	51.326	51.461	53.636	54.887
Health services expenditure growth		3.4%	6.2%	4.3%	10.6%	4.5%	2.3%	0.3%	4.2%	2.3%
Health expenditure/ GDP	2.9%	2.9%	3.0%	3.0%	3.1%	3.1%	3.0%	2.9%	2.9%	2.92%
Increase in health expenditure over baseline	-5.516	-4.230	-1.800	0.000	4.608	6.780	7.917	8.053	10.227	**11.479**

The results of the funding options are shown in Figure 4.12. Interestingly, although health care funding grows fairly strongly (6.4% annually in real terms) in the highest option, even in this option public sector health care funding only reaches 3.21% of GDP by 2010/11 (Table 4.21). This is partly a reflection of relatively high economic growth.

Figure 4.12 Funding options (Rand million 2005/06 real prices)



If the funding model is extended further to 2015/16 the additional funding that becomes available over the 2004/05 baseline is R27.6 billion in the main option or an additional R13.1 billion over the 2010/11 projection.

Differences in some of the key variables across the three scenarios are shown in Table 4.23 for the 2010/11 year. The combination of higher GDP growth, revenue to GDP ratio and health spending as a proportion of total non-interest expenditure tends to be lead to higher levels of public health spending in the model.

Table 4.23 Comparison of key variables across scenarios

Variable values in 2010/11	Low	Main	High
GDP (R bil)	1881	1964	1964
GDP growth	3.3%	3.5%	3.8%
Revenue to GDP ratio	26%	26%	26.4%
Deficit to GDP ratio	-1.7%	-2%	-2%
Non-interest expenditure to GDP ratio	24.3%	24.8%	25.1%
Non-interest expenditure (R bil)	457	487	493
% spending on health services	12%	12%	12.8%
Health spending (R bil)	54.9	58.4	63.1

DISCUSSION

Pulling all this together, while there have been real increases in the funding of health care, (3.8% per annum over 13 years), it is apparent that they have been substantially offset by population increases, particularly in relation to those dependent on the public sector (1.7% uninsured population increase per annum) and rising input costs of labour. Real funding increases of R20.8 billion in the thirteen year period from 1995/96 to 2008/09 have occurred within the context of an increase in the uninsured population of 8.8 million people, leading to a real per capita increase in health care spending of only 1.9% annualised for the period.

However this apparent benign funding climate conceals a number of underlying problems, which have been introduced here and are discussed in more detail in subsequent chapters. These relate particularly to input costs and to new needs such as HIV/AIDS. The data showed that wage costs escalated dramatically in 1996 and 1997. This has led to the paradoxical situation where substantially higher expenditure levels are associated with lower personnel numbers. A case study of this problem by the author for the Western Cape province is shown in appendix 1. Figure 4.2 demonstrates that the per capita expenditure level reached in 1997/98 will only be reached again by 2007/08. Per capita expenditure in 2005/07 is much unchanged since the 95/96 level, but is having to fund significantly higher personnel unit costs.

Thus it appears that much of the financing increases may have been absorbed by increased wage costs and medical inflation, rather than by improved service coverage and quality. In this context of virtually no overall per capita funding growth since 1997/98, the additional burden of managing the HIV/AIDS epidemic (estimated to cost R6-8 billion in later chapters) cannot have been fully funded. Thus despite higher funding levels the health service cares for a population 9-10 million larger with a fairly advanced HIV/AIDS epidemic, with 12000 fewer personnel at expenditure per capita levels which are in real terms fairly similar to those of a decade previously. While the rationale of the wage increases was partly to retain personnel, the sector now has fewer personnel, suggesting incoherence between fiscal, expenditure and wage policy.

Fiscal policy

The trends in health care expenditure appear fairly similar to the broader picture and three phases of total non-interest expenditure. If anything the health sector experienced a more profound spending increase in the peak of 1996/97, but ends the period at slightly lower levels than the average. Like health care expenditure, total non-interest expenditure per capita has been constrained (see Table 4.5) with levels of 1996/97 only being reached again by 2003/04.

These constraints in total non-interest expenditure are partly a reflection of relatively low economic growth (3.7% annualised over thirteen years), and this mainly in the latter period). This has constrained growth in non-interest expenditure throughout government to 4.6% annualised over the thirteen year period, almost all in the third phase (Figure 4.6). Revenue has increased at faster than GDP growth at 5% annualised over the period to close to 26% of GDP, which has protected public expenditure from even greater growth constraints.

Despite very limited GDP growth national revenue has increased. This is likely to have been achieved though increases in the target of revenue as a share of GDP towards 26% and partly through improving revenue collection by strengthening the revenue collecting authority (SARS), widening the tax base and the effects of bracket creep. Both personal and company tax rates were slightly reduced in the period.

Debt as a proportion of GDP and the share of government expenditure spent on interest has certainly been brought down to sustainable levels. This has been achieved partly through the tight fiscal constraints of the early GEAR period, rising revenue and improved debt management. This has brought government some praise for achieving stability in these macro-economic indicators.

Whether a more expansionary fiscal stance would have led to higher growth and improved national reconstruction and employment is somewhat beyond the scope of this chapter. This would have represented a Keynesian perspective on the role of government in increasing aggregate demand, by increasing government expenditure or reducing taxes.[15] This approach could possibly have received greater attention in the period of low growth and unemployment in the late 1990s and through the period of the Asian economic crisis. Treasury analysis in the more expansionary phase after 2000 refers to the potential of fiscal policy to improve economic growth and comments on its own research on fiscal multipliers particularly for investment expenditure. Remuneration expenditure is modelled as having a smaller multiplier effect.[3] At the time of the GEAR policy some analysts from a more left wing perspective and organisations such as the largest national trade union federation (COSATU) argued that a more expansionary fiscal stance associated with greater emphasis on national reconstruction in the immediate post-apartheid period could have led to faster economic growth and more rapid and extensive tackling of infrastructural and social backlogs.

Some neoclassical and monetarist economists however dispute this view and argue that fiscal policy is not very effective at stimulating economic growth because of long lags, small fiscal multipliers and crowding out of private investment.[16,17] Some development economists also point out the role of macroeconomic stability in growth in developing countries.[18] Government argues that the macro-economic stabilization of the early GEAR policy has brought about a much more sustainable fiscal position (e.g. Figure 4.4) which has allowed the more expansionary third phase since 2000/01 (Figure 4.6) – allowing for fairly strong growth in expenditure into the future along with a more sustainable fiscal position. The growth in non-interest expenditure (3.8% annually) which funds service delivery has exceeded growth in total expenditure (3.2% annually) partly because interest payments have been brought down, this through lower debt but also through improved debt management. South African economists continue to debate the most appropriate fiscal stance given South Africa's developmental needs.[19]

However the GEAR policy although it managed to successfully reduce debt and dis-saving, was largely unsuccessful in stimulating growth or reducing unemployment and was largely replaced by a more expansionary fiscal stance since 2000/01 (associated with the third phase of funding increases) and by a new growth strategy, the Accelerated and Shared Growth and Investment strategy (ASGISA) in 2005. In the 2003/04 and 2004/05 budgets[20] government signalled its intention to allow the deficit to increase to as high as 3.5% of GDP to support infrastructure development and support a counter-cyclical approach to boosting growth (i.e. raising the deficit at times of low economic growth to stimulate growth and then reducing the deficit once growth and resultant improving tax flows come through). At the time of writing economic growth over the period from 2004/05 to 2006/07 has been close to 5% per year- the highest in a decade.

While the second phase in the immediate post GEAR period brought increased macro-economic stability, its short term effects on the health system were substantial. These included the reduction of over 19000 personnel, inadequate responses to the HIV/AIDS epidemic in its early years and downsizing in better resourced provinces. A case study of severe implications for the Western Cape Province is shown in appendix 1. This negative effect of structural adjustment programmes on health services especially in the short term has been widely described in other developing countries.[21,22] However a particular problem of the South African reforms was the incoherence of wage and fiscal policy with profound wage increases only months before the initiation of fiscal constraints.

Expenditure prioritization

Health sector funding increases have been fairly close to the average on a percentage basis. Comparing the health care expenditure trend lines to those of the total, the sector appears to have suffered more than the average from the steep expenditure increases associated with the wage increases in the 1996 and 1997 periods and then a sharper cut-back with introduction of the GEAR policy. However when social development expenditure is excluded, the percentage growth in health care funding is above the average.

The health sector received the fourth largest increases in absolute terms (R20.8 billion from 1995/96 to 2008/09, Table 4.13), but just below the average in percentage terms. However, as this chapter has shown, this has been insufficient to address the combined effects of increased need and demand (population growth, HIV/AIDS, improving access to services e.g. from the free primary health care policy) and increased input cost (wages and health inflation). The analysis in Table 4.8 and Appendix 1 illustrate the rise in unit wage costs and the extent to which this has placed pressures on expenditure and the number of staff employed.

If one takes a broader approach to public health, then many of the expenditure areas which have received large funding increases, have the potential to contribute to improved health status. Like John Snow whose investigation of the cholera epidemic in London 1854[22] led to the removal of the handle of the affected pump, improved global health in populations over the past century is often attributed substantially to improvements in nutrition, water and sanitation and housing. Child survival is associated with maternal literacy. Broad approaches to Primary Health Care, such as the Alma Ata declaration, explicitly recognize the importance of broad developmental interventions as part of the primary health care approach. Modern developmental economic literature tends to emphasise not only the role of growth in development, but also that a range of developmental interventions are required for growth including health, education, agricultural and land reform and improved income distribution and so forth.[17,23]

The largest gainer in absolute terms has been Social Development, which has grown by R41.5 billion from 1995/96 to 2008/09 as the social security system has been completely reformed, increasing the number of grant beneficiaries from 2 million to 11 million over the past five years. These have also been achieved through the introduction of a new Child Support grant and substantially increased uptake of disability and foster care grants. The former is a means tested family benefit, which reached 5.6 million children up to the age of 14 years by April 2005, the care giver of each child receiving R180 per month in 2005 (close to the international poverty line of $1 per day). Given the depth of income poverty in South Africa, historically associated with malnutrition, infant deaths etc., this expansion of the basic social assistance system must have positive spin-offs on poverty and is presumed to have the potential to positively affect health status. There is some data to support this, including South African research reporting of improved nutritional status of children in households receiving old age pension grants.[24,25]

Also increased expenditure on social assistance is intended to reduce the poverty gap (i.e. difference from poverty line), the proportion of the population living under poverty lines, reduce huge inequities as evidenced by South Africa's Gini coefficient and income distribution and address basic needs. Interestingly social safety net expenditure is by far the largest expenditure area in OECD countries, especially in Western Europe.[26] Key recent debates include:

- Whether job creating public works programmes are not a preferable option to further expansion of social assistance programmes in addressing income poverty in a context of high unemployment.
- Whether social assistance programmes should be linked to training programmes, job seeking or other conditionalities. These debates feature large in European social security reform.[27]
- The role for Pillar 2 contributory social security systems to widen the contributory base for social security. South Africa has a fairly large pillar 1 (social assistance) system and a well developed private insurance market (pillar 3), but fairly small and limited contributory social insurance systems (pillar 2).
- The extent to which poverty has been reduced, partly given very limited progress on unemployment. Somewhat different perspectives have been produced by local researchers.[28,29]

Educational spending although previously at fairly high levels compared to international benchmarks has declined by close to 1% of GDP from its peak. Female education has been linked to child survival and features prominently in the Millenium Development goals.[30] In development economics, education is seen as a key requirement for economic growth and development and is thought to have been a key driver of growth in several countries such as South Korea, Ireland and Costa Rica.[22] Many health programmes rely on basic skills such as personal hygiene and basic literacy and the supply and quality of health personnel is dependent on educational systems. Health status and nutrition also affect school performance. The human capital approach encompasses multiple complex linkages between the educational, health and economic sectors.

Similarly the increases in local government allocations have been important for the provision of basic water, sanitation and electricity, critical for public health. Control of water-borne diseases through improved water and sanitation is considered to have been one of the key reasons for improved global health status over the past century, including through the reduction of gastro-intestinal and parasitic diseases, child deaths and malnutrition. Electrification has health benefits through reduced burns, improved education, food safety and improved nutrition (refrigeration) etc. It is clear that after democratic transition in 1994 many basic areas of development had huge needs and backlogs including for land reform, provision of basic social infrastructure such as housing, water (Water Affairs and local government) and electricity (Mineral Affairs and local government).

Crime linked to unemployment has presented large pressures in the criminal justice cluster (Police, Justice and Correctional Service). While in the longer term higher employment levels should lead to a smaller proportion of spending in these areas, in the short term these areas have experienced significant pressures linked to workload (prison population, court backlogs, number of crimes).

Some have argued that the relatively low spending priority given to economic services such as trade and industry and agriculture has not helped to build economic growth. Similarly current debates on infrastructure spending (aiming to increase from 15% to 25% of GDP) suggest South Africa's spending in this area is lower than desirable. Recent development economic literature has generated new interest in the role of government in stimulating economic growth in amongst others the Asian tiger economies.[17,22] The focus on economic growth and government interventions to promote growth have recently received attention in South Africa's new Accelerated and Shared Growth and Investment (ASGISA) initiative and are likely to affect expenditure choices in future budgets.[31] Besides the relationship between national income and health care expenditure, developmental economic literature emphasizes the contribution that the health sector can make to economic growth.[12,32]

Some additional resources for health services might potentially be made available should defence expenditure (fifth largest expenditure area, Table 4.12) be reduced further (besides regional peacekeeping efforts it is difficult to see why this still amounts to over R20 billion per year and is the fifth largest expenditure area) or if government interest expenditure can be brought down further. It is difficult to see why Secret Service expenditure should have expanded so significantly and high expenditure in the "provincial other" category calls for greater scrutiny.

Public health sector expenditure has been highly dependent on the fiscus over the period (96% of expenditure is financed by the fiscus). Sector financing is likely to progressively improve further as funding for anti-retroviral treatment and other improvements are progressively phased in. Some senior Treasury officials have suggested that public health care expenditure should ideally rise from 3% to 4% of GDP (personal communication: National Treasury) (1% of GDP is around R10 billion). Growth very substantially above the current 12-13% of government expenditure (Table 4.15 and 4.16). Given the difficulty of substantial reprioritisation within tight budgets and multiple needs, growth in health care spending seems more likely to come from economic growth or/and revenue increases.

Alternatively various other sources of health care financing should possibly be considered including complete retention of patient fees at hospital level, more creative sourcing of private funds e.g. through public health facilities contracting with medical schemes and possibly some form of social health insurance.

Global patterns

South Africa's health care expenditure falls squarely into the middle income country group and is well above the minimum required to fund a basic essential package. South Africa's total health care spending to GDP ratio of 8.4% (Table 4.18 and 4.19) is similar to the global average of 8.1%[7], and thus appears quite reasonable. The level of public expenditure as a proportion of GDP (3.1-3.4%) spent on public health services is not unfavourable compared to the middle income group.

The recent Commission on Macro-economics and Health costed a basic essential package of health interventions at $34 per capita per year.[12] This is somewhat higher than a previous World Bank costing of a basic package, which amounted to $12 for low income countries and $22 for middle income countries,[33] but the more expensive package makes greater provision for HIV/AIDS treatment. The minimum package is above the health care spending levels of virtually all the low income group of countries and the Commission assessed that $22 billion additional funds is required globally annually to get all countries up to this basic level.[12]

Although South Africa's public funding for health services is indeed comparable to other middle income countries there may be factors that suggest that its level of expenditure should be above the average. Firstly South Africa has a heavy HIV/AIDS disease burden, with a mortality profile far worse than its economic peers (lifespan is almost 20 years shorter[13]). Given that health care costs escalate in the years prior to death[34], it is not inappropriate that it fund health services at a somewhat higher level. Secondly it might be that, on account of its high level of private financing and strong private sector, upward pressure is exerted on public sector wages, resulting in higher unit costs. For example although personnel expenditure is the largest area of expenditure, South Africa has significantly fewer doctors than comparable middle income countries and especially within the public sector.[13,35] While higher funding levels may well be required, they are not a substitute for efficiency and more comparative work is required on detailed questions of technical and allocative efficiency across middle income and developing countries.[36] South Africa is often viewed as having a relatively inefficient health service because of its high ratio of total health care funding to GDP, limited revenue pooling and poor mortality indicators.[37]

The pattern of increased government spending as a proportion of GDP as countries get wealthier is well described.[11,38] Hensher cites eight international studies showing a 1.2%-1.4% increase (income elasticity) in health care expenditure for each 1% increase in GDP.[39,40] Similarly the pattern of health care spending comprising an increasing proportion of government spending as national income increases is well known.[31] Noting that health care funding tends to rise with national income[13] it seems fairly clear that in the longer term even public funding levels of 4% of GDP, will appear moderate for South Africa.

The health sector is not the only sector that tends to receive a larger share of the budget as national income rises. Welfare and social security expenditure is many multiples higher than in South Africa in all the OECD countries and in several middle income countries, despite continuing erosion of welfare states.[26] In many of these countries this expenditure is financed through social security contributions, whereas in South Africa rising welfare expenditure has been financed through tax expenditure. Siebert's analysis suggests that developing countries tend to spend larger proportions of their budgets on protection services such as policing, infrastructure and economic services than high income countries.[35]

Countries in the lowest income group have extremely low levels of health care expenditure. A recent WHO expenditure review found that of I$3.6 trillion spent on health services globally, an extra-ordinary 89% was spent in the OECD countries covering 19% of the world population.[7] Thus huge inequities in health care spending exist between countries. More than half the countries in the low income group have public health care expenditure levels at <2% of GDP, including countries such as India.

As discussed earlier, health care funding is a function of national income so it is not particularly useful to compare South Africa against higher income countries. However it is interesting to note that lower health care spending in developing and middle income countries is due both to a significantly lower share of government spending as a proportion of GDP and to a lower proportion of government spending on health care. For example, in South Africa, total government spending is 28% of GDP of which 12-13% is spent on health services, while in the UK the equivalent ratios are 42% and 15%.[41,42] Despite this, there is a perception in the United Kingdom that health care is funded less optimally than other countries in the European Union and OECD and real increases of 5% per year have been allocated over a five year period following the recommendations of the Wanless Commission.[40,43]

Model projecting future funding for public health care system to 2010/11

The model suggests that in real terms substantial additional funding will become available to the health sector between 2004/05 and 2010, with estimates ranging from R11.4 billion to R19.6 billion additional to the 2004/05 baseline of R43.4 billion. This is equivalent to average real growth ranging between 3.9% - 6.4% per annum. Key variables that drive this are continuing economic growth, revenue as a proportion of GDP continuing to exceed 26% and a moderate deficit policy. Another important factor separating the funding options is the extent to which the health sector's share of total expenditure continues its current declining trend or whether this reverses and begins to increase. The health sector funding model developed and presented here is potentially helpful to inform sectoral managers about potential funding scenarios and some of the key variables which drive them, both of which can assist in budget bid and negotiations processes.

That a low end scenario contains 3.9% real growth per annum is a sign of the vastly improved economic, fiscal and revenue position of South Africa compared to the late 1990s – in that period growth of this nature would have been an optimistic scenario (see chapter 6 and Appendix 1)! This higher level of health care funding has been made possible by improved economic growth, a much improved revenue service, an escalating tax to GDP ratio, lower levels of public debt as a proportion of GDP and improved debt management.[44] The possibility of favourable funding options is enhanced by the most recently published government fiscal and expenditure intentions for the fiscal years 2007/08-2009/10.[45]

The increases in health care funding in all the options, although substantial in terms of billions or rand, are relatively modest in terms of funding as a proportion of GDP or as a percentage of government expenditure. Data presented in this chapter and recently published data from the World Health Organisation[13], shows that South Africa's baseline public sector health service funding levels are already comparable to other middle income countries of similar income levels. However even the highest funding option only increases funding to 3.2% of GDP (or 3.5% including social security funds and other government Departments such as Defence and Correctional Services). This level of funding amounts to 12.8% of non-interest expenditure or 11% of total expenditure on the main budget. The Abuja Declaration called for 15% of government expenditure in developing countries to be spent on health services. Given the high burden of disease, especially due to HIV/AIDS and TB, it is may well be appropriate for funding for health care services in South Africa to somewhat exceed the level of its peers. Even relatively small increases of the order of a tenth of a percentage of GDP or of total non-interest expenditure amount to billions of rand. Nevertheless it must be recognized that there is a range of other compelling developmental priorities competing for funding, many of which are critical requirements for public health, including water and sanitation services, housing, education, electrification, income security and social and economic infrastructure.[46-49]

In the course of motivating for additional funding for appropriate health sectoral spending priorities health managers should also give consideration to broader intersectoral interventions that are important for public health.

Other sources of revenue also need to be considered including from medical schemes such as the recently established Government Employees Medical Scheme, the social insurance Road Accident Fund and in the area of HIV/AIDS from donors such as the Global Fund for AIDS, Tuberculosis and Malaria. The possibility of introducing social health insurance (SHI) is a topical policy debate in South Africa and SHI has the potential to raise significant levels of public funding for health care. However much of this may ultimately be spent on more costly private services, resulting in a significantly raised public health to GDP funding level, but limited improvement of public sector health services which serve the poor majority. The extent to which scarce increased public funding for health services should be prioritised for social health insurance for the middle classes or improved public sector funding for the poor is an important debate.

Further research needed on health inflation

The analysis presented in this chapter based on inflation adjustment using the standard CPIX measure showed real growth in the sector of R20 billion or 3.8% annually from 1995/96 to 2008/09. However there is evidence that inflation in the sector may exceed the CPIX and possibly by as much as 2-3% per annum. Firstly analysis by the author suggests that the average cost of employment of a provincial health sector employee increased by 3.4% annually from 1995/96 to 2005/06. Secondly the health component of the CPIX, although largely representing private sector costs, has increased more rapidly than CPIX itself (personal communication Statistics South Africa) and thirdly a specific study of health inflation undertaken by the author with provincial Departments of Health following the strong currency depreciation in 2002 suggested health inflation to be in excess of CPIX. While none of these data sources is robust enough to use as a substitute for the CPIX, the author is of the view that the evidence from these three sources is sufficiently strong for Statistics South Africa to develop a health specific inflation index for use in South Africa as exists in countries such as Australia. If health inflation has indeed exceeded CPIX by on average say 2% annually then real growth over the period reduces to 1.9% or R10 billion over the 13 year period. This lower estimate of real growth matches changes in a number of sector indicators such as personnel numbers better than the higher estimates presented earlier. Broader political and economic factors influencing population health are also likely to play an important role in the burden of disease and health sector structures and performance.

Outcomes

South Africa's health outcomes in terms of life expectancy and under five mortality rates are extremely poor compared to virtually all countries, except for those within the Southern African region. Its comparison to other middle income countries, which have a median life expectancy of 69.5 years and especially countries such as Malaysia, Argentina, Poland, Venezuela and Cuba which have life expectancies of over 70 years is particularly worrying. Life expectancy is also much higher in other middle income countries with large income distribution inequities such as Brazil and Columbia.

This is due partly to the HIV epidemic which has offset a wide range of other developmental gains[50], including significant strides in educational enrolment, widening of social welfare coverage, school nutrition, immunisation coverage, clinic construction, housing construction, electrification etc.[51] This clearly emphasises the need for South Africa to improve it's HIV prevention programmes and improve our understanding of and address the determinants of HIV transmission. However South Africa had poor health status relative to other middle income countries even before the HIV epidemic and this also points to problems in the efficiency and equity in health services. In some of the international literature these poor health outcomes have been seen as technical inefficiency and have resulted in South Africa scoring poorly in various comparative international scorecards of the World Health Organisation[52], the World Bank and the United Nations Development Programme (UNDP). However there has been debate about the validity and usage of some of the indicators used for performance assessment in the WHO 2000 report[50,53] Broader political and economic factors influencing population health are also likely to play an important role in the burden of disease and health sector structures and performance.

CONCLUSIONS

South Africa's public health care expenditure level is on aggregate comparable to other middle income countries. Although the funding level is not particularly high, the findings are to some degree reassuring and helps to partially address concerns about serious under-funding. However the extent and implications of the HIV/AIDS epidemic might be expected to require higher levels of health care expenditure than the average middle income country, most of which don't face the same HIV/AIDS epidemic. Also, further work is required on the comparability of input costs. Despite the apparent comparability of expenditure per capita adjusted for purchasing parity power (I$/capita), more detailed cross country comparisons on a range of inputs, unit costs and key utilization indicators (numbers of doctors, nurses, hospital beds, hospital admissions) would be useful to get a better sense of the comparability.

There has been a substantial increase in real funding of health services over the decade. By 2008/09 there is projected to be an increase in real funding of R20.8 billion compared to 1995/96 (3.8% annually). Spending over the thirteen year period of study showed three phases which coincided with three phases of fiscal policy. Growth in total government non-interest expenditure amounted to 4.6% annually from 1995/96 to 2008/09, driven largely by an increasing revenue: GDP ratio associated with a broader tax base and a more efficient national Revenue Service. The period of the late 1990s marked a period of downsizing and consolidation of health services and was associated with a period of economic stabilization in the immediate post-GEAR period. The period since 2000/01 has seen a return to real per capita growth and a gradual strengthening of services under an escalating burden of HIV/AIDS.

Health's share of total non-interest expenditure has declined from 13.6% to 12.2%, after temporarily rising to 15.2% in 1997/98 following the 1996 wage agreement. This reduction in share was mainly due to substantial funding increases to social assistance grant programmes to address income poverty and to local government for basic service infrastructure and delivery. Health services have received the third biggest absolute increase of any sector over the period from 1995/96 to 2006/07, but on a percentage basis its funding has been slightly below the average. Social grants and local government transfers for water and electricity have been the largest beneficiaries of increased government funding. Budgetary increases in a range of areas such as these should have helped to improve health status, but these positive effects appear to have been largely offset by the extensive HIV epidemic.

The positive effects of real funding increases appear to have been more than offset by the combined effects of growth in the uninsured population, significant wage increases and HIV/AIDS epidemic. Given stagnating medical scheme coverage and growth in the uninsured population of 8 million by 2008/09, per capita funding has only recently surpassed its peak in the mid 1990s. Later chapters will present some of the cost implications that have arisen from the HIV/AIDS epidemic and show that the real increases in funding, given increased costs of labour, have not until very recently contributed to an increase in the number of health workers employed.

Still, the period of real increases starting in 2000/01 is likely to be more sustainable than the increases associated with rapid wage growth in the 1996-97 period because of the improved debt position and macroeconomic stability, compared to the late 1990s. This makes further funding increases more likely than a decade previously. Given huge needs in many sectors, and their importance to public health, it is difficult to envisage significant funds being released from other sectors (except possibly Defence) to fund health services. Thus funding growth for health services is more likely to come from economic growth, revenue increases or specific policies such as revenue retention or social health insurance, than extensive expenditure reprioritisation.

The extremely poor mortality outcomes in South Africa call strongly for ever increasing efforts to counter the HIV epidemic and raise broader questions about whether progress in equity and allocative and technical efficiency have gone far enough. The seeming inability of the existing South African health sector to substantially affect the course of the epidemic also raises questions about whether the time has not come for a rebirth of public health in the country with far more sustained attention being given to addressing health risks in collaboration with other relevant sectors.[6] The substantially better life expectancies in middle income countries such Malaysia, which spend considerably less on health than South Africa, also raises the issue of the extent to which other developmental expenditure (education, water and sanitation, infrastructure, incentives for economic development, employment) contribute to health outcomes and raises difficult questions of prioritization.

CHAPTER 5: FUNDING AND INTER-PROVINCIAL EQUITY

Introduction

The pursuit of equity is a key objective of health care systems. Horizontal equity occurs when persons with the same health needs receive the same health care. Vertical equity occurs when people with different health needs consume appropriately different types and amounts of health care. It has been argued in the South African context that both horizontal and vertical equity are significant problems, in the latter case partly because an insufficient share of funding is allocated to groups with greater needs.[1-4]

Chapter 4 showed total public health expenditure and funding trends, but does not provide insights as to why the nine provincial health services are so substantially different. For example Western Cape provincial health services provide 3.5 primary health care visits per capita, many in doctor based community health centres, and has a hospital admission rate of 123 per 1000 uninsured population per annum predominantly in specialist led regional and tertiary hospitals. In contrast Mpumalanga province delivers 2.1 PHC visits per capita mainly in clinics and has an admission rate of 72 per 1000 largely in generalist-led district hospitals. Chapter 4 presented provincial health care funding as a single aggregated entity, while in reality it is a composite of decisions taken by nine provincial governments.

Some of the key differences in the nine provincial health services can be attributed to differences in funding. This chapter provides a more specific focus on provinces and inter-provincial equity. Prior to democratic transition in 1994, South Africa had four provinces and several apartheid homeland areas, with a significant concentration of health care resources in the major metropolitan areas.

Previous work such as the National Health Accounts (NHA) project[5] and the analysis in Appendix 1 on the Western Cape downsizing reported large inter-provincial inequities. The NHA suggested that progress towards inter-provincial equity had stalled. Its analysis, which has guided sector perspectives on inter-provincial equity for some years, was based partly on the population distribution of the 1996 census and the 1995 October Household Survey, to identify and deduct numbers of privately insured persons. The analysis used in this chapter uses recent data from the 2001 census and 2002 and 2003 General Household survey, which suggests a new perspective of progress towards equity in inter-provincial financing may be emerging.

Approximately 97% of provincial revenue is derived from transfers from national government, mainly derived from general taxes. There are two main types of funding transfers. The most important of these is the provincial equitable share formula, the main unconditional block grant from national to the provincial sphere of government. Provincial governments allocate these funds across sectors including health, education, provincial roads and others. The second is conditional grants, which are ring-fenced funds to be used only for their specified purpose, where the specific amounts and inter-provincial distribution is determined at national level.

The investigation in this chapter will also cover a number of interesting recent changes in the design of funding streams which may affect equity including the removal of the social assistance component from the equitable share formula, the review of the formula with introduction of a poverty component and reduction of the economic component, the introduction of the National Tertiary Services grant and other changes.

This chapter does not report on intra-provincial inequities. These are substantial and the variability between funding of the lowest and highest districts greatly exceeds the range of funding across provinces. A recent study of health spending by district across the country provides useful information in this regard.[6] Progress towards achieving inter-provincial equity provides an important foundation for intra-provincial and inter-district equity.

RESULTS

FUNDING LEVELS

The sections which follow focus particularly on geographic equity in budget allocations.

Table 5.1 and Figure 5.1 show trends in provincial health expenditure in real 2005/06 prices. The largest provincial Department of Health budget is for Kwazulu-Natal which now considerably surpasses Gauteng province. The five provinces with the largest health budgets make up 78.9% of expenditure.

Table 5.1: Trends in provincial health expenditure (constant 2005/06 prices)

	95/96	97/98	99/00	01/02	03/04	05/06	07/08	08/09	Growth 95/96 - 08/09 R million	Growth annualised
Eastern Cape	4,458	5,254	5,050	4,892	5,686	6,213	7,033	7,358	2,899	3.9%
Free State	2,391	2,876	2,389	2,455	2,781	3,111	3,186	3,268	877	2.4%
Gauteng	7,886	9,186	8,095	8,594	8,884	9,840	10,112	10,408	2,522	2.2%
KwaZulu-Natal	6,639	8,330	7,381	8,840	8,942	10,304	11,751	12,106	5,467	4.7%
Limpopo	2,878	3,387	3,207	3,348	4,040	4,777	5,429	5,723	2,845	5.4%
Mpumalanga	1,093	1,815	1,657	1,831	2,176	2,764	2,933	3,079	1,986	8.3%
Northern Cape	560	652	625	650	903	1,073	1,287	1,201	641	6.0%
North West	1,886	2,384	1,999	2,135	2,455	2,987	3,469	3,488	1,603	4.8%
Western Cape	4,741	5,090	4,514	4,690	4,986	5,777	6,221	6,414	1,672	2.4%
Total	32,533	38,973	34,918	37,436	40,853	46,845	51,422	53,044	20,511	3.8%

*Including relevant Works Department expenditure in Western Cape. Works expenditure in other provinces has already been included in the Health vote for several years

Figure 5.1: Trends in provincial health expenditure

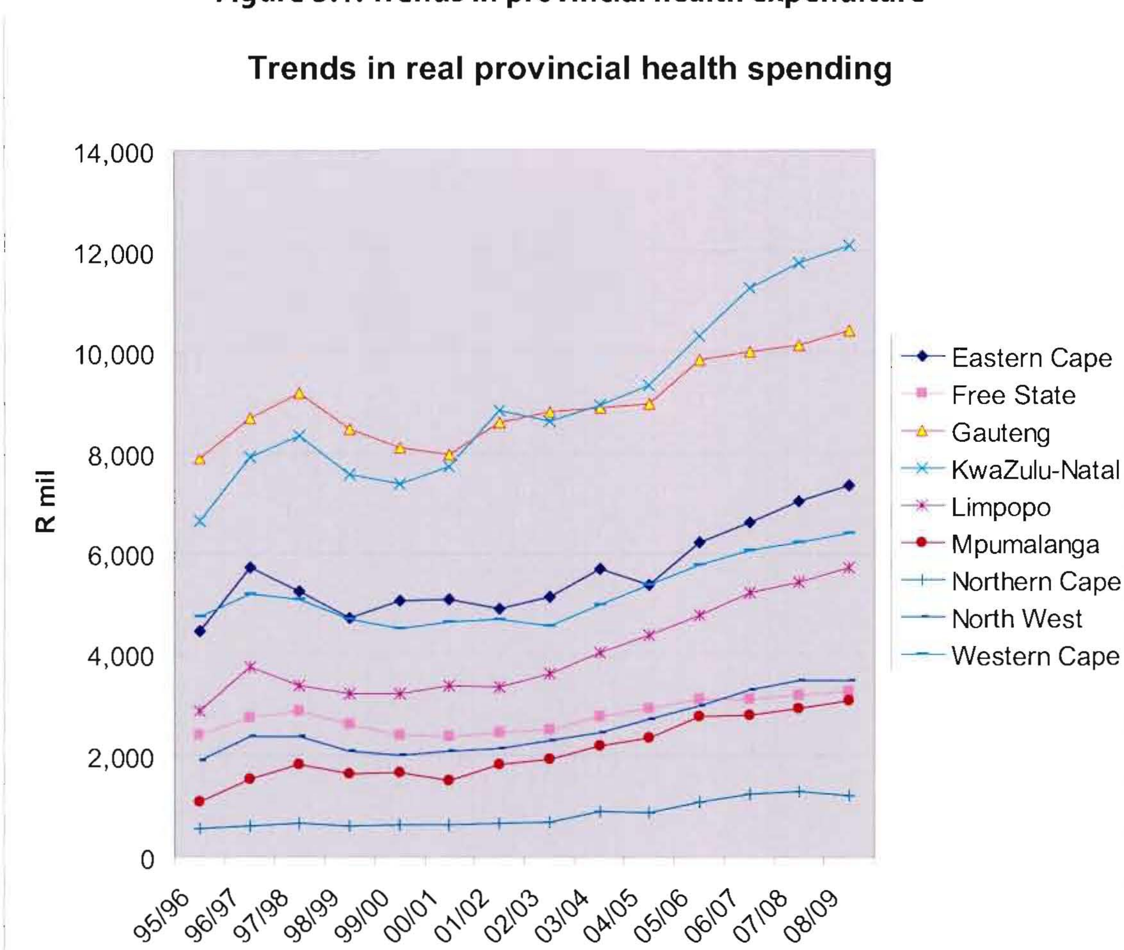


Table 5.2 shows trends in the uninsured population and Table 5.3 and Figure 5.2 present real expenditure trends per capita. Western Cape is the best funded province amounting to R1 757 in 2006/07 and North

West the lowest funded province at R965 per capita.

While this is a significant difference the ratio of the best funded to the worst funded province has reduced from 3.8 in 1995/96 to 1.8 in 2008/09. The figures show significant per capita reductions in Gauteng (-1% per capita annually over 12 years). In Western Cape the constrained funding (0.7% annually) and increased input costs has been reflected through substantial downsizing of personnel[7] with population growth exceeding funding growth, and in Gauteng substantial in-migration and decreasing medical scheme coverage has occurred.[8,9] At the same time Mpumalanga, previously the worst funded province has received increases averaging 6.5% in real per capita terms annually over the 13 year period, Northern Cape 4.6% and Limpopo 3.8%. High growth in provinces such as Mpumalanga and Limpopo is encouraging since these provinces were the lowest funded at the beginning of the period.

Table 5.2: Uninsured population by province (thousands)

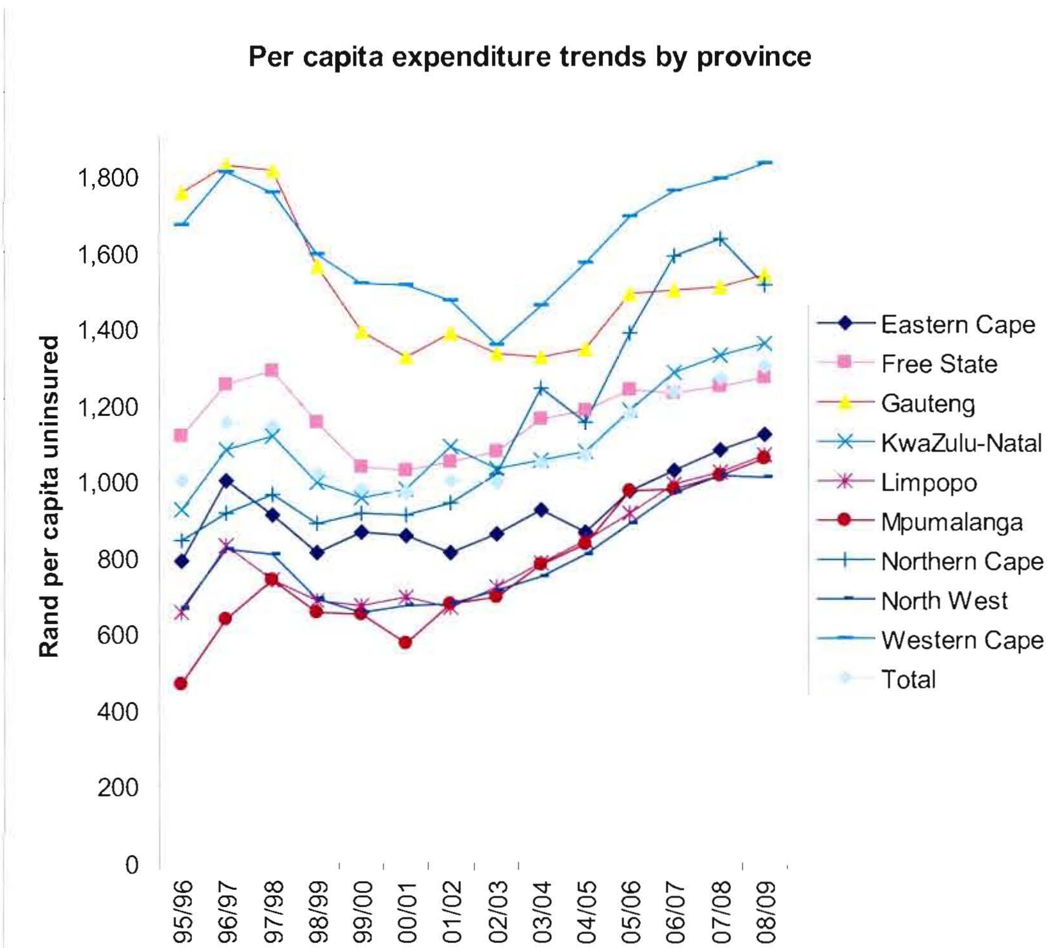
	1995	1997	1999	2001	2003	2005	2007	2008	Change 1995-2008	Change annualised
Eastern Cape	5,683	5,794	5,869	6,050	6,161	6,412	6,517	6,571	888	1.1%
Free State	2,150	2,235	2,308	2,345	2,399	2,522	2,563	2,584	434	1.4%
Gauteng	4,498	5,069	5,830	6,217	6,725	6,613	6,722	6,777	2,279	3.2%
Kwazulu Natal	7,200	7,478	7,769	8,139	8,524	8,718	8,862	8,934	1,734	1.7%
Limpopo	4,412	4,606	4,781	5,027	5,176	5,240	5,327	5,370	958	1.5%
Mpumalanga	2,361	2,458	2,555	2,713	2,806	2,849	2,896	2,920	559	1.6%
Northern Cape	667	679	686	694	728	775	788	794	127	1.4%
North West	2,859	2,963	3,061	3,175	3,298	3,381	3,436	3,464	605	1.5%
Western Cape	2,847	2,905	2,979	3,190	3,429	3,425	3,481	3,510	663	1.6%
Total	32,677	34,188	35,837	37,549	39,246	39,934	40,592	40,925	8,248	1.7%

Sources: Stats SA Census and General Household Surveys, Actuarial Society[10-14]

Table 5.3: Health expenditure per capita (in real 2005/06 prices)

	95/96	97/98	99/00	01/02	03/04	05/06	07/08	08/09	Annualised increase 1995/96-08/09	Annualised increase 1996/97-08/09
Eastern Cape	785	907	860	809	923	955	1,079	1,120	2.8%	1.0%
Free State	1,112	1,287	1,035	1,047	1,159	1,229	1,243	1,265	1.0%	0.1%
Gauteng	1,753	1,812	1,389	1,382	1,321	1,508	1,504	1,536	-1.0%	-1.4%
KwaZulu-Natal	922	1,114	950	1,086	1,049	1,206	1,326	1,355	3.0%	1.9%
Limpopo	652	735	671	666	781	914	1,019	1,066	3.8%	2.1%
Mpumalanga	463	738	649	675	776	935	1,013	1,054	6.5%	4.3%
Northern Cape	839	960	912	937	1,240	1,417	1,633	1,511	4.6%	4.3%
North West	660	805	653	673	744	875	1,010	1,007	3.3%	1.8%
Western Cape	1,665	1,752	1,516	1,470	1,454	1,666	1,787	1,827	0.7%	0.1%
Total	996	1,140	974	997	1,041	1,175	1,267	1,296	2.1%	1.0%
Ratio highest:lowest	3.8	2.5	2.3	2.2	2.0	1.9	1.8	1.8		

Figure 5.2: Per capita expenditure trends by province (05/06 prices)

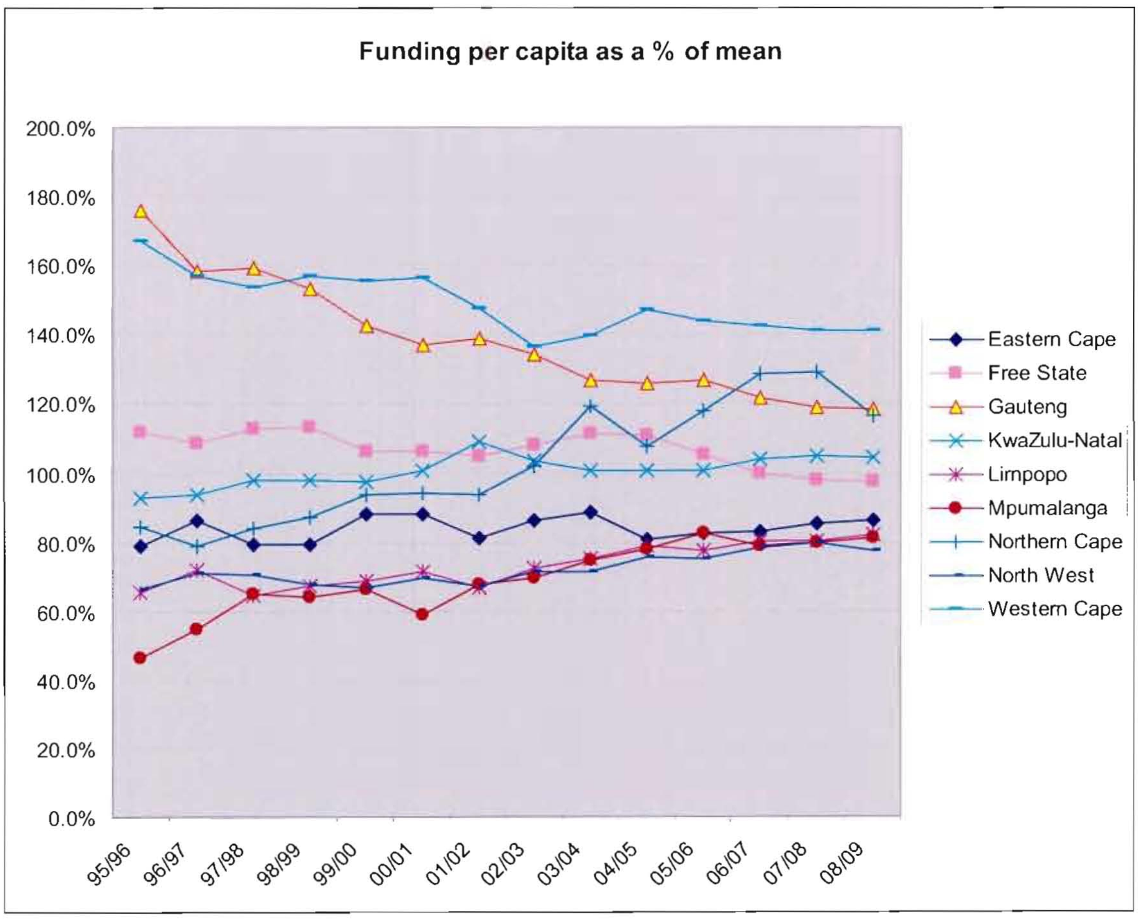


Provincial funding per capita by province as a percentage of the national average is shown in Table 5.4 and Figure 5.3. These suggest a gradual improvement of equity across provinces with some convergence in per capita funding. By 2008/09 Western Cape will be funded at 141.1% of the national average and North West at only 77.7% of the average. These differences no doubt contribute substantially to differences in the nature of the resultant health service.

Table 5.4. Provincial funding per capita by province as a percentage of the national average

	95/96	97/98	99/00	01/02	03/04	05/06	07/08	08/09
Eastern Cape	78.8%	79.5%	88.3%	81.1%	88.7%	82.6%	85.2%	86.4%
Free State	111.7%	112.9%	106.3%	105.0%	111.3%	105.2%	98.1%	97.6%
Gauteng	176.1%	158.9%	142.5%	138.7%	126.9%	126.9%	118.8%	118.5%
KwaZulu-Natal	92.6%	97.7%	97.5%	108.9%	100.8%	100.8%	104.7%	104.5%
Limpopo	65.5%	64.5%	68.8%	66.8%	75.0%	77.7%	80.5%	82.2%
Mpumalanga	46.5%	64.8%	66.6%	67.7%	74.5%	82.7%	79.9%	81.4%
Northern Cape	84.3%	84.2%	93.6%	94.0%	119.2%	118.0%	128.9%	116.6%
North West	66.2%	70.6%	67.0%	67.5%	71.5%	75.3%	79.7%	77.7%
Western Cape	167.3%	153.7%	155.5%	147.5%	139.7%	143.8%	141.1%	141.0%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Figure 5.3 Provincial funding per capita as a percentage of national mean

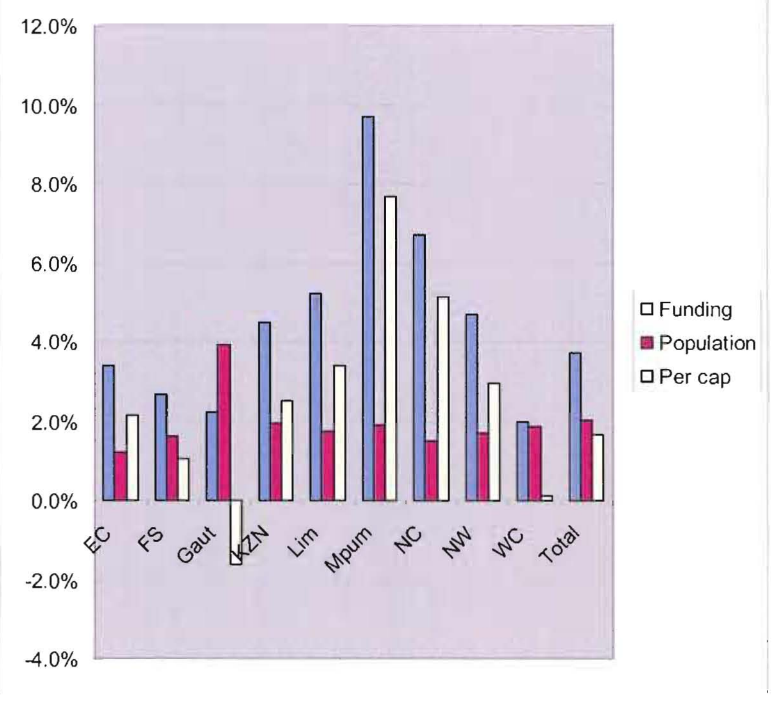


Variation in per capita expenditure growth is due both to progressively more equitable financing (i.e. larger real increases in previously disadvantaged provinces) along with migration into urban provinces. Population migration has been an important factor underlying these changes. Table 5.5 and Figure 5.4 show annualised growth in expenditure, population and expenditure per capita. The period shown is only until 05/06 which is somewhat shorter than in the previous tables. Funding of health care has failed to match population increases in Gauteng and Western Cape. Most marked is the situation in Gauteng which has had relatively low funding growth and high population growth (at a rate of 4% per year and has increased from 13.3% to 17.3% of the total uninsured in 2001) due to urbanization and in-migration leading to a significantly negative real per capita funding trend and a 26.3% decline in total over the 12 year period.

Table 5.5: Annualised growth 1995/96 to 2005/06

	Annualised Real growth in expenditure	Annualised population growth	Annualised real per capita expenditure growth
Eastern Cape	3.4%	1.2%	2.1%
Free State	2.7%	1.6%	1.0%
Gauteng	2.2%	3.9%	-1.6%
KwaZulu-Natal	4.5%	1.9%	2.5%
Limpopo	5.2%	1.7%	3.4%
Mpumalanga	9.7%	1.9%	7.7%
Northern Cape	6.7%	1.5%	5.1%
North West	4.7%	1.7%	3.0%
Western Cape	2.0%	1.9%	0.1%
Total	3.7%	2.0%	1.7%

Figure 5.4: Annualised change in funding and population



The analysis in the sections above (e.g. Table 5.3) use the uninsured population as the user base. The resultant trends suggest that progress towards inter-provincial equity has resumed. This is an important finding, but is partially dependant on the approach used to measure the base provincial population. In order to test the reliability of this finding, a sensitivity analysis was undertaken using three alternate estimates. The main approach used above relies predominantly on the General Household survey series for estimates of insurance coverage by province. The second approach recalculates the denominator population by weighting it to adjust for use of public services by insured persons. Data from Statistics South Africa's General Household Series (GHS) was used to assess relative usage rates of public sector services by insured and uninsured persons and this was found on average to be 1:5.[15,16] The third approach uses data provided only recently by the Registrar of Medical Schemes.[15] The last approach uses both data from the Registrar and weighting for use of the public sector by insured persons.

The results of the approaches to calculating per capita expenditure for 2005/06 are shown in Table 5.6. This shows that this approach does yield slightly different estimates but they are not materially significant in terms of the overall ratio between highest and lowest funded province. Weighting for use of the public sector by insured users leads to lower figures for Western Cape and Gauteng, thus accounting for inequity to a small extent. In general this thesis uses the uninsured rather than the weighted population as a base because of limitations in the data on relative utilisation. Data from the Registrar of Medical Schemes suggests lower use of public hospitals by insured persons (13.5 visits per 1000 insured beneficiaries, compared to 95 per 1000 uninsured).[17] Data from the Registrar on provincial distribution has only recently become available and the linkages between employee addresses and beneficiary distribution may need verification.

Table 5.6 Expenditure per weighted user 2005/06 Rand using alternate estimates of base population

Denominator population	General household survey unweighted (1)	General household survey weighted#	Difference from (1) %	Registrar of Medical Schemes unweighted	Difference from (1) %	Registrar of Medical Schemes weighted	Difference from (1) %
Eastern Cape	955	931	-2.5%	943	-1.2%	926	-3.0%
Free State	1,229	1161	-5.5%	1175	-4.4%	1146	-6.7%
Gauteng	1,508	1395	-7.5%	1550	2.8%	1437	-4.7%
KwaZulu-Natal	1,206	1190	-1.3%	1214	0.7%	1186	-1.7%
Limpopo	914	896	-1.9%	898	-1.8%	889	-2.7%
Mpumalanga	935	912	-2.4%	959	2.6%	928	-0.8%
Northern Cape	1,417	1390	-1.9%	1444	1.9%	1391	-1.8%
North West	875	839	-4.1%	846	-3.3%	830	-5.1%
Western Cape	1,666	1516	-9.0%	1627	-2.4%	1529	-8.2%
Total	1,176	1129	-4.0%	1170	-0.5%	1132	-3.8%
Ratio highest to lowest	1.90	1.81		1.92		1.84	

Analysis of funding patterns

Table 5.3 and 5.4 showed that despite some improvement there are still considerable differences in per capita funding across provinces, with for example funding for North West province being just over half of the level in the Western Cape. If these inequities were on the basis of genuine differences in need then this might provide sufficient justification. However Table 5.7 shows that for a range of indicators this is not the case. North West has higher HIV prevalence, illiteracy and households living in informal dwellings than the Western Cape Province and lower access to piped water and life expectancy.[12,13,18] This analysis suggests both horizontal and vertical inequities.

Table 5.7. Selected indicators of need

	HIV antenatal prevalence 2005	Households living in informal dwellings	Access to piped water	Unable to read or write	Life expectancy at birth 2002
Eastern Cape	29.5	7.70%	41.6%	14.9%	53.5
Free State	30.3	13.50%	88.7%	10.1%	51.7
Gauteng	32.4	14.40%	89.1%	5.1%	54.8
KwaZulu-Natal	39.1	12.80%	62.1%	11.0%	47.5
Limpopo	21.5	3.80%	36.4%	18.5%	54.4
Mpumalanga	34.8	12.40%	67.1%	20.4%	49.5
Northern Cape	18.5	8.20%	86.8%	14.6%	58.8
North West	31.8	16.30%	60.5%	15.8%	52.7
Western Cape	15.7	12.40%	92.0%	4.7%	62.7
Grand Total	30.2	11.70%	68.4%	11.5%	52.5

Source: General Household Survey 2005, Antenatal survey 2005; Actuarial Society

The following sections present an analysis of the funding streams underlying this distribution.

Conditional grants

The analysis presented above includes conditional grants and some of the inter-provincial spending differences, specifically reflect the centralization of certain highly specialized tertiary services and teaching in particular provinces. The per capita analysis presented above to some extent overestimates the true differences, because the user populations for tertiary care differ somewhat from the provincial populations.

Table 5.8 shows inter-provincial per capita spending less conditional grants as a percentage of the national average. When two conditional grants, the National Tertiary Services and the Health Professions Training and development grants are progressively removed from the per capita analysis, Western Cape's advantaged situation is reduced from 143.8% above the average to 123.8% and the position of

North West is improved. This shows that these two conditional grants make a substantial contribution to the apparent inequities.

Table 5.8. Effect of excluding conditional grants on equity position*

	Including conditional grants	Excluding NTSG#	Excluding NTSG and HPTD#
Eastern Cape	82.6%	86.3%	87.5%
Free State	105.2%	100.2%	100.4%
Gauteng	126.9%	115.3%	111.4%
KwaZulu-Natal	100.8%	104.1%	105.8%
Limpopo	77.7%	85.2%	87.0%
Mpumalanga	82.7%	90.1%	91.6%
Northern Cape	118.0%	126.4%	125.9%
North West	75.3%	81.9%	83.2%
Western Cape	143.8%	128.3%	123.8%
Total	100.0%	100.0%	100.0%

* Equity position is funding per capita as a percentage of the national average
\# NTSG = National Tertiary Services grant; HPTD= Health Professions Training and Development grant

While conditional grants are a substantial contributor to inequities, their share of total funding has declined from 20.2% to 18.7% of the total (Table 5.9). A process of grant reform and introduction of new grants such as for HIV/AIDS is progressively changing the distribution of conditional grants with Western Cape's budget being 40.4% grant funded in 1998/99 but 28% in 2008/09. In contrast the proportion of Eastern Cape's budget funded by conditional grants has increased from 4.4% to 12%.

Table 5.9. Conditional grants as a share of each provincial health budget

	98/99	99/00	01/02	03/04	05/06	07/08	08/09
Eastern Cape	4.4%	5.7%	7.1%	11.3%	14.3%	12.6%	12.0%
Free State	18.8%	23.2%	21.1%	22.1%	23.4%	23.3%	22.7%
Gauteng	35.3%	36.0%	34.9%	31.2%	26.8%	30.1%	30.9%
KwaZulu-Natal	17.2%	17.7%	16.2%	13.7%	13.4%	14.0%	14.5%
Limpopo	3.7%	5.1%	9.6%	10.0%	8.1%	7.5%	6.7%
Mpumalanga	5.4%	5.6%	9.9%	12.1%	10.0%	10.7%	9.4%
Northern Cape	7.2%	11.8%	15.4%	19.4%	25.4%	41.3%	34.2%
North West	3.4%	4.8%	8.2%	11.0%	11.6%	13.2%	12.9%
Western Cape	40.4%	40.7%	37.8%	33.7%	28.1%	29.1%	28.0%
Total	20.2%	21.0%	20.9%	19.7%	18.2%	19.1%	18.7%

Some of the progress towards achieving inter-provincial equity has been achieved through reforms to conditional grants, which have been designed in part to improve equity in the distribution of particular services. These reforms include the change from the Central Hospitals grant to the National Tertiary

Services grant in 2002/03. This reform broadened the focus of national funding for tertiary services from 10 central hospitals located in four provinces to 27 tertiary hospitals located in all nine provinces. The inclusion of a developmental component in the Health Professions Training grant in 2002/03 aimed to build specialist capacity in all provinces to widen and build the training platform more equitably. The changing share of conditional grant funding received by province is shown in Table 5.10. Gauteng's share of all grant funds has declined from 41.5% to 32.4% and Western Cape's from 26.3% to 18.1%. However it should be recognized that building up basic primary and secondary level services may be a more urgent equity priority.

Table 5.10: Share of health conditional grants by province

	98/99	99/00	01/02	03/04	05/06	07/08	08/09
Eastern Cape	2.9%	4.0%	4.4%	8.0%	10.4%	9.0%	8.9%
Free State	6.8%	7.6%	6.6%	7.7%	8.5%	7.5%	7.5%
Gauteng	41.5%	39.8%	38.2%	34.4%	30.9%	30.9%	32.4%
KwaZulu-Natal	18.1%	17.8%	18.2%	15.2%	16.2%	16.8%	17.7%
Limpopo	1.6%	2.2%	4.1%	5.0%	4.5%	4.1%	3.9%
Mpumalanga	1.2%	1.3%	2.3%	3.3%	3.2%	3.2%	2.9%
Northern Cape	0.6%	1.0%	1.3%	2.2%	3.2%	5.4%	4.1%
North West	1.0%	1.3%	2.2%	3.4%	4.1%	4.7%	4.5%
Western Cape	26.3%	25.1%	22.6%	20.9%	19.0%	18.4%	18.1%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

The distribution of each conditional grant across provinces as compared to the distribution of the uninsured population is shown in Table 5.11. An analysis of the methodological basis of each of the health conditional grants was undertaken and is summarised in Table 5.12. The latter table indicates that there is still significant potential for further grant reform to achieve greater equity. In particular an approach to the National Tertiary Services grant structured not only on historical outputs, but on need or future service plans to build up basic tertiary services in disadvantaged provinces could be much more equitable. However it should be recognized that building up basic primary and secondary level services may be a more urgent equity priority.

Table 5.11. Distribution of health conditional grants

	Uninsured population	National tertiary services	Health professions training and development	HIV/AIDS	Hospital Revitalisation	Hospital Management and quality improvement	Integrated nutrition programme
Eastern Cape	16.1%	7.8%	8.4%	15.1%	11.8%	16.3%	21.3%
Free State	6.3%	9.5%	6.1%	7.3%	5.3%	8.9%	5.9%
Gauteng	16.6%	38.9%	36.4%	18.2%	22.7%	12.3%	9.2%
KwaZulu-Natal	21.8%	15.2%	12.7%	23.2%	18.5%	15.8%	21.8%
Limpopo	13.1%	1.0%	4.8%	10.3%	10.8%	11.6%	18.1%
Mpumalanga	7.1%	0.9%	3.6%	7.6%	6.9%	8.2%	7.8%
Northern Cape	1.9%	0.8%	2.7%	2.5%	5.8%	6.7%	2.7%
North West	8.5%	1.1%	4.1%	9.6%	9.6%	8.4%	8.9%
Western Cape	8.6%	24.8%	21.3%	6.1%	8.6%	11.7%	4.3%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 5.12. Methods used to allocate health conditional grants

Conditional grant	Allocation 2005/06 R million	Allocation methodology	Potential problems leading to inequity
National tertiary services	4,529	Based on actual number of services delivered multiplied by average unit costs for each specialist service type	The allocation method perpetuates inequity, since it is based on utilization, which is closely linked to existing supply. Inadequate data is available on spillovers through cross-border flows.
Health Professions training and development	1,520	Main component of grant is based on distribution of medical students	The exclusion of nursing students disadvantages provinces with large nursing colleges, but no medical students
HIV/AIDS	1,135	Several components based on distribution of HIV infected persons, AIDS sick, numbers on antiretroviral treatment	The grant only covers special programmes, so provinces with high AIDS caseloads are not reimbursed for higher general hospital costs. Provinces with stronger services will be able to enroll more patients onto ARV treatment.
Hospital Revitalisation	1,027	Project funded.	Better resourced provinces have more capacity to develop projects and bids and spend.
Hospital Management	150	Historical, no clear formula	Variable- grant will phase out from 2006/07
Integrated Nutrition grant	123	Based on poverty and malnutrition rates	None – but grant will be phased out in 2006/07

EQUITABLE SHARE AND OWN REVENUE

When conditional grants are removed from the analysis (Table 5.8), there is still a degree of inequity and this will be explored in this section. Firstly provinces with more affluent populations are able to generate more own revenue. Table 5.13 shows that Western Cape is able to augment its budget (excluding conditional grants) by 11.4% or R1.3 billion whereas Eastern Cape is only able to augment its budget by 1.5% or R326 million.

Table 5.13. Total own revenue by province

	Equitable share allocation to provinces R million	Own revenue R million	Total Revenue R million	Percentage increase in revenue through own revenue
Eastern Cape	22 202	326	22 528	1.5%
Free State	8 660	390	9 050	4.5%
Gauteng	20 810	1635	22 445	7.9%
KwaZulu-Natal	28 398	1120	29 518	3.9%
Limpopo	18 375	378	18 753	2.1%
Mpumalanga	9 976	272	10 248	2.7%
Northern Cape	3 124	106	3 230	3.4%
North West	11 086	426	11 512	3.8%
Western Cape	12 072	1373	13 445	11.4%
Total	134 706	6026	140 732	4.5%

Secondly provinces vary considerably in the proportion of their budgets (less conditional grants that they allocate to health services. Table 5.14 shows Mpumalanga allocates 21.5% whereas Western Cape allocates 30.6%.

Table 5.14 Percentage of unconditional provincial revenue spent on health services

	Health budget excluding conditional grants 2005/06 R million	Total provincial revenue excluding conditional grants R million	Percentage
Eastern Cape	5,264	22 528	23.4%
Free State	2,393	9 050	26.4%
Gauteng	6,474	22 445	28.8%
KwaZulu-Natal	8,996	29 518	30.5%
Limpopo	4,659	18 753	24.8%
Mpumalanga	2,205	10 248	21.5%
Northern Cape	765	3 230	23.7%
North West	2,548	11 512	22.1%
Western Cape	4,117	13 445	30.6%
Total	37,420	140 732	26.6%

Thirdly the equitable share allocations themselves may not be completely equitable. Table 5.15 shows total equitable share allocations per capita uninsured person. Northern Cape receives a significantly higher allocation per capita.

Table 5.15 Equitable share allocation per capita uninsured

	Equitable share allocation to provinces R million	Equitable share per capita uninsured R
Eastern Cape	22 202	3450
Free State	8 660	3429
Gauteng	20 810	3088
KwaZulu-Natal	28 399	3300
Limpopo	18 376	3552
Mpumalanga	9 976	3474
Northern Cape	3 124	4191
North West	11 086	3294
Western Cape	12 072	3504
Total	134 706	3375

To explain this it is necessary to understand the method of the formula and this is shown in Table 5.16. A new Equitable Share formula was initiated in the 2005/06 budget. The most important changes from the previous formula was the exclusion of the social welfare component, given the shift of the social grant function into a conditional grant, the reduction of the economic component from 3% to 1% and the inclusion of a new poverty component at 3%.

Table 5.16. Equitable share formula 2005/06 (before phasing)

	Education	Health	Social Welfare	Basic	Poverty	Economic Activity	Institutional	Weighted Average
Weighting	*51%*	*26%*	*0%*	*14%*	*3%*	*1%*	*5%*	*100%*
Eastern Cape	17.4%	15.1%	_	14.2%	20.7%	8.1%	11.1%	16.0%
Free State	5.8%	6.0%	_	6.0%	7.1%	5.5%	11.1%	6.2%
Gauteng	13.9%	17.9%	_	20.0%	11.3%	33.0%	11.1%	15.7%
KwaZulu-Natal	22.8%	21.8%	_	21.0%	23.3%	16.5%	11.1%	21.7%
Limpopo	14.9%	12.6%	_	11.7%	17.0%	6.5%	11.1%	13.7%
Mpumalanga	7.6%	7.2%	_	7.0%	6.7%	7.0%	11.1%	7.5%
Northern Cape	1.7%	1.8%	_	1.8%	2.0%	2.4%	11.1%	2.2%
North West	7.7%	8.4%	_	8.2%	8.0%	6.5%	11.1%	8.1%
Western Cape	8.2%	9.4%	_	10.2%	3.8%	14.5%	11.1%	8.9%
TOTAL	100.0%	100.0%	_	100.0%	100.0%	100.0%	100.0%	100.0%

Table 5.17 Design of Equitable share formula

Component	Share	Design	Comment
Education	51%	Average school enrollment over the previous three years; School-age population 5-17 years. Equally weighted	The equal weighting between the components may disadvantage provinces with high enrolment, particularly where this is due to older students. The poverty weighting may be inadequate to correct for higher off-budget school fee revenue in affluent provinces, backlogs and poorer educational backgrounds.
Health	26%	Population without medical aid, population with medical aid; weighted 4:1	Retention of the insured component may be unnecessary, given that insured persons should pay hospital fees. 4:1 weighting may be too high given hospital claim patterns reported by the Registrar of medical schemes. There is no weighting for other aspects of need.
Social Welfare	0%	Excluded in new formula given shift in funding mechanism to a conditional grant	
Basic	14%	Population (average of 2001 census and 2002 and 2003 General Household surveys	
Poverty	3%	Share of population in lowest two income quintiles as taken from Income and Expenditure survey	The inclusion of this component has made the formula more sensitive to need linked to poverty. However it does not fully address vertical equity issues.
Economic activity	1%	Regional Gross Domestic Product data 2003	The reduction from 3% to 1% has made the formula more equitable
Institutional	5%	Shared equally across provinces	The high institutional weighting and its equal distribution results in Northern Cape (NC) receiving the same allocation as the most populous province KZN- R747 million. This results in a higher per capita allocation to NC. However this does indirectly address the additional costs of very low population densities.

Table 5.18 compares the actual outcome of provincial budget processes with notional equitable allocations to the health sector arising from the equitable share formula. Allocations by the Western Cape and KZN provinces are significantly higher than "anticipated" by the formula, whereas Mpumalanga and North West appear significantly under-resourced.

Table 5.18. Comparison of health budgets (less conditional grants) vs. health component of the equitable share formula

	Health budgets 2005/06 less conditional grants R million	Health component of the equitable share formula	Difference	% difference
Eastern Cape	5 264	5 267	-3	-0.1%
Free State	2 393	2 087	306	14.7%
Gauteng	6 474	6 250	223	3.6%
KwaZulu-Natal	8 996	7 622	1 374	18.0%
Limpopo	4 659	4 395	264	6.0%
Mpumalanga	2 205	2 515	-311	-12.4%
Northern Cape	765	615	150	24.5%
North West	2 548	2 947	-399	-13.5%
Western Cape	4 117	3 274	842	25.7%
Total	37 420	34 972	2 448	7.0%

Inclusion of Local Government in Equity Analysis

Local government plays an important role in delivery of primary care services, particularly in certain provinces. This may change with the progressive implementation of the National Health Act of 2003/04, which defines health services, with the exception of environmental health services as a provincial function. The distribution of local government own revenue sourced expenditure on health services is very inequitable and increases the inter-provincial provincial inequities. This is shown in Table 5.19.

Table 5.19: Provincial and local government funding per capita 2005/06

	Provincial Health budget 2005/06 R million	Local government own revenue for health R million	Total R million	Increase constituted by local government own revenue	Total per capita	Per capita funding as a percentage of national average
Eastern Cape	6,213	69	6,282	1.1%	980	81%
Free State	3,111	31	3,142	1.0%	1246	103%
Gauteng	9,840	529	10,369	5.4%	1568	130%
KwaZulu-Natal	10,304	275	10,579	2.7%	1213	101%
Limpopo	4,777	18	4,795	0.4%	915	76%
Mpumalanga	2,764	35	2,799	1.3%	982	81%
Northern Cape	1,073	9	1,082	0.8%	1396	116%
North West	2,987	30	3,017	1.0%	892	74%
Western Cape	5,777	295	6,072	5.1%	1773	147%
Total	46,845	1,290	48,135	2.8%	1205	100%
Ratio of highest to Lowest					2.0	

Bringing the various factors together in an example comparing the highest and lowest funded provinces, Table 5.20 shows the basis of the differences in per capita funding. The relative contributors to the inequity are conditional grants (41.8%), provincial choice within a fiscal federal system (35.5%), own revenue largely dependant on differing ability to pay and local tax bases 16.6% (8.7% local and 7.9% provincial) and differences generated through the equitable share formula itself (6.1%). The per capita funding figures in this table differ slightly from earlier tables, since they focus on original budget figures for 2005/06, as opposed to expenditure projections which were the source for the earlier tables.

Table 5.20 Differences in per capita funding of two provinces 2005/06*

Funding decision point	North West	Western Cape	% difference	Composition of total difference
Equitable share formula (R million)	3294	3504	6.4%	6.1%
Provincial own revenue (R million)	127	398	214.8%	7.9%
Subtotal (R million)	3421	3902	14.1%	
Provincial choice (%)	22.13%	30.6%		35.5%
Subtotal (R million)	757	1,195	57.8%	
Conditional grants (R million)	103	472	358.7%	41.8%
Local govern own revenue (R million)	9	85	858.5%	8.7%
Total (R million)	869	1,752	101.7%	100.0%

* The selected provinces are the highest and lowest funded
# The population denominator used is the uninsured population

DISCUSSION

The data shows substantial inequity in funding across provinces, even by 2008/09, fourteen years into the new democratic dispensation. When local government own revenue is included (Table 5.19) the best funded province in 2005/06, Western Cape, is still funded at twice the level of the worst funded, North West. These findings are consistent with previous focuses on addressing equity in the first decade of democracy.[3,4] McIntyre and Gilson have argued that not only is horizontal inequity extensive in South Africa but that there has been little attention to addressing vertical equity i.e. by giving preference to groups with greater needs.[1]

However the new and more recent data presented in this chapter show that the level of inequity has reduced over the last decade (e.g. Figure 5.3) with the ratio of highest to lowest per capita province decreasing from 3.8 in 1995/96 to 1.8 in 2008/09. This suggests that after a period of stagnation that progress towards inter-provincial equity has resumed and is an important finding for South Africa.

There have been substantial funding increases to the lowest funded provinces of Mpumalanga, Northern Cape and North West. Mpumalanga's real per capita funding has increased by 127.5%, while Gauteng's has declined 12.5% (Table 5.3) over thirteen years. The absorption of these funds (to the extent that they are not fully taken up by wage increases) is an issue and Mpumalanga and North West provinces have both experienced under-expenditure for the last two financial years. For example, Mpumalanga under-spent by R146 million in 2003/04.[19,20]

At the same time real per capita spending in Gauteng and to some extent Western Cape (e.g. see Figure 5.1) has declined dramatically. The simultaneous effects of population growth, wage and input cost increases and the HIV epidemic along with substantial in-migration is likely to have presented particular pressures. The case of the substantial downsizing in Western Cape is presented in Appendix 1 showing that despite being the best funded province and experiencing fairly small real per capita funding reductions, the province downsized by approximately 9000 health workers in the late 1990s as it struggled to deal with increased wage costs in the second (immediate post GEAR) funding phase.

This analytic perspective of progress towards inter-provincial equity is striking, but is substantially based on the demographic and medical scheme coverage changes reflected in census 2001, mid-year population estimates, October Household Survey of 1999 and subsequent General Household surveys. If the 1995 October household survey and 1996 census are used as measures for population and medical aid coverage then Gauteng appears substantially better funded. There is also substantial variability between Statistics South Africa's own provincial population estimates across different studies. This uncertainty about population denominators should ideally be resolved through more accurate assessment both by surveys, such as the Demographic and Health Survey, and by data collected by the Registrar of Medical Schemes.

If the data are correct and there has indeed been progress towards equity in inter-provincial financing, then this raises other important questions about why services and standards are so different between provinces and about what efficiencies are needed to improve quality and access. While there have been significant strides towards equity in inter-provincial funding, there remain substantial inequities in the distribution of skilled health personnel. These are partly linked to difficulties in recruitment and retention and partly to residual differences in inter-provincial funding for tertiary health services and training.

However residual funding inequities are still fairly large. The research has shown these are due to a range of factors including:

- Conditional grants, especially the National tertiary services and Health professions training and development grants
- Variability in own revenue base affecting both provincial and local government own revenue.
- Design of the equitable share formula.

The decentralisation and assignment of expenditure functions to provinces has created elements of fiscal federalism in the South African public finance system. Provinces have constitutional authority to make decisions around expenditure choices. Expenditure decentralization is widely recognized in the economic literature as a tool to improve allocative efficiency i.e. to produce the mix and of public services that local citizens need and demand.[21,10] Different public goods have different spatial characteristics and lower tier governments may have more information about the needs of their citizens. However the very different preferences of decentralized authorities may create inequities such as the funding discrepancies shown in Table 5.14. This degree of variability and resultant inequities in health sector funding associated with fiscal federalism have sometimes led to calls for a single national health service or for a return to a single national allocation system for the health sector as in the 1997 function committee system and formula or as in the UK Resource Allocation Working Party (RAWP) formula approach.[22] Bird and other authors have argued that for key social services such as health and education, greater attention should be placed in the design of inter-governmental transfer mechanisms to ensure at least basic levels of service delivery.[23,24]

While South Africa has had extensive expenditure decentralization, there has been very little decentralization on the revenue side, especially for taxation. The literature on fiscal federalism presents different perspectives. Greater fiscal decentralization is often advocated to better match tax assignment with revenue assignment. Where expenditure but not revenue functions have been assigned, provinces become responsible to the electorate for delivery but cannot raise their own revenue. Dependence on the national government is generated, with less ability of the electorate to enforce fiscal accountability.[25,9] Devolution of taxing and spending powers is seen as forging a closer link between where money is spent and where it is raised.

However tax assignment has both equity and efficiency implications and where revenue bases differ substantially, as in South Africa, decentralization of taxation could significantly affect equity. One can see the potential for this in the data presented above where provincial own revenue and local own revenue are already significant causes of the inequities that exist between provincial health systems. Taxation functions and collection of user fees for functions such as water and electricity in South Africa have been devolved to local government and this has led to substantial inequities in these services, whose provision is important for health. The Financial and Fiscal Commission, a constitutional entity established to advise on fair allocation systems, recommended some decentralisation of tax functions, but proposed that the equity implications of this be partially compensated for by a proposed new component of the equitable share formula to recognize wide local variations in the tax base.[26] The fact that the data shows that 16.6% of the existing funding differences between the best and worst funded provinces are due to own revenue differences, suggests that some compensation for own revenue capacity should be considered in the funding.

The degree of residual inequities is still substantial, so further interventions are clearly required. However the magnitude and pace of future redistributive reforms is limited by the severe effects of the past period, which saw substantial downsizing out of proportion to funding changes and associated with simultaneous high increases in input costs. For example the Western Cape experience cited in Appendix 1 showed that 9000 personnel have already been downsized and 24% of hospital beds closed. This suggests that equalization should preferably be upwards and gradual.

Future reforms to further improve equity can be made in multiple areas. For the National Tertiary Services grant there are a range of potential options, including using the grant to build up a basic tertiary (ophthalmology, Ear Nose and Throat surgery, urology etc.) infrastructure in less developed provinces, changing the grant to some degree from an output based to a need based approach and ultimately refocusing the grant on a smaller subset of higher level tertiary care as basic tertiary services become more equitably distributed. Research on cross-border flows is required to provide a better understanding of genuine spillovers. The Health Professions Training and Development grant could be reformed to become somewhat more equitable if its focus on medical education were broadened to other categories e.g. nursing. As discussed above consideration should be given to introducing some compensation for own revenue capacity into the equitable share formula. Local government funding is likely to decline given reduced local government health functions as specified in the National Health Act of 2003.[27] However in building up tertiary level (sub-specialist) services it should be recognised that these need to firmly support and complement more basic primary and secondary (e.g. regional hospital) services in their regions, noting that well distributed basic services may be a more important determinant of equity in health service utilisation.

Recent reforms to the equitable share formula, which funds provincial governments, appear to be favourable for equity. These include the introduction of a poverty component and the reduction of the economic component weighting. However the effect of the reforms is somewhat more complex because of the removal of the social welfare component which itself had an income poverty component and the differential uptake of social security grants across provinces. Local authors have argued the case for greater prominence of vertical equity issues such as indicators of deprivation within the equitable share formula.[1,28]

Further research on the formula should be undertaken to examine need and the determinants of expenditure more empirically, although final decisions while requiring strong technical input are ultimately political. For example within the education component the existing formula may not adequately account for the implications of poverty and backlogs in the need for educational spending and the differences in school fees generated across provinces. On the other hand the use of historical data may ignore the effects of urbanization. The main subcomponent of the health component may be more equitable if weighted for need elements such as demographic factors, distribution of HIV and other factors. On the other hand the grant may not adequately reflect utilization differentials due to cross-border flows. The subcomponent allocations for insured persons may be unnecessary and inequitable given billing of insured persons and revenue differentials. The institutional component is almost certainly too large for an administrative core that is equal across provinces and should probably be reduced. Its protective effect on the Northern Cape could be differentially conceptualized as a density or ruralness component or weighting in the formula, which might be applicable to various services including roads, health and education. The poverty component has been determined politically and further empirical work on poverty and its implications for public expenditure would be useful. Possibly the most contentious component is the economic activity one which is to some extent a proxy for tax decentralization. On the one hand rewarding economic activity may incentivise activities that promote economic growth and promote fiscal decentralization while on the other a larger economic component would perpetuate inequities. The inclusion of a new component to compensate for revenue capacity should be considered. Consideration could also be given to capital backlogs.

The differing choices made across provinces may to some extent reflect true allocative efficiencies, but on the other hand represent unacceptable inequities. Further research on the nature of these allocative decisions may help to understand them better. For example in Limpopo higher allocations to agriculture have to some extent been aimed at increasing economic growth, nutrition and employment. Inequities are to some extent amenable to intervention, including through national norms and standards, increased information and communication about inequities, pressure on provincial officials and politicians or ultimately greater centralization of funding.

CONCLUSION

The use of new demographic and medical scheme coverage, such as from census 2001 and General Household surveys of 2002 and 2003, suggest that a new picture of improving inter-provincial equity in health care funding is emerging, though some of this is undoubtedly linked to population movements into better resourced provinces as revealed by the 2001 census. It is vital to confirm available data on public sector dependence by province as this is critical to discussions of equity.

However residual inequities are still large with the best funded province receiving approximately twice that of the lowest funded. This is due to a range of factors including conditional grants, provincial choice, differential own revenue bases and the equitable share formula itself. The basis of these inequities has been explored in detail in this chapter and a range of proposals made to progressively improve equity.

The substantial downsizing that has already occurred in previously advantaged provinces suggests that equalization should as far as possible be upwards and gradual as new revenue becomes available. The substantial differences in professional personnel distribution, service outputs and quality across provinces suggest more work is needed on how to achieve better quality services at the emerging average funding levels (technical and allocative efficiency and management). Recruiting and retaining skilled health professionals in previously disadvantaged provinces will be a key factor.

CHAPTER 6: SITUATIONAL ANALYSIS WITH FOCUS ON COMPOSITION OF PROVINCIAL HEALTH CARE EXPENDITURE

INTRODUCTION

As a prelude to modelling the funding requirements of a future South African health service, this chapter explores aspects of the baseline situation with respect to spending and service trends, outputs and unit costs in the context of health needs. This chapter deals with objective 2.1 of the thesis. The chapter focuses especially on the composition of provincial expenditure by functional area (e.g. primary care, hospitals) and by economic classification (e.g. personnel, capital). This analysis is useful to examine allocative efficiency, demonstrate what the sector is spending its money on and how this has changed given stated policy priorities. The chapter also demonstrates how additional funding (see chapter 4) has been spent. The analysis provides a useful understanding of the existing situation and facilitates the development of planning models, such as the model presented in chapters 8 and 9.

The chapter focuses on provinces, given that provincial health care expenditure comprises the significant majority (around 80%) of total public health care expenditure and fairly reliable data is available for a nine year period (1999/00 to 2008/09).

The chapter examines the extent to which Primary health care (PHC) expenditure has increased, given that it is considered a key pillar of the health service, particularly since democratic transition in 1994, with strong state and African National Congress endorsement of the PHC philosophy and its centrality in Reconstruction and Development.[1,2] The findings will suggest that although PHC has received significant augmentation of funding, hospitals have received very limited real funding increases over the past decade, despite facing increases in input costs, population growth and the effects of the HIV/AIDS epidemic. Trends in hospital expenditure, outputs and unit costs are explored, providing information on a range of hospital types.

The objectives of this chapter are:

- To describe some key indicators of need, particularly mortality.
- To describe selected key demand trends.
- To analyse spending trends by provincial departments of health by functional area and from this to make observations on allocative efficiency.
- To analyse hospitals and primary care spending along with output data to assess trends in unit costs and make observations on technical efficiency.
- To analyse spending trends by economic classification.

RESULTS

The results are presented in four sections covering need, demand, functional expenditure and technical efficiency.

NEED

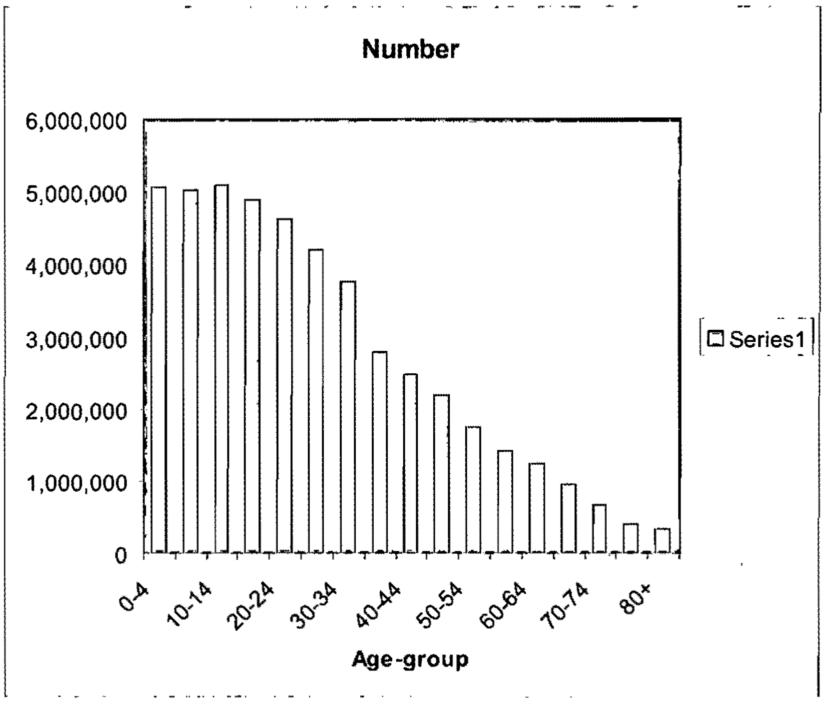
The term "need" refers here to the capacity to benefit from health care and related interventions such as associated with the epidemiological (mortality and morbidity) and socio-demographic profile of populations. The distribution of the population by age group is shown in Table and Figure 6.1. The population is still a fairly young one with 42.9% less than 20 years and only 5% above 65 years. There is a marked drop-off in numbers in the middle age groups with the number in the 40-45 year age group under half of the 0-4 year age-group. This reflects particularly the effects of the HIV epidemic on premature mortality.

Table 6.1 Population by 5 year age groups 2005*

Age group	Number	Percent
0-4	5,063,900	10.8%
5-9	5,031,100	10.7%
10-14	5,099,300	10.9%
15-19	4,898,100	10.4%
20-24	4,621,200	9.9%
25-29	4,211,100	9.0%
30-34	3,762,000	8.0%
35-39	2,780,200	5.9%
40-44	2,483,200	5.3%
45-49	2,187,200	4.7%
50-54	1,757,100	3.7%
55-60	1,422,200	3.0%
60-64	1,244,200	2.7%
65-69	955,900	2.0%
70-74	654,500	1.4%
75-79	392,300	0.8%
80+	324,700	0.7%
Total	46,888,200	100.0%

Source Statistics South Africa 2005[3]

Figure 6.1. Population by 5 year age-group



Population density varies substantially across the country - in 1996 it ranged from 2- 432 persons per square km between Northern Cape and Gauteng provinces[4] and this has implications for the type and cost of services to be rendered. The population is progressively urbanising and this has implications for facility planning. In 1996 the proportion of the provincial population living in urban areas ranged from 11%-97%, with the lowest being Limpopo and the most dense being Gauteng.

There are approximately 925 000 – 1 180 000 births per year, a crude birth rate of approximately 22.4-23.8 per 1000 population.[3,5] This has implications for maternity and neonatal services in the public or private sectors.

MORTALITY

Deaths are projected to have increased from 318 287 in 1997 to around 731 000 in 2005 to 788 000 in 2010, mainly due to the effects of HIV/AIDS. [6,3,7] There has been a marked increase in deaths in the middle age groups. Life expectancy at birth is estimated to be dropping from around 55 years in 2000 possibly to as low as 45–51 years in 2005.[8,13] Table 6.2 compares deaths reported by three sources and shows that between 1997 and 2002 the lowest of the three projections was an annual increase in deaths of 8.3%.

Table 6.2 Total mortality – data from three sources

	Population Register[6]	Statistics South Africa[6]	Actuarial Society ASSA 2003[7]
1997	250,745	316,505	420,900
1998	299,737	367,689	460,410
1999	327,826	381,902	503,247
2000	366,121	413,969	531,291
2001	407,675	451,936	583,365
2002	441,731	499,968	632,561
2003	484,332	552,825	680,585
2004	513,931	567,488 (incomplete)	720,654
2005			748,444
Change annual 1997-2004	12.0%	9.7%	8.3%

Demographic and mortality projections derived from a national demographic and AIDS model (ASSA)[7] suggest that changing morbidity and mortality patterns from AIDS exceed the effect of population aging as a key need issues. The ASSA model projects crude mortality rates rising from 8.1 per 1000 population in 1990 to 11.7 in 2000 and 16.1 in 2010. This is a doubling in crude mortality and must to some extent reflect increased morbidity and need for health services. Deaths are projected to rise by 4% on average annually between the years 2000 and 2010. The proportion of the elderly over 65 years is projected to increase from 41 per 1000 in 1990 to 51 in 2000 and to 55 per 1000 population in 2010. There is projected to be an annual average growth in the elderly population of 2.1% per annum from 2000 to 2010.

The Medical Research Council's investigations into mortality and burden of disease refer to the quadruple burden of disease experienced in South Africa. According to their research HIV/AIDS, chronic diseases, poverty-related conditions and injuries all contributed substantially to the number of deaths in the year 2000. After HIV/AIDS (29.8%), cardiovascular disease (16.6%), infectious and parasitic diseases (10.3%), malignant neoplasms (7.5%), intentional injuries (7.0%) and unintentional injuries (5.4%) were the leading cause of death.[8]

Table 6.3: Cause of death profile by four major disease groups, South Africa 2000*

	Male N=303 081	Female N=253 504	Persons N=556 585
HIV/AIDS	26%	34%	30%
Other communicable, maternal, perinatal and nutritional (Group I)	21%	20%	21%
Non-communicable (Group II)	36%	40%	37%
Injuries (Group III)	17%	6%	12%

Source: Medical Research Council[8]

The specific causes of deaths by disease category and specific cause are shown in table 6.4.

Table 6.4 Cause of death by disease category and specific cause[8]

Disease category	Total	Top 20 specific causes of death	
HIV/AIDS	165,859	HIV/AIDS	165,859
Cardiovascular disease	92,201	Ischaemic heart disease	32,919
		Stroke	32,114
		Hypertensive heart disease	14,233
Intentional injuries	38,854	Homicide/violence	32,485
		Suicide	6,370
Unintentional injuries	30,076	Road traffic accidents	18,446
Infectious / parasitic excluding HIV/AIDS	57,502	Tuberculosis	29,553
		Diarrhoeal diseases	15,910
		Septicaemia	6,047
Malignant neoplasms	41,691	Trachea/bronchi/lung cancer	7,173
		Oesophageal cancer	5,803
Perinatal conditions	27,361	Low birth weight	11,876
Respiratory disease	23,009	COPD	12,473
		Asthma	6,987
Respiratory infections	22,340	Lower respiratory infections	22 097
Diabetes mellitus	13,157	Diabetes mellitus	13,157
Diseases of digestive system	12,617	Cirrhosis of liver	5,672
Genito-urinary diseases	8,049	Nephritis/nephrosis	7,225
Nervous system disorders	7,160		
Nutritional deficiencies	6,488	Protein-energy malnutrition	5,511
Congenital abnormalities	3,859		
Endocrine and metabolic	2,109		
Maternal conditions	1,875		
Mental disorders	838		
Benign neoplasms	744		
Cot death	491		
Musculo-skeletal diseases	259		
Skin diseases	48		
All causes	556,587		

Source: Bradshaw[8]

The Medical Research Council reported a national age adjusted mortality rate as varying significantly across provinces, with a range from 11.7 per 1000 in Western Cape to 17.6 per 1000 in Kwazulu-Natal (KZN) in 2000.[9] Age adjusted mortality is approximately 1.5 times as high in KZN and Mpumalanga provinces as in Western Cape.

Recent cause of death data from Statistics South Africa confirms the large rise in deaths due to communicable diseases and also shows increasing death rates from non-communicable diseases (Table 6.5).

Table 6.5 Age standardized mortality rates by burden of disease group in women 15-65 years*

	Communicable diseases	Unnatural causes	Non-communicable diseases	Total
1997	179	82	340	601
1998	239	79	359	677
1999	304	78	379	761
2000	411	72	415	898
2001	512	70	446	1028
2002	643	72	473	1188
2003	747	73	512	1332
2004	836	74	543	1453
Change 1997-2004	367.0%	-9.8%	59.7%	141.8%

* Source: Statistics South Africa[10]

The scale of the HIV epidemic necessitates particular attention. The epidemic has led to a great increase in the national burden of disease, which is probably unprecedented in the country's history. By 2004 prevalence of infection among public sector ante-natal clinic attenders amounted to 29.4% (confidence interval 28.5%-30.5%) and was highest in Kwazulu-Natal province (KZN) at 40.7% (38.8%-42.7%).[11] Prevalence in the total population over 2 years was estimated in a recent study to be 10.8%, with a higher rate in females (13.3%) than males (8.2%) and with provincial rates varying from 1.9% in Western Cape to 16.5% in KZN.[12] Approximately 5.25 million persons are estimated to be infected with HIV in South Africa in 1996 and 636 131 to be sick with AIDS.[13] It is estimated that 15.7% of health workers are infected.[14]

The concurrent tuberculosis (TB) epidemic has escalated from 215 154 reported cases in 2003 to 302 467 in 2005 (from 550 to 645 per 100 000 persons).[15] Cure rates are very low at 50.8% in 2004/05 and 48% in 2005/06[15,16]. TB has been declared a national emergency.[17]

Determinants of disease

Work emerging from the Medical Research Council is examining some of the overall risk factors for the burden of disease in South Africa (personal communication Dr. D. Bradshaw). Key determinants of mortality and loss of disability adjusted life years (DALYs) include unsafe sex, tobacco, inter-personal violence, obesity, hypertension, diabetes, cholesterol, under-nutrition and unsafe water and sanitation.

DEMAND

Demand for health services is strongly linked to patterns of supply and this should be considered in the interpretation of the utilization data which follows.

Primary care visits have increased from 81.9 million to 101.7 million over the five year period from 2000/01 to 2005/06. This is a total increase of 23.2% or a 4.4% annual increase. Most marked have been the increases in Mpumalanga (11.4% annual) and Limpopo (6.2% per annum).

Table 6.6. Primary care visits

	00/01	01/02	02/03	03/04	04/05	05/06	Annual change 00/01-05/06
Eastern Cape	14,339,786	14,383,889	13,746,488	14,503,175	15,312,880	14,618,214	0.4%
Free State	5,069,882	5,446,065	5,725,472	5,972,199	6,031,495	5,912,089	3.1%
Gauteng	10,649,014	11,094,574	12,012,319	12,396,325	13,059,604	14,162,418	5.9%
KwaZulu-Natal	15,315,661	16,908,055	18,000,507	18,948,993	19,428,937	19,789,376	5.3%
Limpopo	10,984,360	11,748,869	13,680,318	14,381,591	15,253,259	14,862,213	6.2%
Mpumalanga	3,953,523	5,100,122	5,399,366	6,063,243	6,193,706	6,792,927	11.4%
Northern Cape	1,931,154	2,010,410	2,124,661	2,420,212	2,332,201	2,175,354	2.4%
North West	8,237,237	9,039,665	8,892,998	8,768,182	9,668,768	9,822,014	3.6%
Western Cape	11,426,477	11,839,414	12,856,051	12,877,078	13,593,636	13,623,772	3.6%
Grand Total	81,907,093	87,571,063	92,438,180	96,330,998	100,874,486	101,758,377	4.4%

Source: District Health Information System and Department of Health

Primary care utilisation has increased from 2.2 to 2.6 visits per uninsured person (Table 6.7). There is a considerable inequity in utilization ranging from 2.1 in Gauteng and 2.4 in Mpumalanga to 4 in Western Cape in 2004/05. The visit rate was reported to be 1.8 per capita in 1992/3[2] and a similar figure was reported for 1995.[18]

Table 6.7 Primary care visits per capita uninsured

	00/01	01/02	02/03	03/04	04/05	05/06
Eastern Cape	2.4	2.4	2.3	2.4	2.4	2.3
Free State	2.2	2.3	2.4	2.5	2.4	2.4
Gauteng	1.8	1.8	1.8	1.8	2.0	2.1
KwaZulu-Natal	1.9	2.1	2.1	2.2	2.2	2.3
Limpopo	2.2	2.3	2.7	2.8	2.9	2.8
Mpumalanga	1.5	1.9	1.9	2.2	2.2	2.4
Northern Cape	2.8	2.9	3.1	3.3	3.1	2.8
North West	2.6	2.8	2.7	2.7	2.9	2.9
Western Cape	3.7	3.7	3.8	3.8	4.0	4.0
Grand Total	2.2	2.3	2.4	2.5	2.5	2.6

Source: District Health Information System and Department of Health

Outpatient utilisation

Outpatient (OPD) visits (including casualty) have been fairly stable at around 20 million. This amounts to 510 visits per 1000 population with a range from 280 in Mpumalanga to 761 in Gauteng. This is shown in Tables 6.8 and 6.9. However reporting on this variable to the District Health Information System (DHIS) is sub-optimal, so some caution must be exercised in interpreting these data. The ratio of hospital OPD visits to PHC visits averages 20.4% and is high in Gauteng (38.9%) and Kwazulu-Natal (29.4%). This super-imposed on relatively low PHC utilisation rates in these provinces suggest PHC services are being bypassed and that referral systems are not functioning well.

Table 6.8 Outpatient and casualty visits by province 2004/05

Outpatient (OPD) and casualty visits (thousand)	Eastern Cape	Free State	Gauteng	KwaZulu-Natal	Limpopo	Mpumalanga	North West	Northern Cape	Western Cape	Total
OPD visits	1,514	806	4,097	4,797	1,397	546	833	208	1,837	16,034
Casualty visits	558	240	986	919	365	249	345	156	696	4,515
OPD plus casualty	2,072	1,046	5,083	5,716	1,762	795	1,178	364	2,533	20,549
OPD and casualty visits per 1000 uninsured populatiion	331	424	761	657	339	280	350	483	738	518
OPD and casualty visits as a proportion of primary health care visits	13.5%	17.3%	38.9%	29.4%	11.6%	12.8%	12.2%	15.6%	18.6%	20.4%

Source: District Health Information System

Table 6.9 Trends in outpatient and casualty visits in acute hospitals

	99/00	00/01	01/02	02/03	03/04	04/05
Outpatient and casualty visits						
District	6,900,573	7,368,426	7,388,362	7,034,357	7,039,178	6,417,947
Regional	5,256,460	8,329,930	8,940,588	10,270,735	9,085,193	8,345,646
Tertiary	3,809,946	4,779,555	5,013,961	4,771,891	4,554,436	3,993,991
Total	16,306,883	20,817,815	21,616,356	22,360,066	20,954,018	19,097,488
Outpatient and casualty visits per 1000 uninsured						
District	0.19	0.20	0.20	0.18	0.18	0.16
Regional	0.15	0.23	0.24	0.27	0.23	0.21
Tertiary	0.11	0.13	0.13	0.12	0.12	0.10
Total	0.45	0.57	0.57	0.58	0.53	0.48

Source: District Health Information System

There are approximately 13 million outpatient visits in specialist (i.e regional or tertiary) hospitals per year or 0.31-0.39 per 1000, giving 7.4 primary care visits per specialist hospital OPD visit. Another analysis by the Modernisation of Tertiary Services project (Table 6.10)[18] found a similar mean number of specialist OPD visits (0.32 per capita), with the 66th centile for specialist hospitals being 0.44 per capita and the 75th centile 0.55 visits per capita.

Table 6.10 Outpatient visits per 1000 in specialist hospitals

	33 percentile	Mean	Median	66 percentile	75 percentile	80 percentile
Regional	98.07	122.22	149.1	210.79	264.5	344.93
Tertiary	63.71	177.01	101.13	200.1	247.43	283.98
National referral	18.78	20.25	25.82	30.97	34.16	43.87
Total	180.56	319.48	276.05	441.86	546.09	672.78

*Source: Modernisation of Tertiary Services Reports

Table 6.11 shows that specialist (regional or tertiary) OPD rates differ substantially across provinces, from 0.11 in Limpopo to 0.56 in Gauteng (which itself has declined from 0.81). This suggests gross inequity in access to specialist opinions and treatment.

Table 6.11 Inequity in OPD rates in regional or tertiary hospitals by province

	00/01	01/02	02/03	2003/04	04/05
Eastern Cape	0.20	0.19	0.19	0.18	0.18
Free State	0.58	0.65	0.71	0.37	0.25
Gauteng	**0.81**	0.77	0.72	0.67	**0.56**
Kwazulu Natal	0.32	0.39	0.49	0.42	0.41
Limpopo	0.09	0.09	0.10	0.11	**0.11**
Mpumalanga	0.11	0.09	0.09	0.11	0.12
Northern Cape	0.22	0.20	0.20	0.19	0.22
North West	0.12	0.12	0.10	0.11	0.16
Western Cape	0.60	0.65	0.61	0.62	0.51
Total	0.36	0.37	0.39	0.35	0.31

Source: District Health Information System

Table 6.12 makes a comparison with private sector specialization in medical schemes. Approximately 0.337 of beneficiaries (337/1000) consult a specialist annually, with a total visit rate of 1.3 per capita! (4 times the public sector level).

Table 6.12 Private sector medical scheme covered specialist usage per 1000 beneficiaries

	1st visit	Total visit	Ratio total: first visit
Gynaecologist	48	200	4.2
Physician	36	192	5.3
Paediatrician	29	164	5.7
Aneasthetist	55	112	2.0
Surgeon	30	98	3.3
Orthopod	27	87	3.2
Opthalmologist	25	69	2.8
Orthodontist	6	59	9.8
Psychiatrist	9	56	6.2
Dermatology	19	50	2.6
Urologist	13	43	3.3
Radiotherapist	3.7	43	11.6
Cardiologist	11	43	3.9
Neurosurgeon	6.3	25	4.0
Neurologist	6.5	22	3.4
Maxillo-facial	6	16	2.7
Gastro-enterologist	3.5	13	3.7
Plastic surgeon	3	9	3.0
Total	337	1301	3.9

Source: Council for Medical Schemes[20]

Hospital inpatients

There are approximately 3.7-3.8 million hospital admissions per year or 95 per 1000 uninsured persons. These rates are considerably lower than in the South African private sector where hospital admission rates amounted to 268/1000 beneficiaries in 2003/04 and 209/1000 in 2004/05.[19]

There is a significant variability across provinces, which is not well understood with admission rates ranging from 69.4/1000 in North West to 145.7/1000 in Northern Cape. Table 6.13 shows that the ratio between admissions and outpatient (including casualty) visits is 19.6% or 1: 5.5. However in Northern Cape it is 57.6% associated with a relatively high admission rate. Trends in hospital admission rates by province are shown in Table 6.14 and for acute hospitals in Figure 6.2.

Table 6.13 Hospital admissions 2004/05

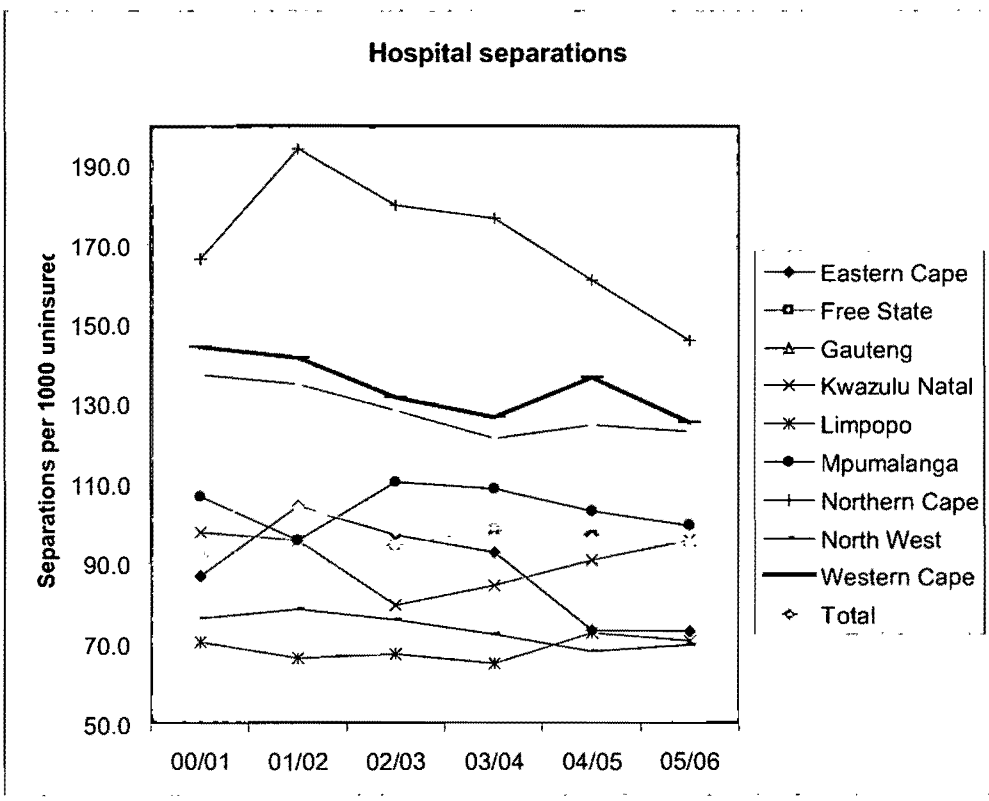
	Eastern Cape	Free State	Gauteng	Kwazulu Natal	Limpopo	Mpumalanga	Northern Cape	North West	Western Cape	Total
Separations	464,502	248,542	817,969	828,944	371,709	280,838	112,741	234,076	430,172	3,789,493
Separations per 1000 uninsured	73.0	99.5	123.0	95.5	70.4	99.3	145.7	69.4	125.0	94.9
Admissions as proportion of outpatients	22.7%	27.1%	17.6%	15.6%	19.2%	31.9%	57.6%	21.3%	18.5%	19.6%
Day patients as a proportion of admissions	1.7%	7.7%	10.8%	8.3%	5.5%	8.0%	5.2%	17.8%	10.4%	8.0%
Deaths as a proportion of admissions	7.5%	7.1%	5.7%	7.5%	5.0%	5.8%	6.8%	2.5%	3.2%	6.0%

Table 6.14: Trends in hospital admissions per 1000 uninsured persons

	00/01	01/02	02/03	03/04	04/05	05/06
Eastern Cape	86.9	104.2	97.0	92.7	73.2	73.0
Free State	91.6	95.8	94.3	98.2	97.2	99.5
Gauteng	137.2	134.8	128.1	121.2	124.5	123.0
Kwazulu Natal	97.7	95.6	79.4	84.3	90.7	95.5
Limpopo	70.3	66.2	67.3	64.9	72.6	70.4
Mpumalanga	106.7	95.8	110.2	108.5	102.9	99.3
Northern Cape	166.3	194.0	179.8	176.4	161.0	145.7
North West	76.0	78.5	76.0	72.2	67.8	69.4
Western Cape	144.1	141.3	131.4	126.6	136.3	125.0
Total	102.4	103.8	98.1	96.4	95.9	95.0

The hospital separations term as used in Figure 6.2 is an equivalent measure for hospital admissions in the District Health Information System and is calculated from patient discharges plus deaths plus transfers out of hospital less transfers into hospital.

Figure 6.2: Trends in acute admissions per 1000 uninsured by province



Do differences in hospital admission rates represent differences in need or availability? Later in this chapter the results of a multiple regression model are presented suggesting that admission rates between 2000/01 and 2005/06 were best predicted by supply side factors of personnel and doctor availability. Admission rates in the Northern Cape are likely to be higher because of the very low population density and large distances in that province. Some of the variability in admission rates is likely to be due to centralisation of tertiary specialist hospitals in selected hospitals funded by the National Tertiary Services grant. Table 6.15 shows that when reported tertiary admissions are subtracted from total admissions then inequity is significantly lessened. However no accurate data are available on cross-border flows and it is possible that high levels of tertiary admissions reflect local substitution of tertiary for regional care. Unpublished work by London in the Western Cape showed that a large proportion of inpatients in tertiary hospitals claimed to live locally, often within five kilometres of the hospital (personal communication L. London).

Table 6.15 Admission rates less reported tertiary admissions 2003/04

Per 1000 uninsured population	Admission rate total	Reported tertiary admissions	Admissions less tertiary admissions
Eastern Cape	92.7	3.2	89.6
Free State	98.2	13.2	85.0
Gauteng	121.2	37.2	84.0
Kwazulu Natal	84.3	10.0	74.3
Limpopo	64.9	1.8	63.1
Mpumalanga	108.5	1.2	107.2
Northern Cape	176.4	28.5	147.9
North West	72.2	1.1	71.1
Western Cape	126.6	31.2	95.4
Total	96.4	13.5	82.8

Table 6.16 examines the effect of HIV/AIDS on admissions using an AIDS admissions model developed by the author. Admissions due to HIV are steadily increasing, but total admission rates have been fairly stable over a decade.[21] This suggests that non-AIDS admissions are progressively being squeezed out, reducing from 103 per 1000 to around 70/1000.

Table 6.16 Hospital admissions and HIV/AIDS

	Non-HIV related admissions	HIV related admissions	Total admission rate
96/97	103.8	1.7	105.6
97/98	102.7	3.0	105.7
98/99	93.3	4.8	98.1
99/00	90.2	7.3	97.5
00/01	90.2	10.5	100.7
01/02	88.4	14.2	102.6
02/03	81.4	18.1	99.5
03/04	74.9	22.2	97.0
04/05	69.6	26.3	95.9
05/06	66.3	28.6	94.9

Regional hospitals manage close to 40% of admissions (Table 6.17), district hospitals 38% and tertiary hospitals around 16%.

Table 6.17 Admissions by hospital type

	99/00	**00/01**	**01/02**	**02/03**	**03/04**	**04/05**
District	41.2	42.6	41.2	37.7	36.8	35.5
Regional	30.0	37.8	41.2	38.6	38.7	36.9
Central	15.5	15.5	16.1	15.9	15.3	15.4
Subtotal	86.7	95.9	98.4	92.3	90.7	87.8
Other	5.8	4.8	4.2	7.3	6.3	5.7
Total	92.4	100.7	102.6	99.5	97.0	93.4
Percentage						
District	44.6%	42.3%	40.1%	37.9%	37.9%	38.0%
Regional	32.4%	37.6%	40.1%	38.8%	39.9%	39.5%
Central	16.8%	15.4%	15.7%	16.0%	15.8%	16.5%
Other	6.2%	4.7%	4.1%	7.3%	6.5%	6.1%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

The Modernisation of Tertiary Services study reported on admission rates by speciality. These are shown in Table 6.18 for regional and tertiary hospitals combined. This shows that the utilisation rates of the specialities of obstetrics and gynaecology, general or internal medicine, general surgery and paediatrics far exceed any other areas.

Table 6.18 Admission rates by speciality (regional and tertiary hospitals)

Admissions per 1000 uninsured	33 percentile	Mean	Median	66 percentile	75 percentile	80 percentille
Obstetrics & Gynaecology	11.34	14.96	17.06	21.14	26.98	27.74
General Medicine	10.22	13.27	15.62	23.26	26.9	29.36
General Surgery	8.29	12.35	13.37	18.7	22.41	24.69
Paediatric Medicine	4.83	7.42	6.26	9.59	11.75	13.13
Ophthalmology	0.31	1.24	0.74	1.57	2.01	2.05
Orthopaedics	0.9	1.26	1.22	1.56	2.14	2.39
Trauma	0.53	0.87	0.59	0.89	1.02	1.3
Nephrology	0.16	0.83	0.34	0.54	0.89	1.24
Critical Care & ICU	0.24	0.78	0.47	0.69	0.8	0.89
Paediatric Surgery	0.32	0.77	0.77	0.96	1.12	1.13
Cardiology	0.33	0.66	0.4	0.42	0.43	0.45
Medical & Radiation Oncology	0.28	0.59	0.36	0.62	0.77	0.84
Urology	0.34	0.56	0.35	0.49	0.58	0.68
Neonatology	0.18	0.49	0.24	0.61	0.75	0.85
Ear Nose & Throat	0.13	0.37	0.41	0.65	0.69	0.69
TB	0.32	0.36	0.43	1.16	1.31	1.4
Neurosurgery	0.14	0.33	0.14	0.18	0.2	0.28
Respiratory Medicine	0.19	0.31	0.27	0.44	0.63	0.74
Mental health and psychiatry	0.27	0.35	0.37	0.57	1.65	2.36
Cardiothoracic Surgery	0.12	0.26	0.14	0.15	0.16	0.25
Dermatology	0.02	0.25	0.04	0.07	0.12	0.16
Plastic & Reconstructive Surgery	0.16	0.25	0.29	0.4	0.46	0.57
Neurology		0.23				
Vascular Surgery	0.07	0.19	0.16	0.26	0.31	0.33
Haematology	0.13	0.19	0.17	0.45	0.61	0.69
Infectious Diseases	0.09	0.14	0.23	0.38	0.41	0.43
Endocrinology	0.06	0.14	0.07	0.07	0.07	0.08
Burns	0.03	0.1	0.14	0.24	0.25	0.26
Nuclear Medicine	0.05	0.1	0.06	0.17	0.24	0.27
Liver and pancreas surgery	0.09	0.09	0.09	0.09	0.09	0.09
Craniofacial Surgery	0.03	0.06	0.03	0.06	0.07	0.08
Clinical Immunology	0.01	0.05	0.01	0.02	0.02	0.03
Human Genetics	0.01	0.05	0.01	0.01	0.01	0.01
Rheumatology	0.06	0.05	0.08	0.1	0.11	0.11
Rehabilitation Centre	0.05	0.04	0.06	0.07	0.08	0.09
Gastroenterology	0.04	0.03	0.06	0.12	0.15	0.18
Renal Transplant		0.02		0.03	0.05	0.06
Total	40.34	60.01	61.05	86.73	106.24	115.9

EMERGENCY MEDICAL SERVICE

Use of emergency ambulance services average 67/1000 per year (Table 6.19).

Table 6.19 Persons transported by emergency ambulance service per 1000 uninsured

	Patients per 1000 2003/04	Patients per 1000 2004/05	% of PHC visits
Eastern Cape	61.9	61.1	2.5%
Free State	92.1	70.1	2.9%
Gauteng	64.2	65.2	3.3%
Kwazulu Natal	67.6	66.4	3.0%
Limpopo	13.2	14.0	0.5%
Mpumalanga	48.4	48.1	2.2%
Northern Cape	109.2	126.2	4.1%
North West	32.7	32.2	1.1%
Western Cape	102.4	120.8	3.0%
Total*	67	67	2.7%

*Excluding Limpopo

HEALTH CARE SPENDING AND ALLOCATIVE EFFICIENCY

The South African public health service operates 4712 health care facilities as shown in Table 6.20. It employs 230 087 personnel of which 12 200 are doctors and 104 650 are nurses.[22] Although legislation and broad policy is set by the national Department of Health, delivery of health services is largely by provinces and local government and is in the process of progressive decentralization into a district health system.

Table 6.20 Public health facilities in South Africa 2005

Clinic	3,152
Community health centre	281
Satellite clinic	231
Other	639
Subtotal	4,303
District hospital	263
Regional hospital	67
Tertiary or central hospital	15
Specialised hospital	64
Subtotal	409
Total	4,712

Source: District Health Information system 2005

SPENDING BY BUDGET PROGRAMME AND FUNCTIONAL AREA

Table 6.21 presents trends in expenditure by budget programme, expressed in real 2005/06 prices. A standardized budget structure is used by all nine provinces, which enables consolidation and comparison of expenditure data. In absolute terms by far the largest increase has been in District Health Services (R9.2 billion from 1996/97 to 2008/09 or 64% of the total increase). This includes primary health care services and the HIV/AIDS programme. The Provincial and Central Hospital Services programmes show a decline in the immediate post GEAR period till 1999/00.

Table 6.21: Trends in budget programme expenditure (Rand million real 2005/06 prices)

	96/97	97/98	99/00	01/02	03/04	05/06	07/08	08/09	12yr08	12yr08
Administration	2,614	1,505	1,349	1,525	1,690	1,706	1,828	1,862	-751	-2.8%
District Health Services	12,572	13,784	14,294	14,382	15,823	18,197	20,834	21,733	9,161	4.7%
Emergency Medical Services	988	988	988	996	1,392	1,739	2,217	2,312	1,324	7.3%
Provincial Hospital Services	10,730	11,259	9,401	9,259	10,739	11,703	12,056	12,189	1,459	1.1%
Central Hospital Services	8,742	8,958	6,179	7,279	6,897	7,923	7,715	7,828	-914	-0.9%
Health Sciences and Training	563	679	709	821	1,070	1,540	1,742	1,794	1,231	10.1%
Health Care Support Services	1,102	870	494	527	711	1,011	861	867	-235	-2.0%
Health Facilities Management	1,158	1,205	1,299	2,125	2,251	3,330	4,218	4,507	3,349	12.0%
Total	38,655	39,243	34,824	36,887	40,621	47,102	51,422	53,044	14,389	2.7%

Figure 6.3: Budget programme trends (Rand million real 05/06 prices)

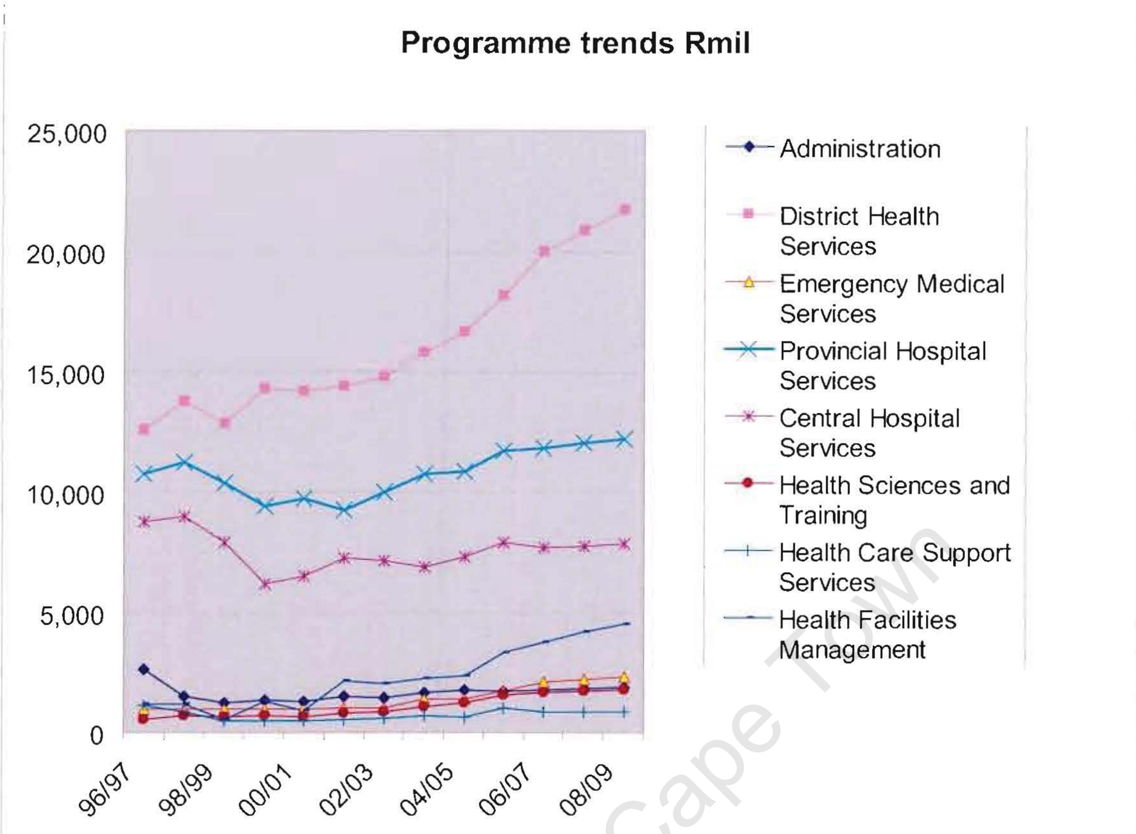


Table 6.22 and Figure 6.4 present the same data from 1999/00 onwards, but grouped by functional area (based on budget subprogrammes). The 1999/00 year was a low point in the longer term cycle. Figure 6.5 shows expenditure on a per capita basis and figure 6.6 on a percentage basis.

Over the period from 1999/00 (from which data according to the new classification is available) there has been a notable increase in several areas, especially HIV/AIDS, health facility management, primary health care and emergency medical services.

Primary care services received the largest absolute increase of R4.8 billion or 7.5% annually per year from 1999/00 to 2008/09. Its share of the total increases to 19.1% by the end of the period. This excludes primary care visits treated in hospital outpatient departments, by local government, facilities management, HIV, nutrition and forensic pathology (coroner) services. More detail is found in a subsequent section. Dedicated HIV/AIDS programmes have come on stream during this period with expenditure growing from R90m in 1999/00 to R2.7 billion by the end of the period. Facility management has grown very strongly to R4.5 billion by 2007/08, increasing by 14.8% annually over the period.

In contrast expenditure on recurrent hospital services has been fairly flat. Recurrent hospital expenditure although the largest single category of expenditure, declines from 70.4% to 53.5% of total expenditure through the period. After declining from 1996/97 to 1999/00 hospital expenditure increases from 1999/00 by 2% annually to 2008/09. Greater detail on hospitals is shown in a subsequent section.

Table 6.22 Trends in expenditure by functional area (05/06 prices)*

Functional area	99/00	01/02	03/04	05/06	07/08	08/09	Change 99/00 to 08/09	Change annual
Hospitals	23,796	24,857	25,052	27,555	27,866	28,357	4,561	2.0%
PHC	5,315	5,728	7,023	8,330	9,527	10,156	4,840	7.5%
Health facilities	1,299	2,125	2,251	3,330	4,218	4,507	3,208	14.8%
HIV/AIDS	90	100	725	1,703	2,600	2,679	2,589	45.8%
Emergency Medical (ambulance) services	988	996	1,392	1,739	2,217	2,312	1,324	9.9%
Administration	1,349	1,525	1,690	1,706	1,828	1,862	514	3.7%
Health sciences and training	709	821	1,070	1,540	1,742	1,794	1,086	10.9%
Health care support services	494	527	711	1,011	861	867	373	6.5%
Coroner services	0	0	1	63	450	397	397	0.0%
Nutrition	77	235	710	171	162	163	86	8.7%
Total	34,314	36,887	40,674	47,101	51,420	53,042	18,728	5.0%

* Functional areas were derived from grouping expenditure of relevant budget sub-programmes

Figure 6.4 Trends in expenditure by functional area (05/06 prices)

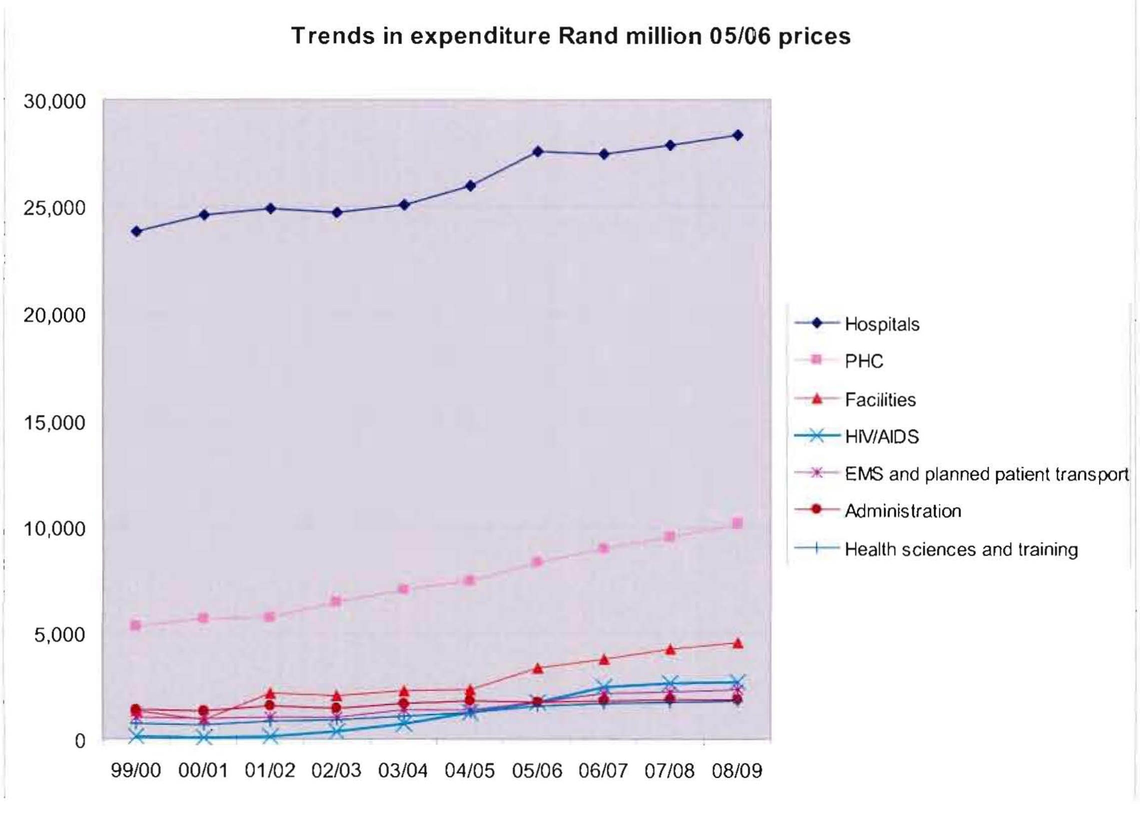


Figure 6.5 Per capita trends in functional expenditure

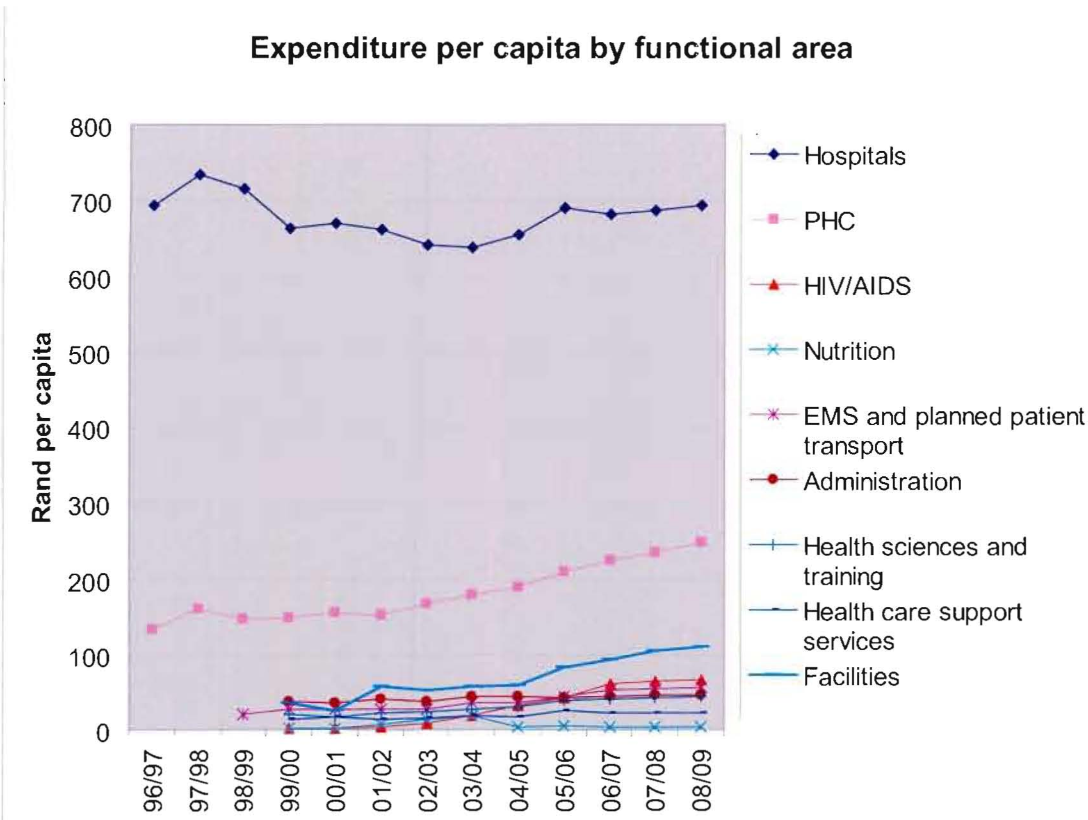
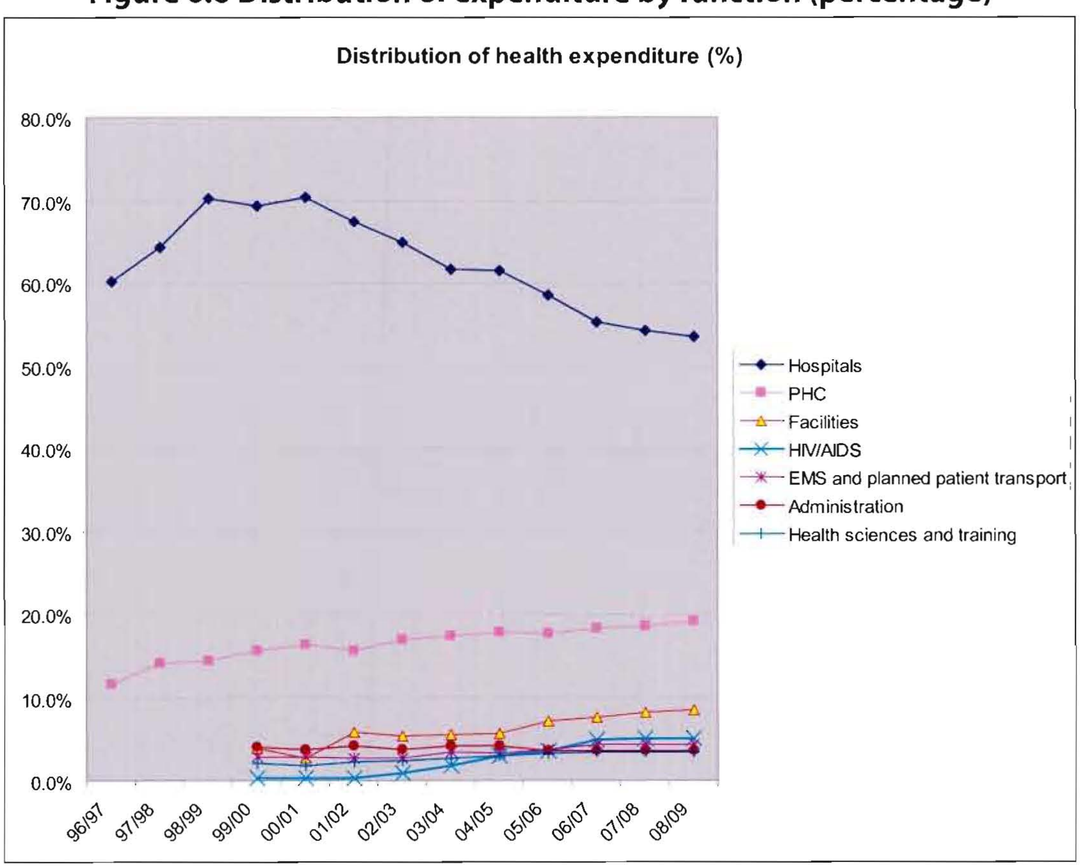


Figure 6.6 Distribution of expenditure by function (percentage)



The increases shown in health sciences and training and health support services should be treated with caution as they are likely to reflect data problems associated with difficulties in the introduction of the new budget classification structure and in some provinces reclassification of conditional grant expenditure.

PRIMARY HEALTH CARE EXPENDITURE

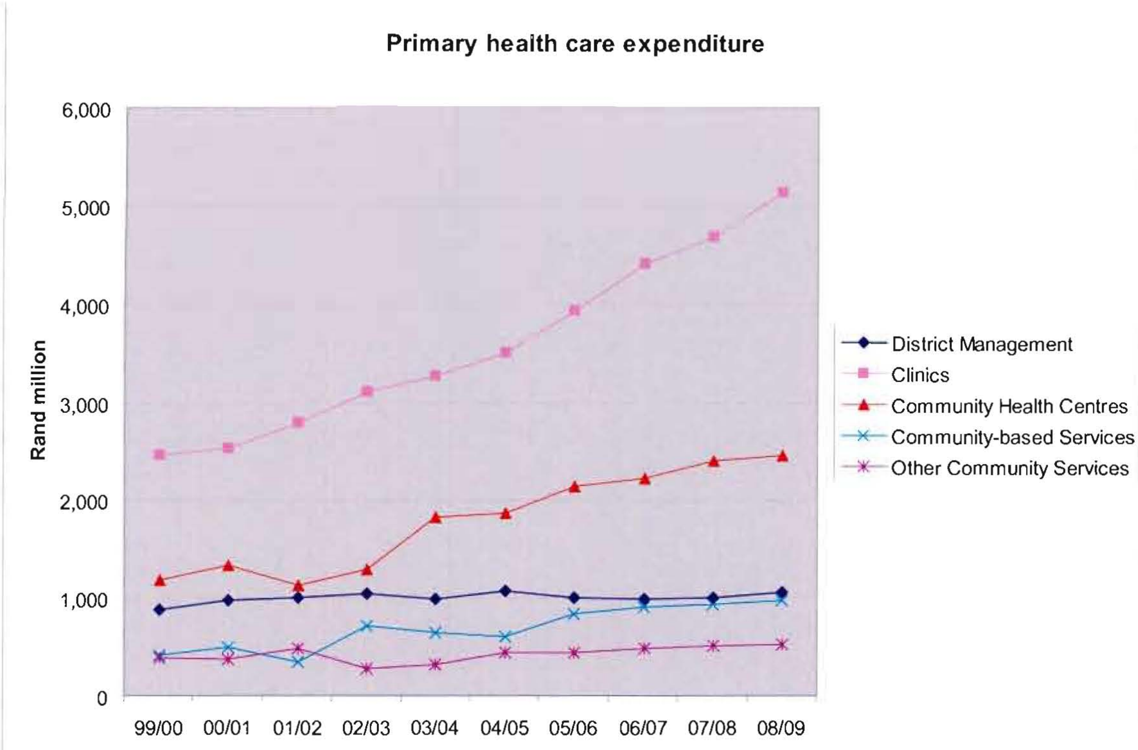
Table 6.23 shows spending on five key provincial subprogrammes, which form the core of primary care services. This shows significant increases in PHC expenditure over the period, amounting to 6.3% annually. The increase in spending on clinics and community health centres is very apparent as shown in Figure 6.7. These increases provide evidence of commitment to the primary health care policy of the Department and of improving allocative efficiency.[23] Expenditure per capita rises to R256 per capita uninsured per annum by 2008/09.

Table 6.23 Trends in provincial out-of-hospital primary health care expenditure (R million real 05/06 prices)

	99/00	01/02	03/04	05/06	07/08	08/09	Change 99/00 to 08/09	Change annual
District Management	884	1,008	983	997	1,000	1,061	177	2.1%
Clinics	2,455	2,781	3,264	3,920	4,689	5,136	2,681	8.5%
Community Health Centres	1,180	1,121	1,823	2,141	2,397	2,460	1,280	8.5%
Community-based Services	409	341	642	836	940	971	562	10.1%
Other Community Services	387	478	311	436	502	528	141	3.5%
Total	5,315	5,728	7,023	8,330	9,527	10,156	4,840	7.5%
Per capita uninsured	148	156	187	216	243	256	108	6.3%

Figures from 99/00 to 05/06 are past expenditure where-as 07/08 to 08/09 are forward budget projections in the Medium Term Expenditure Framework

Figure 6.7 Trends in primary health care expenditure (05/06 prices)



While these five subprogrammes constitute the core of provincial spending on PHC, there are a number of other areas, less easy to quantify precisely, which add further to the level of PHC expenditure. These are shown in Table 6.23 and include local government spending on primary care, an estimate of spending by district hospitals on primary care and spending on the dedicated HIV/AIDS programme. Although included in the District Health programme a proportion of the latter is in fact spent in hospitals. When this expanded definition is used, spending on PHC as a proportion of total health care expenditure (including the HIV dedicated programme) rises from 21.6% to 26.7% over the period.

Table 6.24 Expanded estimate of Primary health care (PHC) expenditure (real 2005/06 prices)

	99/00	2001/02	2003/04	2005/06	07/08	08/09	Change 99/00 to 08/09	Change annual %
Subtotal from table above	5,315	5,728	7,023	8,330	9,527	10,156	4,840	7.5%
Nutrition	77	235	710	171	162	163	86	8.7%
Local government	1,326	1,246	1,118	1,097	1,071	1,059	-267	-2.5%
Primary care in district hospitals	1,170	1,133	1,062	952	952	952	-217	-2.3%
Health facilities management	44	183	332	628	719	840	796	38.8%
Subtotal	7,932	8,525	10,246	11,179	12,433	13,169	5,237	5.8%
Per capita Rand)	221	227	261	280	306	322	100	4.2%
HIV/AIDS	90	100	725	1,703	2,600	2,679	2,589	45.8%
Total	8,022	8,626	10,971	12,882	15,032	15,848	7,826	7.9%
Per capita (Rand)	224	230	280	323	370	387	163	6.3%

Table 6.25 shows the distribution of PHC facilities by province, with an average of 1:8948 including satellite and mobile clinics or 1: 11 967 excluding these. As expected Gauteng has the lowest and Northern Cape the highest number of service points per capita, because of their extremes of population density. A national guideline of one facility per 10 000 has sometimes been used (e.g. Department of Health, Format for strategic planning, Unpublished document, 2004). Geographic access to primary care facilities is fairly good, with 77% of households within 5km of a clinic, 93% within 10 km and 95.6% within 15km (Department of Health, Integrated Health planning Framework 2005). Approximately 876 new clinics have been opened since 1994.

Table 6.25 Primary health care facilities, 2005

	Clinic	Community Health Centre	Satellite clinic	Mobiles	Total	Population per service point
Eastern Cape	687	31	33	120	871	7,361
Free State	238	24	5	99	366	6,889
Gauteng	278	24	49	37	388	17,043
KwaZulu-Natal	506	14	15	144	679	12,839
Limpopo	443	27	0	117	587	8,927
Mpumalanga	212	28	6	88	334	8,530
Northern Cape	87	17	59	71	234	3,313
North West	332	57	8	93	490	6,899
Western Cape	274	58	52	130	514	6,663
Grand Total	3,057	280	227	899	4,463	8,948

Source: District health information system and Health Systems Trust, National Primary Health Care Facilities Survey 2000 and 2003

The basic infrastructure of PHC facilities, such as water supply, sanitation and electrification of clinics, has improved since the 2000 national PHC Facilities Survey[24], but examination rooms are often not adequate (31 per cent). Inequities and shortages in skills were noted with overall national availability of personnel working in PHC services per 100 000 population being 26.5 for professional nurses, 3.5 for doctors, 2.5 for pharmacists, 0.8 for radiographers, 0.3 for physiotherapists, 0.5 for occupational therapists, 1 for dentists and 1 for social workers.[23]

Table 6.26a and Table 6.26b present a number of primary care performance indicators, with immunisation coverage 83.7% in 2004/05 and high levels of antenatal clinic usage. A national primary care survey suggests the supply of medicine and medical equipment has improved. However tuberculosis (TB) cure rates are poor at 54 per cent[25], with a further 12 per cent completing treatment without a cure being demonstrated. While it is encouraging that the number of people with sexually transmitted diseases (STDs) treated is declining (from an estimated 1,9 million in 2001 to 1,7 million in 2003), the number is extremely high, considering that many cases are managed in the private sector or are asymptomatic.

Table 6.26a Selected primary care performance indicators by province

	Immunisation coverage rate 03/04	Antenatal coverage rate 03/04	Antenatal visits per covered mother	Tuber-culosis cure rate 2001	Presence of indicator antibiotic	Water supply on site in clinics	Adequate consulting room
Eastern Cape	88%	97%	4	47%	88%	96%	39%
Free State	81%	86%	5	64%	97%	100%	80%
Gauteng	73%	105%	3	58%	93%	100%	83%
KwaZulu-Natal	85%	113%	4	37%	99%	96%	46%
Limpopo	84%	99%	4	53%	95%	98%	50%
Mpumalanga	75%	102%	4	50%	96%	100%	24%
Northern Cape	94%	104%	4	47%	95%	97%	79%
North West	72%	87%	4	59%	94%	100%	44%
Western Cape	87%	77%	5	66%	99%	100%	96%
Weighted average	81%	99%	4	54%	94%	98%	59%

Source: District health information system and national primary health care survey[23]

Table 6.26b Trends in primary care performance

	98/99	99/00	00/01	01/02	02/03	03/04	04/05
Antenatal coverage	94.2			92.6	97.1	99	95.5
Antenatal visits per client				4	3.9	3.9	4.1
Delivery coverage at institutions				74.3	72.8	70.3	74.2
Male condom distribution rate			4.3	6.4	7.1	7.4	7.5
Condom use at last sex	17%				52%	52%	
Percentage PHC facilities where condoms are freely available	79%		86.90%			97%	
Women year contraception protection %				24%	24%	23%	24.7%
Immunisation coverage of children <1 year	61.2%		63.7%	79.5%	80.9%	81.0%	83.7%
PHC facilities offering testing for HIV % (VCT)	56%		56.20%		67%	70%	
TB cure rate	63%	63.8%	63.0%	53.7%	54.1%	57%	50.80%

Source: District health information system, Health Systems Trust[15,26,27]

Hospital expenditure

South Africa has 409 hospitals, of which 263 are district, 67 regional and 15 tertiary. This is shown in Table 6.27.[27]

Table 6.27 Hospitals by province

	District Hospital	Regional Hospital	National Central Hospital	Provincial Tertiary Hospital	Specialised Hospital	Total
Eastern Cape	63	10	0	0	14	87
Free State	25	6	1	1	3	36
Gauteng	8	12	4	0	6	30
KwaZulu-Natal	36	14	1	2	10	63
Limpopo	39	6	0	2	3	50
Mpumalanga	19	4	0	1	1	25
Northern Cape	23	2	0	0	3	28
North West	22	4	0	0	3	29
Western Cape	28	9	3	0	21	61
Grand Total	263	67	9	6	64	409

Real growth in hospital services expenditure has been slow. Table 6.28 shows trends in hospital services spending. Expenditure grew slower than the growth in hospital admissions or in the uninsured population. A relatively small proportion of the additional funding which has gone into the sector since 2000/01 has gone into recurrent hospital expenditure. The overall slow growth contains fairly rapid growth in some types of hospital spending (TB hospitals and sub-acute, step-down and chronic medical hospitals), with almost no growth in others (central and district hospitals). Figure 6.8 shows the same data graphically. Hospital expenditure has remained fairly stable despite rising input costs, population growth and HIV/AIDS.

Table 6.28 Trends in hospital expenditure (Rand million real 05/06 prices)*

	99/00	01/02	03/04	05/06	07/08	08/09	Change 99/00 to 08/09	Change annual (%)
District	8,218	8,319	7,416	7,930	8,094	8,339	121	0.2%
General (regional)	7,451	7,986	8,545	9,082	9,139	9,240	1,789	2.4%
TB	234	258	434	513	602	610	376	11.2%
Psychiatric	1,335	1,460	1,421	1,679	1,876	1,897	562	4.0%
Chronic/subacute	67	68	116	190	174	177	109	11.3%
Dental	187	195	183	202	205	206	19	1.1%
Other specialised	125	40	39	36	61	60	-65	-7.8%
Central	5,325	5,474	5,554	6,098	5,843	5,913	588	1.2%
Provincial tertiary	854	1,057	1,343	1,825	1,872	1,915	1,061	9.4%
Total	23,796	24,857	25,052	27,555	27,866	28,357	4,561	2.0%

*Adjusted for hospital reclassification in Gauteng

Figure 6.8 Trends in hospital expenditure (R million real 05/06 prices)

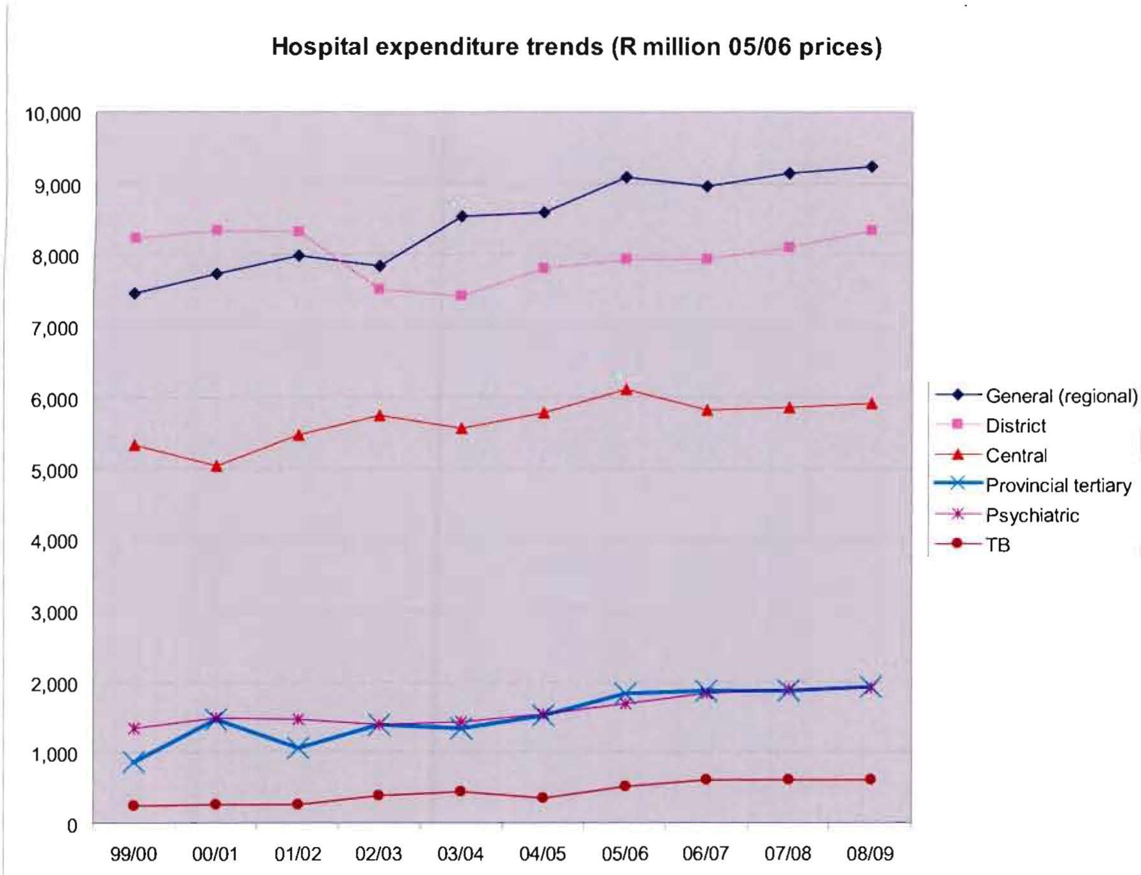
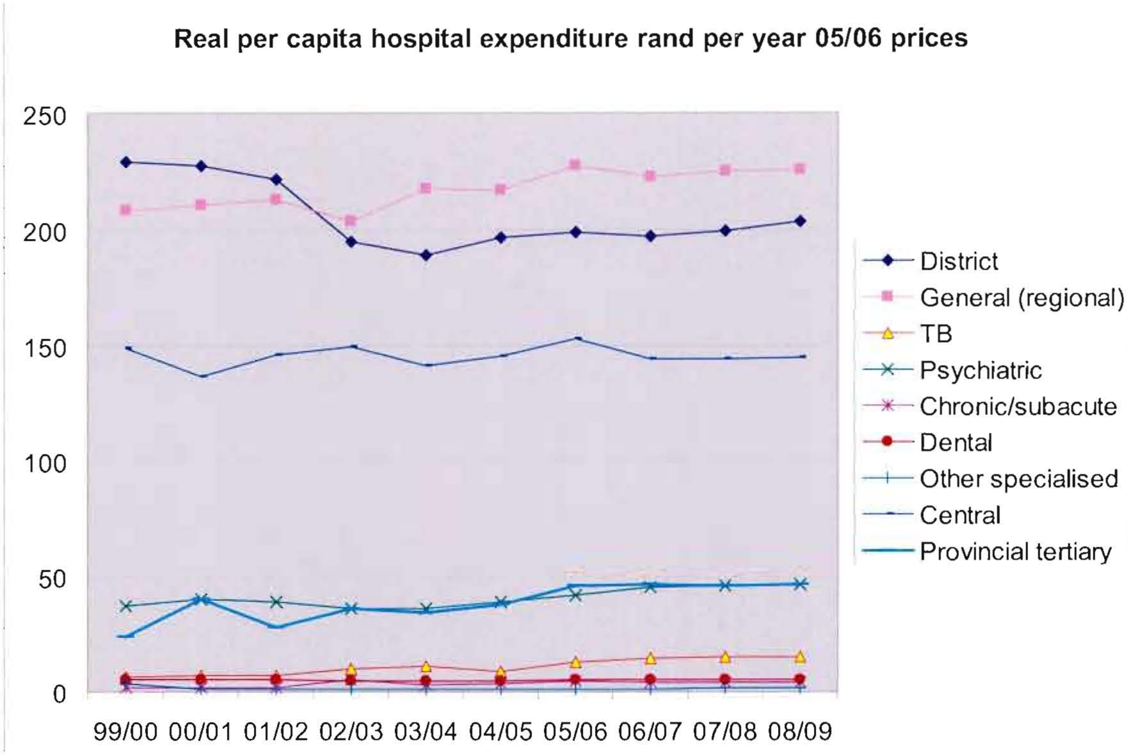


Figure 6.9 shows per capita funding trends. In this analysis there is a decline in most hospital types, but particularly for district.and central hospitals. Note also that the starting year shown namely 1999/00 was itself a low point after three years of downsizing.

Figure 6.9 Per capita trends in hospital expenditure



Expenditure on health facilities management was shown in Table 6.21. The increasing pattern of capital expenditure follows analysis by the Department of Health demonstrating a serious situation pertaining with health sector infrastructure with large backlogs (personal communication: Mr. R Bennett). The Hospital Revitalisation programme has been initiated to upgrade or replace particular hospitals.[28]

In 1996 a national Health Facilities Audit was carried out on 434 hospitals. At that stage the replacement value of the hospital estate was approximately R36.4 billion (2005/06 prices).[29] The audit showed that a third of facilities by value needed complete replacement or major repair. Models by the Department of Health suggested this has risen to 40% and that backlogs and transformation of hospitals would require R16.1 billion over 8-10 years. Total costs including clinics, medical equipment, ambulance replacement and hospital upgrading, rehabilitation and replacement approximate R53.6 billion. The estate of R36.4 billion is deteriorating annually at approximately 4.5%, equivalent to R1.6 billion per year. However annual maintenance expenditure, at only 1%-1.5% of capital value annually is far below need (3-4.5%). Despite existing maintenance and the Hospital Revitalisation Program, hospital infrastructure is deteriorating at around 3% or R109 million per year. The cost of upgrading and rehabilitation far exceeds the available funds. If backlogs were to be eliminated over 10 years this would require R4 billion spending per year, 8 times the current grant (R500 mil per year). The existing huge backlogs largely arise from inadequate prioritisation of this area over decades. Replacing hospitals or building new ones has become extremely expensive (e.g. >R100-150 million for a 250 bed hospital). Provinces are increasingly unable to afford to replace old hospitals and are likely to become increasingly dependent on national government to fund such projects. The country's hospital stock is becoming increasingly aged.

Low rates of equipment replacement along with poor maintenance have translated into large backlogs. Medical equipment deteriorates at a much faster rate than physical facilities (approximately 10% per year) and thus requires regular replacement. Medical equipment has large maintenance requirements (approximately 10% per year). Models and data of the national Department of Health suggest serious problems with deterioration of medical equipment. Medical equipment has a short life-span (averaging approximately 10 years) requiring substantial replacement costs. Models of replacement and maintenance suggest an annual requirement of R1.02 billion for each. This is far below existing expenditure levels and unless addressed, the state of medical equipment will continue to deteriorate.

HIV/AIDS

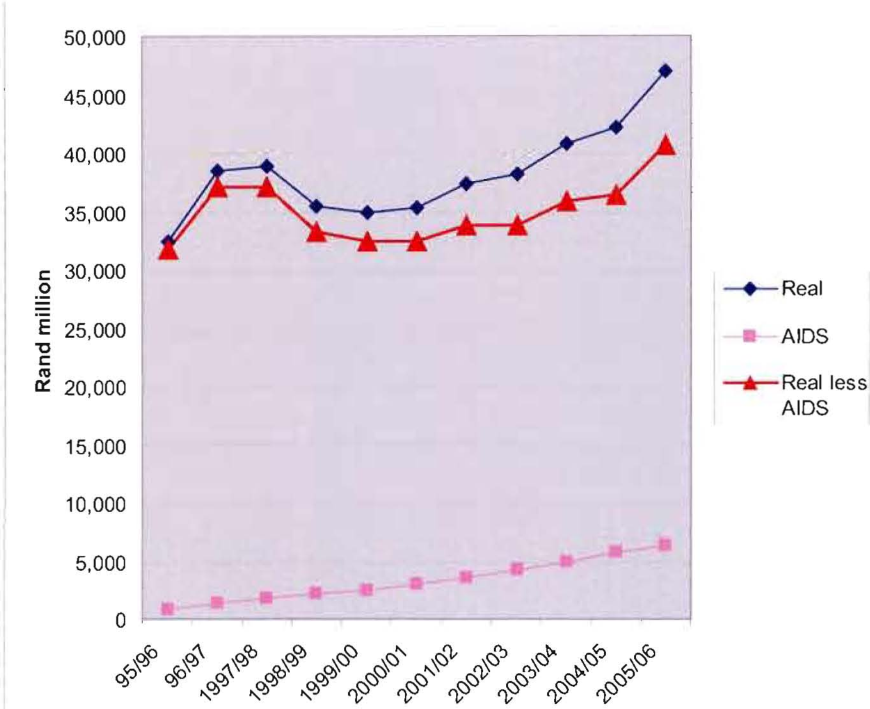
By 2005/06 R4.3 billion had been specifically added to health budgets from the national government to address the HIV epidemic. This is shown in Table 6.29. However this will not fully cover the costs of care. An estimate by the author of expenditure devoted to HIV/AIDS related activities is shown in Figure 6.10. The HIV/AIDS epidemic is estimated to be costing around R5.4-7 billion per year and the sector has been incompletely compensated for this.[30] Figure 6.10 suggests that when the cost of AIDS is subtracted from overall provincial expenditure trends, that the overall budgetary increase since 1997/98 is small. By July 2007 178 000 persons had commenced antiretroviral treatment by the public sector as compared to an estimated 500 000 – 600 000 persons with AIDS.[7]

Table 6.29 National funding allocated for HIV/AIDS related expenditure in the health sector (Rand million real 05/06 prices)

Rand million	99/00	2001/02	2003/04	05/06	07/08
National Department of Health (core)	108	266	469	396	419
HIV/AIDS conditional grant		68	362	1,135	1,511
Allocation to provinces 2002 budget			651	954	975
Allocation to provinces 2003 budget			542	1,500	1,533
Education grant		80	131	136	139
Social services grant		16	72	138	131
Total	108	430	2,227	4,260	4,709

Source: National Treasury 2004

Figure 6.10 Trends in provincial and modelled AIDS expenditure



Source: AIDS expenditure modeled by the author based on utilisation data from Abt (personal communication)

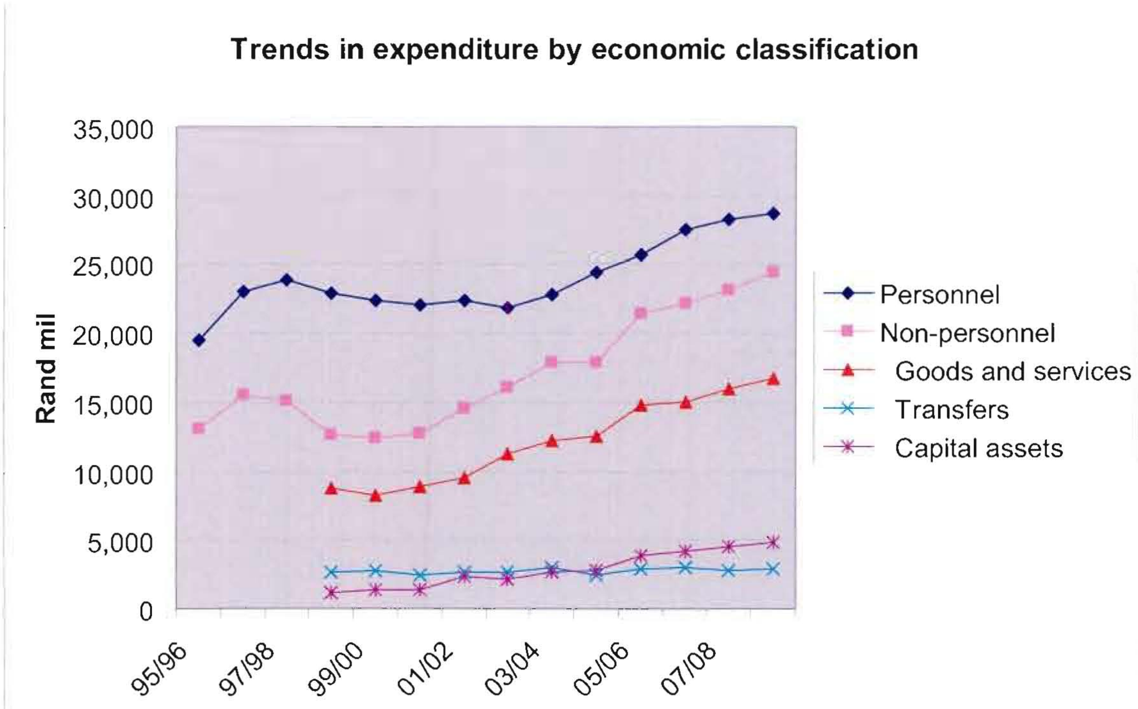
Expenditure by economic classification

Table 6.30 and Figure 6.11 show trends in expenditure by economic classification. To gain an understanding of the paradoxical situation of escalating personnel expenditure but declining personnel numbers these should be viewed alongside Table 4.8. Expenditure on personnel increased by 18.6% in real terms in 1996/97 following a centrally negotiated wage agreement which allowed amongst others for wage progression across salary levels, known as rank promotions. However the financial implications of the agreement were not fully funded in the context of the GEAR macro-economic policy of fiscal constraint and in the five year period from 1996/97 the sector downsized from 235 182 employees to a low of 213 538 in 2001/02. From 1997/98 to 2005/06 personnel expenditure increased by only R1.8 billion in real terms (0.9% annually) of which approximately half comprised a further improvement of the remuneration package known as the rural and scarce skills allowances. The overall effect of these changes over a decade have been an increase in personnel unit costs by 39.4% and employee numbers in the sector have not yet recovered to levels of the mid 1990s.

Table 6.30: Expenditure by economic classification (Rand million 2005/06 prices)

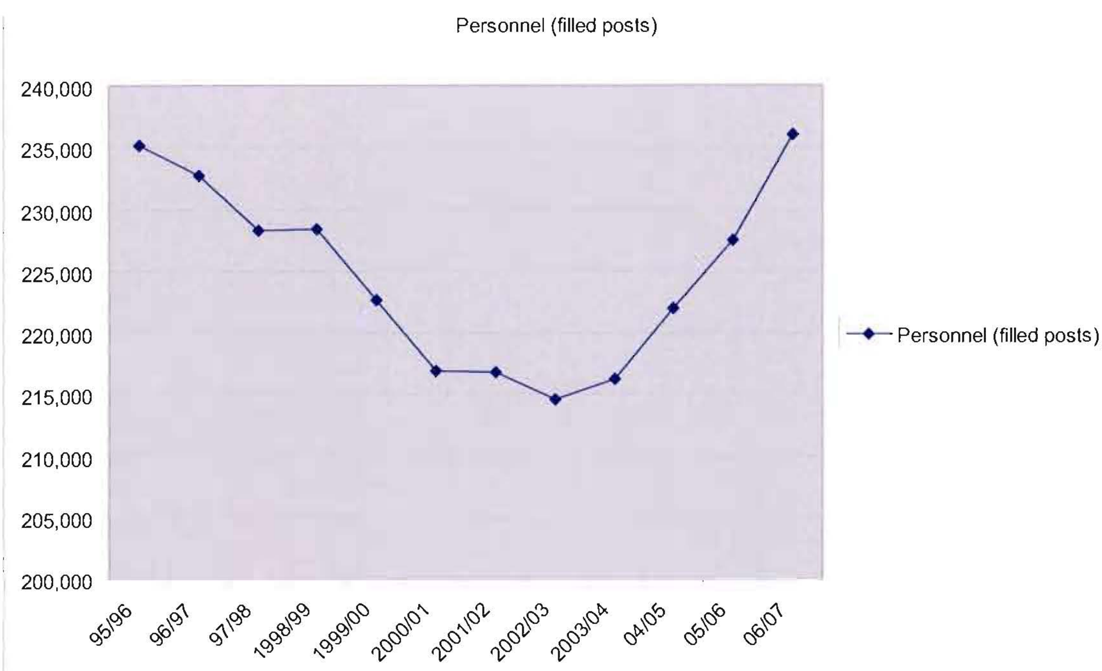
	95/96	97/98	99/00	01/02	03/04	05/06	07/08	08/09	9yr08	9yr08
Current			30,588	31,851	35,037	40,406	44,167	45,410	14,823	4.5%
Compensation of employees	19,434	23,872	22,348	22,326	22,761	25,668	28,250	28,691	6,344	2.8%
Goods and services			8,240	9,521	12,220	14,726	15,917	16,719	8,479	8.2%
Transfers and subsidies			2,811	2,685	2,953	2,845	2,809	2,862	51	0.2%
Municipalities				948	927	1,145	993	1,006	1,006	
Payments for capital assets			1,419	2,350	2,632	3,851	4,446	4,772	3,353	14.4%
Buildings				1,546	1,551	2,119	2,612	2,820	2,820	
Equipment				801	1,080	1,718	1,820	1,929	1,929	
Sub-total non-personnel	13,098	15,100	12,452	14,561	17,861	21,435	23,172	24,353	11,901	7.7%
Total	32,533	38,973	34,800	36,887	40,621	47,102	51,422	53,044	18,244	4.8%

Figure 6.11 Trends in expenditure by economic classification (2005/06 prices)



Trends in filled posts in provincial Departments of Health are shown in Figure 6.12. While overall and even per capita health care spending has recovered and risen to levels above the pre-GEAR period and despite a recovery of 19 818 new personnel over the past three years, the number of health personnel has only recently returned to the level of the mid 1990s, with the most severe losses having been in Western Cape and Gauteng provinces.

Figure 6.12 Trends in filled posts



In contrast to personnel expenditure, non-personnel expenditure has grown by an average of 7.7% over the thirteen year period from 1995/96 to 2008/09, despite being squeezed out in the late 1990s. Goods and services, which includes medicines and laboratory services has increased strongly by R8.4 billion from 1999/00 to 2008/9 or by 8.2% annually in real terms. Expenditure on capital assets has grown particularly strongly from 99/00 averaging 14.4% per annum, with growth on buildings and equipment.

TECHNICAL EFFICIENCY AND UNIT COSTS

While expenditure on primary health care has grown strongly (7.4% annually from 2000/01 to 2005/06) this has in the main been matched by a significant increase in primary care visits (4.4% annually). Real cost per visit has increased by 2.8% per annum to R68.60 (excluding facilities management). The unit cost figures for 2003/04 are similar to the average found (R63 per visit) by a recent review of 37 facility and district costing studies.[30] Given the general picture in the economic classification of constrained personnel expenditure and improving non-personnel, infrastructure and medicine supplies, it is likely that productivity of personnel is improving and that shortages of complementary inputs are being progressively addressed.

However less than 3% of nurse-based visits are referred to doctors (District Health Information System 2005) and most nurses do not have specialist primary health care nurse training[32] so quality is likely to be sub-optimal.

Table 6.31 Expenditure per primary care visit (real 05/06 prices)

	00/01	01/02	02/03	03/04	04/05	05/06	Change annual %
Visits	81,907,093	87,571,063	92,438,180	96,330,998	100,874,486	101,758,377	4.4%
Visits per capita	2.2	2.3	2.4	2.5	2.5	2.6	2.7%
Expenditure R million	4,888	4,942	5,432	6,127	6,409	6,982	7.4%
Expenditure per visit R	59.7	56.4	58.8	63.6	63.5	68.6	2.8%
Expenditure per capita	133	132	141	156	162	175	5.6%

* Expenditure used includes clinics, community health centres and local government, but excludes community based services, other community services and district management. If these are included expenditure per visit was R87.9 in 2004/05

Table 6.31b. Expenditure per primary care visit by province

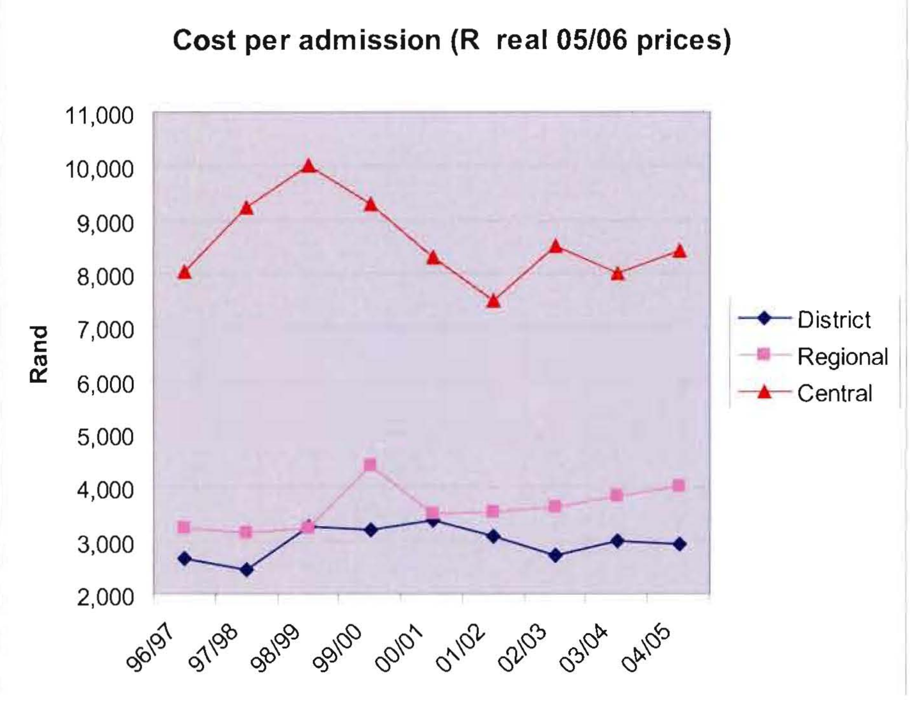
	03/04	04/05	05/06
Eastern Cape	71.8	65.3	67.9
Free State	35.6	38.9	43.1
Gauteng	81.6	82.1	96.6
KwaZulu-Natal	69.3	70.2	70.4
Limpopo	44.7	44.7	47.4
Mpumalanga	55.2	57.3	57.0
Northern Cape	44.9	47.2	53.5
North West	60.7	65.3	70.8
Western Cape	72.2	70.7	78.0
Total	63.6	63.5	68.5

While hospital funding has been extremely constrained over the past decade, hospital outputs have been similarly restricted. Unit costs have been fairly stable as shown in Table 6.32 and Figure 6.13.

Table 6.32 Cost per hospital admission (rand real 05/06 prices)

	96/97	97/98	99/00	01/02	03/04	04/05	Change % annual
District	2,669	2,446	3,207	3,092	2,987	2,921	1.1%
Regional	3,215	3,147	4,403	3,535	3,840	3,997	2.8%
Central	8,029	9,226	9,305	7,476	7,999	8,411	0.6%

Figure 6.13 Cost per hospital admission



With respect to outpatient workload, hospitals managed 20.5 million outpatients and casualty visits in 2004/05 (0,52 per uninsured person). A district outpatient visit costs R239 in 2005/06 prices, a regional visit R303 and a tertiary visit R516. Hospital outpatient departments are often unduly occupied with primary care activities. In Gauteng, outpatient visits comprise a high 22.5% of primary care visits, double the national average, while in the country as a whole general outpatient visits exceed specialist visits (source: District Health Information System 2005). Further analyses of variation in inpatient and ambulatory unit costs across provinces are presented in the Intergovernmental Fiscal Review 2004, 2005 and 2006.[33,34,35]

Table 6.33 Cost per Outpatient visit (Rand real 05/06 prices)

	96/97	97/98	99/00	01/02	03/04	04/05	Change % annual
District	164	151	198	220	230	239	4.8%
Regional	220	216	263	268	289	303	4.1%
Tertiary	396	455	441	443	466	516	3.4%

Figure 6.14 Cost per OPD visit

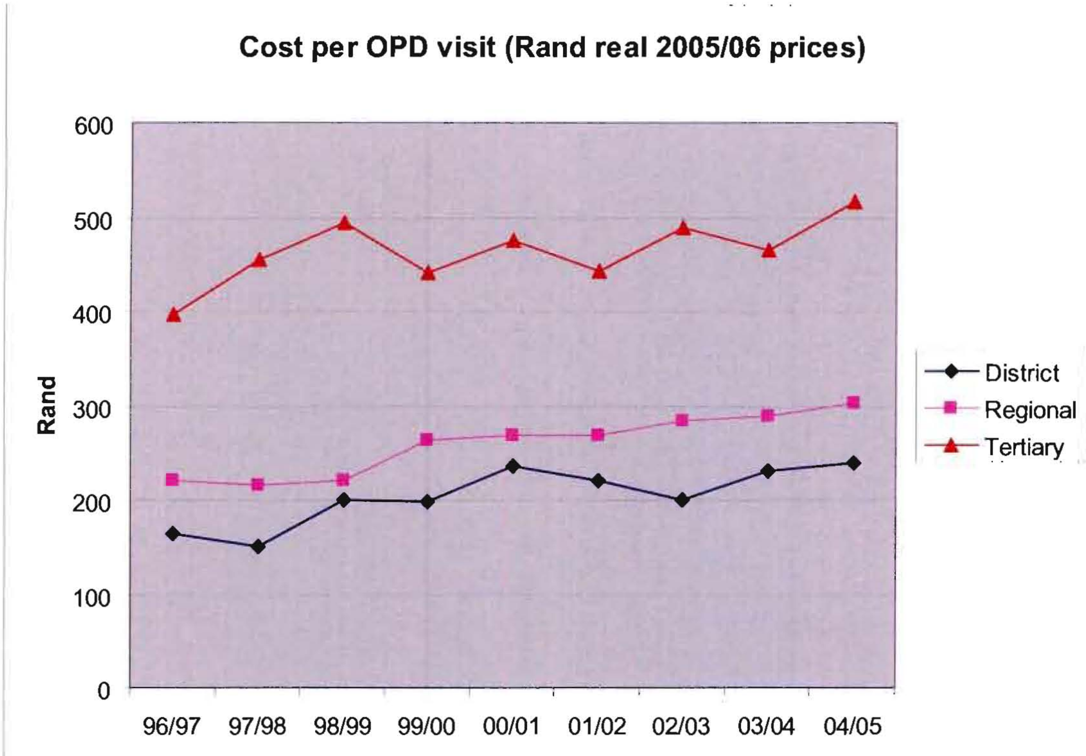
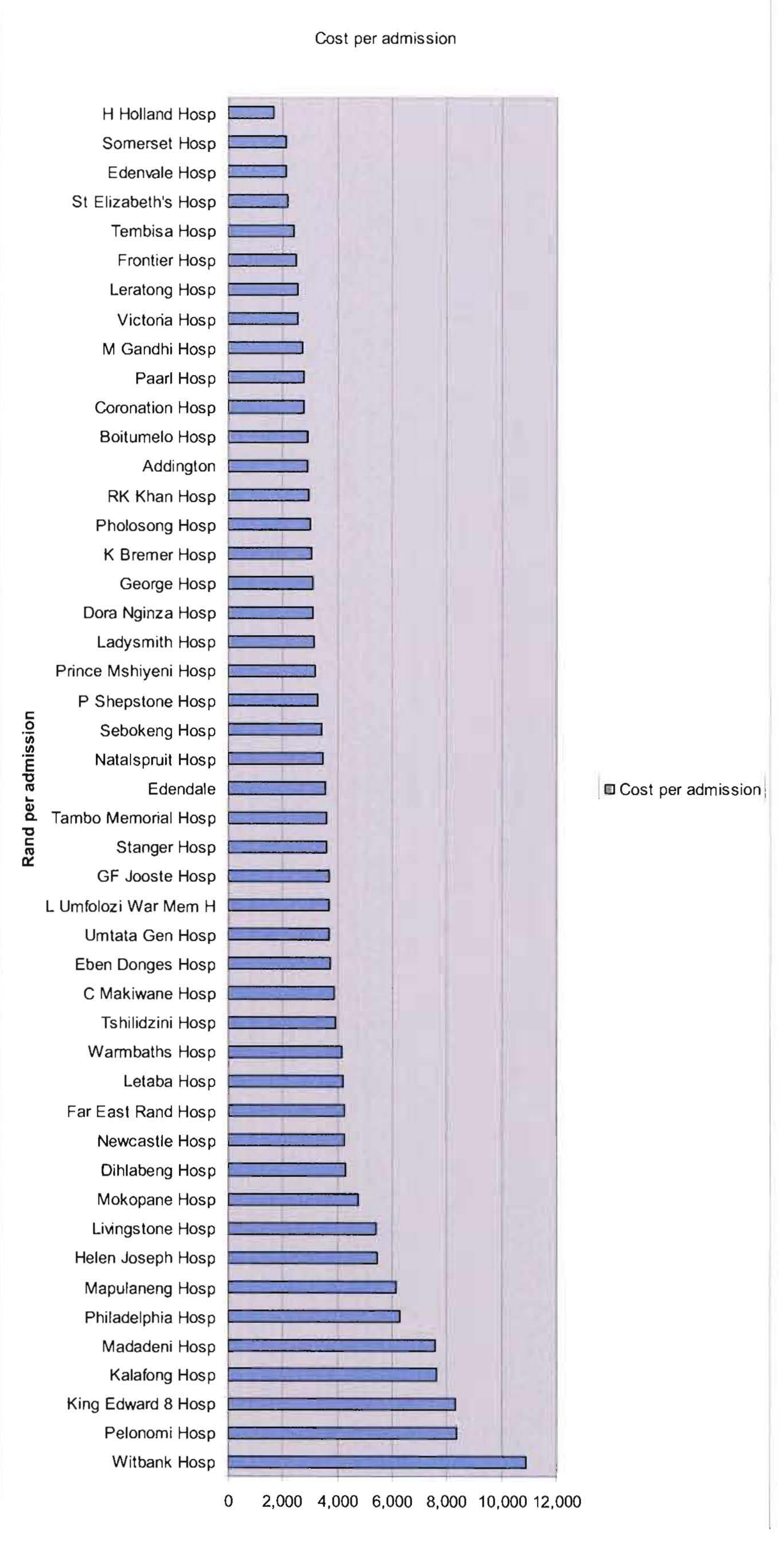


Figure 6.15 compares costs per admissions across regional hospitals. This shows a wide degree of variability that may represent relative under-resourcing of certain hospitals and inefficiencies in others.

Figure 6.15 Cost per admission across regional hospitals



Despite great constraints in additional financial resources to hospitals and a hugely increased HIV-related workload[12] there is still evidence of inefficiencies, mainly at the district hospital level, with fairly large numbers of district hospitals having low bed occupancy rates. In addition, through most of the hospital system, beds in use are substantially fewer than planned beds, leading to inefficiencies in the use of physical capital.[20] Despite limited resources and strong evidence of crowding out of non-HIV admissions, there is still evidence of inappropriate hospital use with a level of care study in public hospitals suggesting that 44.9% of inpatients could be managed at a sub-acute level, 8.7% in a rehabilitation unit, 4.9% in a hospice, 4.3% at outpatients or home based care and a further 4% should not be in hospital at all.[36]

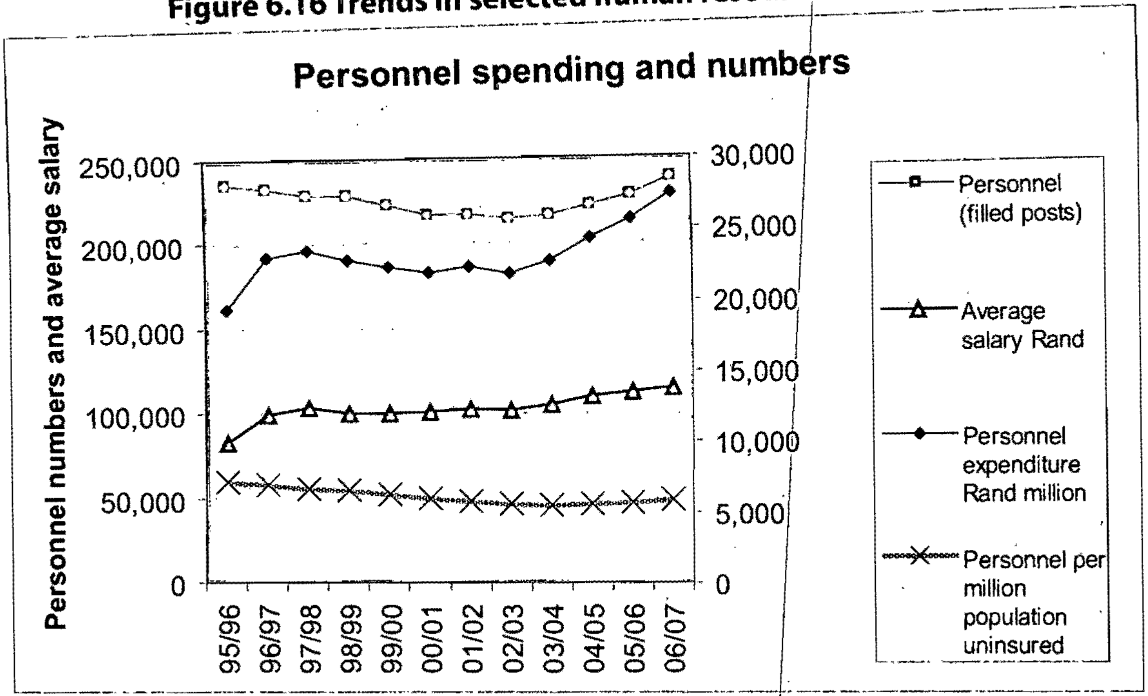
HUMAN RESOURCES

Although the data presented above suggests that the overall trend in personnel financing has been positive, the situation is more complex. Table 6.34 and Figure 6.16 show trends in several key personnel expenditure indicators. Although personnel expenditure increased from R19.4 billion to R25.7 billion, this has masked a decline of 20,000 filled posts from 1995/95 to 2002/03, largely because of a 36.7% increase in average wages. This problem is discussed in more detail with respect to a Western Cape case study in Appendix 1. While fiscal limits of the GEAR period associated with higher unit costs from the 1996 wage dispensation led to managerial pressures to downsize and deteriorating working conditions, skilled personnel had options to accept severance packages and enter the private sector or emigrate. The average wage of a health sector employee was R112 827 in 2005/06 (expressed in 2005/06 prices). Health worker remuneration in the civil service is spread across 16 salary levels with 57.6% of employees at salary levels 5 or below, 35.5% are at salary levels 6-8 (76 861 persons, mainly nurses) and only 6.9% (14912 persons, mainly doctors) are at salary level 9 and above (Source: Vulindlela October 2003).

Table 6.34: Trends in personnel expenditure, filled posts, average salaries (Rand million real 05/06 prices)

	95/96	97/98	99/00	01/02	03/04	05/06
Expend Rand million real 05/06 prices	19,414	23,573	22,326	22,318	22,739	25,668
Personnel (filled posts)	235,182	228,248	222,701	216,822	216,251	227,495
Average salary	82,547	103,277	100,252	102,931	105,150	112,827
Personnel per million population uninsured	7,197	6,676	6,214	5,774	5,510	5,654

Figure 6.16 Trends in selected human resource indicators



Despite substantial progress in reducing funding inequities over the decade, inequities in high level professional personnel deployment are still great, as shown in Table 6.35 and this demonstrates the necessity for the South African health system to focus on getting its professional human resources management and distribution right. These human resource inequities may initially appear surprising given the progress towards equity in financing described above. However Table 6.35 includes services funded by conditional grants. Furthermore the professional groups shown in the table, excluding professional nurses, total only 16000 out of 216000 health sector employees and these somewhat scarce categories of personnel are difficult to recruit and retain in several provinces.

Table 6.35: Public sector health workers by province per million uninsured population 2003#

Feb03	EC	FS	Gaut	KZN	Lim	Mpu	NC	NW	WC	Total	Ratio of highest : lowest
Dental specialists	0	0	4	4	0	1	0	0	1	2	>100
Medical specialists	24	89	208	60	12	7	27	15	339	92	27.9
Occupational therapy	2	26	22	12	15	15	11	10	28	15	13.7
Dieticians and nutri	2	15	13	6	10	16	15	9	15	10	6.4
Physiotherapy	5	22	24	22	11	13	20	11	29	17	6.0
Oral hygiene	2	4	5	2	4	2	2	2	9	3	5.7
Speech therapy and a	1	6	9	6	6	6	5	4	7	6	5.7
Dental practitioners	6	14	28	6	8	18	17	13	33	15	5.5
Doctors total group	153	329	467	276	143	177	346	132	652	292	4.9
Pharmacists	21	32	37	35	23	28	33	20	68	33	3.2
Radiography	43	71	87	44	19	19	44	19	135	54	3.1
Dental therapy	1	1	2	0	6	3	2	5	4	2	2.8
Medical practitioner	129	240	259	215	131	170	319	117	313	199	2.5
Professional nurse	891	1,286	1,166	1,043	1,117	872	1,377	895	1,169	1,058	1.6

Ranked in order of ratio of highest to lowest staffing distribution

MULTIVARIATE ANALYSIS WITHIN REGRESSION MODEL

A limited multiple regression model was run to examine the statistical relationship between some of the key variables, particularly to examine some of the determinants of health care expenditure and hospital admission rates.

With respect to health care expenditure (HCE), on the demand side HCE was found to be correlated with primary care visits (phc), hospital admissions, HIV antenatal seroprevalence (hiv) and population size (pop). The multi-linear regression model had high predictive value (R^2= 0.992) with p values for each of the four variables remaining in the model <0.001.

Expenditure= 0.407*phc + 8.82*admissions+ hiv*103.8 – 0.813 pop -2636.

On the supply side health care expenditure was strongly associated with numbers of doctors and total personnel. Again the model had high predictive value (R^2= 99.3%, p values for each variable <0.0001).

Expenditure = 1.163*doctors + 0.125*personnel -21.4

The regression model for hospital admissions found that in the best fitting model, hospital admissions were determined mainly by supply side variables of numbers of health personnel. This model had $R^2 = 0.995$; with p values for all remaining variables shown <0.002. This finding is useful since it helps to explain why total hospital admissions have changed minimally despite the substantial AIDS epidemic. It suggests that human resources are the critical determinant of hospital workloads, and validates the approach used later for hospital costing built up from normative staffing models and clearly demonstrating human resource shortfalls.

Admissions = doctors*0.049 + personnel*0.015 +4.5

A demand side model to predict hospital admissions does show them to be positively associated with outpatient visits (OPD) and population (pop). However again, a model for outpatient visits showed them to be predicted by personnel and doctor numbers but inversely related to primary care visits (phc, i.e. a substitute).

Admissions = 0.07*OPD+ 0.06 pop +5.8

OPD visits = Personnel*0.139+doctors*0.39-0.147*phc

DISCUSSION

NEED

The data presents strong evidence of escalating need with mortality numbers increasing by more than 8% annually from 1997-2004 across three studies. HIV infection rates have escalated dramatically to become an unprecedented regional and global epidemic. Life expectancy is declining. However despite this the proportion of the population which is over 65 years is growing, providing a further driver of need. South Africa has a quadruple burden of disease with injuries, diseases of poverty and chronic diseases all being important causes of death.

DEMAND

There is good evidence of increasing demand for primary care services with visits increasing by 20 million over the past five years. This is a positive indication of improving access and allocative efficiency. The high ratio of outpatient to primary care visits in Gauteng and KZN provinces associated with low PHC utilisation rates suggest weaknesses of PHC services in these provinces, bypassing and inadequate referral systems. Both the national primary health care and hospital information systems lack information on referrals and this must be addressed.

Despite the HIV epidemic there is little indication of increasing hospital outputs. Given that HIV comprises a significantly larger proportion of hospital workloads, this strongly suggests that demand for hospital services is being restrained by supply side constraints, most likely limited personnel numbers. This finding is corroborated by the findings from the multiple regression model. There are significant inequities in access to specialist hospital services, which need to be addressed by building up basic specialities in under-developed provinces.

Spending

The data highlight a number of substantial challenges which need to be addressed in any national sector plan. While real spending on health services has increased significantly over a decade (Chapter 4), this chapter has demonstrated that this has been powerfully counteracted by a number of key changes:

- Growth in the uninsured population from 32 million to R40 million from 1995 to 2006. This has led to flat per capita funding growth in which only by 2006/07 will levels last reached in 1996/97 again be attained (Figure 4.2)
- Rising unit labour costs leading to total personnel numbers employed by the sector being lower in 2004 than they were in 1995 (Table 6.34)
- The effects of the HIV/AIDS epidemic, now the largest cause of mortality and over 5 million persons infected.
- Growth of primary care visits by 20 million from 80 million to 100 million.
- Substantial infrastructural backlogs, especially in hospitals.

With respect to allocative efficiency there has been progress. Previous authors noted a centralized hospicentric system, with a high proportion of spending on large central hospitals and poor access to basic primary care services in many areas. Hospital infrastructure was often in poor condition. The chapter shows significant reprioritisation and growing expenditure for HIV/AIDS programmes, capital expenditure, primary care services and ambulance services. In the economic classification there has been an encouraging re-emergence and increase in spending on goods and services (medicines, laboratories, medical and surgical consumables, maintenance) and in capital (buildings and equipment). Thus there is clearly a more efficient distribution of funds across levels of care and a recovery of capital financing.

Primary care expenditure has grown as part of a wide range of efforts to build up the PHC system and infrastructure, in keeping with a broader PHC philosophy. Comparisons with historical trends documented by the National Health Accounts project confirms increasing trend in PHC expenditure.[37]

Inequity has been a serious concern of extensive previous research.[38,39] Despite some progress, the chapter continues to show substantial inequities in the distribution of professional health personnel, hospital admission rates, primary care visits and outcomes such as TB cure rates.

While spending on the HIV/AIDS has grown substantially and consumed a significant share of additional resources, the funding available is still far below what is required in terms of both prevention and treatment.[40]

Capital expenditure has grown along with belated recognition of large capital backlogs, growing national emphasis on infrastructure and the initiation of the Hospital Revitilisation programme, a national programme of hospital reconstruction and upgrading. However the programme is still operating at a scale far below what is required, at the same time as facing significant constraints in management and repeated under-spending (personal communication Mr. R. Bennett).

The data presented show substantial human resource problems. However personnel spending has been fairly flat after the 96/97 wage increases and, given rising unit costs, this has been associated with reductions in numbers of personnel employed, a pattern that has only recently begun to be reversed. The recent Annual Health Review[41] placed great emphasis on human resource problems in the health care system.

The three provinces with the highest level of per capita funding, Western Cape, Northern Cape and Gauteng, have the highest admission rates to hospital (Table 6.14). They also have the highest rates of PHC consultations, with the exception of Gauteng, which with the new population data emerges with a picture of sub-optimal PHC provision.

Both hospital and PHC data suggest increasing convergence in utilization trends and thus improving equity in outputs. For example compared to previously published data, PHC utilization in Mpumalanga appears to have significantly increased from a low of 1.4 visits per capita uninsured in 2000/01. However inequities do still exist, with for example fairly low hospital admission rates in Limpopo.

Problems include the financing implications of HIV/AIDS, higher average wages and shortages of skilled professionals. Further, to achieve the provision of an appropriate PHC package across the country, attention will need to be paid to intra-provincial inequities and a review of funding requirements.
Primary health care spending has increased in real and real per capita terms, particularly for the key areas of clinics and community health centres. Health care spending is significantly associated with primary care utilisation in the multiple regression model. Rising PHC visit rates are likely to be due

amongst others to the free PHC policy (removal of user fees) and the construction of more than 700 new clinics since 1994. The data suggest relatively low funding in Limpopo and relatively low levels of PHC utilisation in Gauteng with significant bypassing directly to hospitals. The chapter does not discuss substantial inequities between districts, which far exceed that between provinces.[42] Utilisation data is difficult to interpret, given uncertainty in the population served and fairly widespread use of private services.[43] When utilisation rates are recalculated using data derived from self-declared use of public services in household surveys, then these rates are significantly higher (3.5 per capita). This is an important issue to resolve.

In the course of the research the author noted some significant data quality problems in the national hospital dataset. Greater efforts are required to improve the quality of national hospital information systems. Nevertheless the data presented provides probably the best estimates currently available of hospital utilization and unit costs by hospital type. These levels provide benchmarks for exploring variability across provinces, technical efficiency and serve as a useful base from which to model future hospital configurations.

Hospital funding has been fairly flat overall, with declines noted especially in central hospitals. This finding should be considered along with the increase in personnel unit costs, shown in chapter 6 and Appendix 1.

The relative stability of hospital outputs, and indeed declining per capita output trends, is surprising. The increase in the uninsured population by over 7 million persons (see chapter 4) and the large HIV/AIDS epidemic would both be expected to increase utilization of inpatient and outpatient services. Certainly a range of sero-prevalence surveys among hospital inpatients has shown escalating levels of HIV/AIDS prevalence. It is difficult to understand why hospital utilisation has not increased to date, but possible explanations may include funding constraints associated with higher unit costs and reduced numbers of health personnel (see chapter 6). These may be limiting supply, so that patient access is being reduced. This perspective is supported by the multiple linear regression model which shows personnel and doctor numbers as important determinants of hospital admission and outpatient rates. Also a shift from hospital to PHC services may be occurring, with the regression model showing a negative regression co-efficient.

CONCLUSION

This chapter shows changing trends in expenditure by functional component of the health care system. Primary health care expenditure has grown, particularly to put in place new HIV/AIDS programmes. However hospital funding has declined steadily on a per capita basis and given rising input costs may partly underlie deficiencies in the quality of hospital services. Spending on ambulance services has increased.

Considering the economic classification of expenditure, there has been much needed stabilisation and significant increases in spending on goods and services (medicines, laboratories etc.) and in capital expenditure. However personnel expenditure has been constrained following the 1996/97 wage increases, and this is likely to have constrained filling of new posts and development of health services, especially in historically under-served provinces.

The chapter describes a rising trend in primary care services expenditure in several subprogrammes, including in the key areas of clinics and community health centres. Utilisation has risen, but is still significantly below the Department of Health's target of 3-2.5 visits per capita. However the chapter shows potential uncertainty around the population served, which suggest a re-examination of the targets is required.

Although funding has improved and this has been reflected in additional clinics, utilisation and reasonable outcomes in term of antenatal coverage and immunisation, there are still a range of problems including inadequate TB treatment success and a significant proportion of consulting rooms not being of adequate standard.

Furthermore the current service is based (75%) on nurse based clinic services and greater investment is probably required in building skills, strengthening doctor support and providing the full package of primary health care services.

This chapter has shown that hospital funding has shown a declining real per capita expenditure trend, particularly in central hospitals. It has shown widely divergent levels of hospital funding across provinces, associated with very different configurations of hospital care (some predominantly based on general practitioner led district hospitals, while others are based on specialist led regional and tertiary care).

Detailed data has been presented on utilization and unit costs by hospital type, which provides a useful basis for further exploration of technical efficiency and modelling of future patterns of care and funding scenarios, such as in chapter 8 and 9.

CHAPTER 7: HEALTH SECTOR GOALS AND PRIORITIES

INTRODUCTION

The literature review in Chapter 2 outlined a typical planning cycle in which a phase of setting goals and objectives follows the situational analysis. In order to inform the quantitative planning framework analysis of Chapter 8 this chapter briefly reviews some of the key sector goals and priorities as set out in a number of overarching national policy and planning documents, White Papers, strategic plans and the Department's "Ten point plan".[1,2]

The Department sees its vision as an accessible, caring and high quality health system.[1] Its mission is envisaged as improving health status through prevention and promotion of healthy lifestyles and to consistently improve the health system by focusing on access, equity, efficiency, quality and sustainability. Elsewhere the Department states its aim as promoting the health of all people in South Africa through a caring and effective national health system based on the primary health care approach.[3]

The Department envisages that a basic health care package must be guaranteed for all, including primary, emergency and tertiary services.[4] There must be acceptable standards of care and a range of activities must be undertaken to improve quality of care. Segall, in a Department of Health paper, argued that although primary health care had emerged as a lead issue, that if the quality of the service is inadequate, the object of the exercise is lost, health outcomes are disappointing and the public stop using and bypass the service. He argued that improving quality of care should be the top priority for the next five years.[5]

PLANNING, INFORMATION AND MANAGEMENT

The Department sees the importance of improving health planning as an important priority in its own right. Planning systems should be improved, amongst others through development and use of a national planning framework[6] and development of a full set of planning norms for each level of care.[7] The development of provincial health service transformation plan has been identified as one of five critical priorities adopted by the National Health Council (the statutory forum of Minister of Health and provincial political heads).[8] The intention of these plans is to guide provinces to resize and reshape their health services to ensure they are appropriate, adequately resourced and sustainable. The Public Finance Management Act and its regulations require all government departments to develop and regularly update strategic plans for the three year medium term expenditure framework.[9]

The Department of Health has developed a framework with national objectives to assist provincial Departments in this task.[10]

Adequate and appropriate Information systems are required for planning, monitoring and evaluation and performance management. All Departments are required to submit annual reports to Parliament and the Department of Health has developed a framework to guide provinces on key indicators to be reported on.[11,12] The District Health Information system (DHIS) should be strengthened.

The Department recognizes that leadership and management needs to be strengthened throughout the health system and that without strong management implementation of plans may fail.[6] Strengthening of management at district level and in hospitals is considered important for the success of decentralisation initiatives. The Department has supported the establishment of various management training programmes.

PRIMARY HEALTH CARE

Even prior to democratic transition in 1994, the health plan of the African National Congress emphasized the primary health care approach as a foundation for the new national health system.m This has been reaffirmed in various policy documents from early White Papers to recent strategic plans.[1,14]

The organization of primary health care (PHC) services is envisaged as operating within the context of a decentralized district health system. Although the policy for this was adopted over a decade ago[7,15] there have been various challenges which have delayed implementation. Policy intentions are to establish decentralised district structures throughout South Africa in line with the National Health Act 2003.[16] In order to improve inter-sectoral collaboration, the boundaries of 53 health districts correspond to the boundaries of District and Metropolitan municipalities. District based planning and Health Information systems should be implemented. Proposals to encourage District authorities to contract with private general practitioners will be investigated.[4,17]

With respect to PHC services a critical policy development was the development of a core (later called comprehensive) package of primary health care services.[18] This document outlined the detailed content of services to be provided at three levels: clinics (including mobile clinics), community health centres and community based services. A subsequent document which attempted to lay out norms and standards for primary health care provides more details on the nature of services to be provided, but little in the way of quantitative planning norms.[19] The policy intention is to implement the comprehensive package of PHC services broadening the existing scope of services offered in facilities to the comprehensive set of services contained in the core package. Clinics should provide comprehensive integrated (one-stop) primary care services at least 8 hours per day, 5 days per week.[15] Training of primary care personnel should be improved and support visits by doctors increased.

A national Committee of Inquiry tabled a bold target for primary care utilisation to increase from 1.8 per 1000 to 3.5 per 1000 and for its staffing to be substantially increased to the levels proposed for a model district shown in Table 7.1.

Table 7.1 Primary care personnel per district of 100 000*

Category	Personnel	
Doctors		4.62
Nurses	Professional nurse	18.00
	Community health	5.00
	Primary care nurse	26.96
	Staff nurse	18.10
Allied	Dietician	1.00
	Occupational therapy assistant	2.50
	Occupational therapist	1.00
	Physiotherapist	1.00
	Physiotherapist assistant	2.50
	Psychologist	1.00
	Social worker	2.50
	Speech therapist	0.50
Dental	Dental therapist	2.50
	Oral hygienist	1.00
Administrator	Chief professional nurse	5.00
	Cleaner/cook/gardener/domestic	15.00
	Security	10.00
	Ward helper/porter	5.00
	Clinic administrator/clerk	15.00
Pharmacy and other	Pharmacist	1.50
	Driver	5.00
	Laboratory assistant	5.00
Total		150.00

* At baseline utilisation rate of 1.8 per 1000.
Source: Committee of Inquiry[15]

PUBLIC HEALTH, HEALTH PROGRAMMES AND COMMUNITY BASED CARE

Public health interventions, health programmes and community based services are seen as playing an important role in preventing and controlling disease and an integral part of the PHC approach. Policy documents and sector plans lay out a range of intended interventions.

Noting the rising prevalence and mortality levels arising from chronic diseases, the Department aims to implement healthy lifestyle and exercise campaigns. Anti-tobacco legislation and actions are being progressively strengthened.[20] Initiatives to address trauma include implementation of a national injury prevention strategy. Labelling of alcohol products and other aspects of a new regulatory framework for alcohol products is intended.[8]

Various strategies are intended to address communicable diseases. While attempts to put in place a national strategy for HIV/AIDS were initiated over a decade ago[21,22] it has taken much longer than anticipated to get an effective national response implemented. HIV prevention and promotion programmes should be expanded. Voluntary counselling and testing and Mother-to-child prevention programmes should be extended to all primary care facilities.[3] Sexually transmitted infection management should be improved including the addition of antiviral therapy for herpes. The Department of Health aims to distribute 450 million male and 3.5 million females condoms per annum.[3] Aims of the national treatment programme were outlined in the Cabinet-approved Operational plan for the comprehensive care and treatment of HIV and AIDS in South Africa. The operational plan envisaged rapid acceleration of numbers of persons on treatment from 53 000 persons starting treatment in 2003/04 to 551 089 starters by 2008/09, bringing the total number of persons on anti-retroviral treatment to 1,470,510 by 2008/09.[23] By September 2006 the Department had initiated 210,000 persons on treatment in 270 sites and planned to expand the AIDS treatment programme to at least one site per subdistrict.[3,8] The operational plan envisaged that the programme would cost R4.5 billion annually by 2007/08. The plan would need to encompass a range of measure to strengthen the national health system, increase human resources by 14500, improve physical facilities and strengthen laboratory and pharmaceutical services.[21]

Interventions to address other infectious diseases include improving epidemic preparedness and strengthening malaria programmes through artemisin based combination therapy, improved spraying, bed-nets and education. A tuberculosis (TB) crisis plan is being implemented to improve TB cure rates from 60% to 85% through model districts, improved adherence rates and more rapid turnaround time for laboratory tests. Polio eradication programmes should continue and measles elimination is aimed at through high clinic immunization and mass campaigns.

Efforts to improve child health should include improving immunization coverage to over 90% and improved management of child illnesses and implementation of the Integrated Management of Child Illnesses (IMCI) strategy. Community based interventions include the health promoting schools initiative to target the school based population.

Environmental health services should be strengthened and built up under the authority of category C municipalities (District Councils). Norms and standards for food safety system should be developed and food fortification programmes implemented. A national community health worker programme should be developed and implemented.

HOSPITALS

The Hospital Strategy Project as early as 1995 outlined a comprehensive strategy for hospital services. However its recommendations were never systematically implemented and have resurfaced in various forms in later policy documents.[24]

One of the most important policy documents to emerge on hospital services is the Modernisation of Tertiary Services (MTS) report.[24] Hospital services should be accessible to all, but delivered in a tiered approach. The report proposes the following categorisation of hospitals. Level 1 hospitals provide general practitioner-based community hospital services. They also provide basic surgical procedures not available in community health centres. They should preferably be available within a one hour drive time to 80-90% of the population. In high density urban environments mixed level 1 and 2 hospitals may be an option.

Level 2 hospitals provide specialist outpatient and inpatient services. The main specialties in level 2 hospitals should be medicine, surgery, obstetrics and gynaecology, paediatrics and neonatal intensive care, orthopedics, psychiatry, radiology, anaesthetics and rehabilitation. The MTS report, based on its Geographic Information System (GIS) analysis for drive time radiuses of 60 minutes to regional hospitals, proposed that the country have 56 regional (level 2) hospitals.

Level 3 hospital care is the specific focus of the MTS report. The report proposes, based on drive time analysis with 2 hour radius that the country should have 17 tertiary hospitals. Of these, only 6 (National Referral) and 2 (Central) will contain a set of the most highly specialised services. The basic tertiary hospital, in addition to the regional specialties will contain amongst others: ophthalmology, urology, ear nose and throat surgery, full ICU service, vascular surgery, burns unit, major trauma unit, plastic surgery, respiratory medicine. The proposed tertiary hospitals in the MTS report are outlined in Table 7.2.

Table 7.2 Tertiary hospitals, 2014

Province	Hospital	Fully Developed Tertiary Hospital Services	National Referral Services	Central Referral Unit
Eastern Cape	Port Elizabeth	Yes	-	-
	Frere	Yes	-	-
	Umtata	Yes	-	-
Free State	Universitas	Yes	Yes	
Gauteng	Chris Hani Bara	Yes	-	-
	George Mukhari	Yes	-	-
	Johannesburg	Yes	Yes	Yes
	New Pretoria Academic	Yes	Yes	-
KwaZulu-Natal	Inkosi Albert Luthuli	Yes	Yes	-
	Greys	Yes	-	-
	Ngwelezana	Yes	-	-
Limpopo	Polokwane/Mankweng	Yes	Yes	-
Mpumalanga	Rob Ferreira	Yes	-	-
Northern Cape	Kimberley	Yes	-	-
North West	Klerksdorp	Yes	-	-
Western Cape	Groote Schuur & Red Cross	Yes	Yes	Yes
	Tygerberg	Yes	-	-
	Total	**17**	**6**	**2**

* As proposed by Modernisation of Tertiary Services report[24]

Improving hospital infrastructure is considered an important priority. The National Health Facilities Audit conducted in 1995 demonstrated large backlogs and poor condition of physical infrastructure of hospital facilities. The Hospital Revitalisation programme is seen as having achieved successes in the hospitals upgrading or rebuilding public hospitals.[25] These include a comprehensive approach to upgrading infrastructure and medical equipment in association with hospital management and quality improvement programmes. The Department aims to rapidly and substantially expand the Hospital Revitalisation programme and to extend the programme to 65 hospitals over the next three years.[3]

Health technology management systems should be improved through a life cycle approach including development of essential health technology packages, technology audits, improved processes for assessing new technology, improved acquisition systems, electronic asset registers, better maintenance and timely replacement.

While the Department has expressed a general intention to develop norms and standards for all levels of care, few quantitative norms have in fact emerged. However the Modernisation of Tertiary Services report[26] and the Integrated Health Planning Framework (personal communication: Department of Health 2005) have begun to lay out some potential reference norms (Table 7.3).

Table 7.3 Emerging hospital reference norms or targets

	District	Regional	Tertiary	Tertiary 1	National Referral	Central	Psych-iatry	TB	Special-ised	Stepdown	Total	Source
Length of stay	3.2	4.13	6.20	6.07	6.20	9.49	60	30	16			IHPF05*
Length of stay with step-down	2.5	3.3	5.5	5.3	5.5	8.8	34.5	15.2	8.7			IHPF05
Bed occupancy		80%	80%	85%	90%							Modernisation
Admissions per 1000	60.16	20.15	11.17				1.60	3.40	1.60		98.08	
Beds per 1000	0.48	0.23	0.22				0.17	0.16	0.10	0.25	1.61	
Area per bed	51	75	100				50	33	75			IHPF05
Construction Cost per bed 04/05 prices Rand	472,200	669,375	1,380,000				340,500	268,290	535,500	193,800		
Equipment as % of replacement cost	25%	30%	60%	50%	60%	75%	15%	15%	20%			IHPF05
Referral rate		20%		20%	20%							Modernisation

Source: Department of Health Integrated Health Planning Framework (IHPF) and Modernisation of Tertiary Services report[24]

The Department of Health aims to decentralise and delegate powers and functions for hospital management to institutions. Frameworks for delegation of financial, human resource and other functions have been developed. Cost centre accounting systems should be implemented in hospitals, also to strengthen decentralization to service units within hospitals. Improving quality of care is a priority. This should be achieved amongst others through strengthening community participation and hospital accreditation. Complaints procedures, morbidity and mortality meetings, clinic audit and other measures should be routinely implemented to improve quality.

Emergency medical services

A new national Emergency Medical Service (EMS) model has been developed (personal communication Department of Health).[27] This envisages shorter response times of less than 15 minutes for emergencies in urban areas and less than 45 minutes in rural areas. Ambulances should have two person ambulance crews to ensure that patients can be constantly observed. Communication systems and control centres should be improved to ensure rapid processing of notifications of emergency events and dispatch and tracking of vehicles. The number and positioning of ambulance stations and ambulances should be reviewed to ensure optimal locationing of vehicles for rapid response. Emergency care practitioners should be well trained and the duration of training of Basic Emergency Assistants should be extended and the capacity of Ambulance Colleges strengthened. The vehicle replacement programme should be continued to ensure a modern well maintained ambulance fleet. Air ambulances should be available to deal with selected serious emergencies in remote areas.

HEALTH SERVICE INPUTS

Funding

Attempts are being made to better link budget bids to costed plans. Both the national Departments Integrated Health Planning Framework and provincial Service Transformation Plans are progressively attempting to develop and provide long term costed service plans to inform long term funding requirements and mobilize resources.[6,8] Public sector funding should continue to make progress toward inter-provincial equity.

Human resources

A recent strategic framework for human resources developed by the Department of Health lays out a range of priority areas.[28,29] This aims to develop and implement a national human resource plan, improve wages of health workers and strengthen health management training and develop national standards for such training. Better human resource information and monitoring and evaluation systems should be developed. Strategies to improve access and equity in human resource distribution should be developed. Access to health workers in rural areas must be improved.[27]

Shortages of health care personnel are acknowledged in various fields including specialized nursing, general and specialised medical practice, clinical technology, pharmacy, radiology and pathology and should be addressed robustly.[4] Methods to fast track filling of posts should be investigated. It is intended that 30 000 additional posts be filled over a five year period.[27] Increased use of mid-level workers, such as pharmacy assistants and community health workers is a policy objective. More recently the Department has begun planning for a new cadre of medical assistants.[8] Although the Department has not developed staffing norms, it expresses an intent to build human resource planning capacity and to work on norms for facilities in conjunction with provinces, possibly through use of the World Health Organisation's Workload Indicators for Staffing Needs (WISN) approach.

The supply of health professionals and capacity of educational institutions should be reviewed in order to increase student numbers to ensure adequate levels of personnel. The appropriateness of education and ongoing skills acquisition should be improved. A culture of valuing health workers should be promoted. A national health human capital programme should be developed to build human resources for health over the next decade.[4] An audit of nursing colleges was undertaken in 2006 and the Department proposes to re-open nursing colleges and increase intake of nursing students.[8]

The Department aims to improve the conditions of health workers both through a new wage dispensation for professional workers, to be implemented from July 2007 and through a better physical environment in health facilities.[8,26]

Medicines and laboratory services

The National Drug Policy (NDP) aims to ensure access to safe, cost-effective and affordable quality medicines for all citizens. Various initiatives should be undertaken to improve availability and affordability of medicines. Essential drug lists (EDLs) define the essential medicines that should be made available in the public sector facilities. EDL lists are to be regularly reviewed and improved. Surveys suggest that availability of essential medicines is progressively improving. Pharmaceutical supply chains should be strengthened and the proportion of out of stock or expired medicines reduced. Control systems should be introduced to reduce leakage. The process of medicine registration should be made more efficient.

Laboratory services should be strengthened through consolidating and building on the progress achieved within the National Health Laboratory Service. Laboratory services need to be strengthened to support the HIV/AIDS and TB programmes and reduce turnaround times, particularly in rural areas.

CHAPTER 8: METHODOLOGY PART 2: DEVELOPMENT OF A QUANTITATIVE HEALTH SECTOR PLANNING MODEL

INTRODUCTION

The development of a quantitative national planning framework was identified as an important priority of the National Department of Health. Important methodological breakthroughs have been made over recent years and the Department has now developed an Integrated Health Planning Framework (IHPF). Variations of the model are being used to inform the national Hospital Revitalisation programme and by provinces to inform provincial strategic plans. The author contributed to the development of early versions of the model and has subsequently developed a substantively different variant, which has been of use within the National Treasury to inform aspects of financial allocations. This chapter describes aspects of the methodological development of this type of quantitative health sector planning tool.

Experience in the South African health sector has demonstrated potential uses of an overview quantitative health sector planning model. One such use is to provide cost (and thus funding) estimates for different scenarios for the South African health service. Typically such models combine, within a spreadsheet-based model, component parts of the health system, such as hospitals, primary care, emergency ambulances, training colleges and others. In their simplest form, output based models derive from output norms (e.g. admission rates per capita) and unit costs. Input-based models start from required inputs and their costs (e.g. hospital bed norms or personnel required to deliver a particular service). These approaches are frequently combined by determining the inputs required to deliver a specific output. Relevant input and output variables are costed and the service configuration must as far as possible be brought within the limit of the financial envelope. At one level, the approach used has similarities to the Financial and Fiscal Commission's costed norms approach[1], which attempts to inform funding levels by defining normative levels of service outputs and benchmark costs.

Uses of such models that have emerged in the South African health system have been to:

- Analyse the public health system and make comparisons across provinces
- Develop various health system configuration scenarios to assist planning at national and provincial levels.
- Assist with capital planning, particularly by demonstrating sustainability of various service configurations. In addition, costs of constructing, upgrading, maintaining, replacing and transforming capital such as buildings (hospitals, clinics) and equipment have been included in the model. This is an advance on previous models and provincial plans, which were considered to

make insufficient provision for capital and maintenance.

- Demonstrate affordability of various service configuration options (e.g. sizing and shaping) within a given budget limit
- Develop norms, benchmarks and targets by which to measure the health system. Some of these have already been incorporated into a national framework for strategic plans of provinces[2] and into annual reports. These include hospital bed numbers by type, efficiency benchmarks e.g. cost per admission.
- Motivate for funding. For example at a time of fiscal constraint in the Western Cape province, use of a normative model successfully defended against a proposed budgetary reduction of hundreds of millions of rand through its ability to clearly link service norms such as admission rates to budgetary levels.
- The model shows, for example, how HIV/AIDS drives costs in the sector and has already been useful in supporting additional allocations to the sector amounting to several billion rand.[3,4]

These uses have conceptual linkages to a number of the planning and modelling approaches used in other countries and discussed in the literature review, particularly the systems theory type approaches, such as those used by Denton, Wanless, Navarro and others.[5,6,7] For example Denton in Ontario used a model with various modules in which changes in need (demography, mortality) could be linked to demand (age specific utilisation rates) and supply in terms of beds and health personnel). The model was used to show how changes in need and demand over time would lead to changes in supply including in the requirement for hospital beds and graduate outputs.[5] Wanless used demand and supply side modelling to calculate long term funding requirements for the British National Health Service. Particular attention was given to the potential for preventive interventions for chronic diseases to reduce demand over the long term and a number of key areas of supply side improvements such as cancer, diabetes and coronary heart disease management.[7]

The Hospital Strategy Project (HSP)[8] developed a method to determine hospital bed and staffing norms for the country. Although potentially a very powerful report, its recommendations were never systematically implemented. The detailed model used by the HSP for norm development was not published and the norms provided became progressively unaffordable as factor costs grew in real terms.

In the Western Cape province a simple service and cost norm model known as the normative model (Department of Health, 1998) was developed by the author, building on the HSP approach and proved very useful in guiding service restructuring to deal with a lengthy period of downsizing[9]. This model was based substantially on input norms, such as beds per thousand population and staff per bed ratios.

The province continues to use a normative planning tool for budgeting and planning, based on a set of model personnel establishments.

Development of a National Planning Framework for South Africa was identified by the national Department of Health (DOH) as a key strategic objective.[10] Initial attempts to prescribe a range of hospital bed and other norms were rather unsuccessful, due to the inability to incorporate the proposed norms within a financial framework, which could demonstrate affordability.

A substantial breakthrough emerged in the year 2000 when a new more sophisticated Integrated Health Planning Framework (IHPF) was developed by a team including the author. This model links a wide range of input, output and cost variables. It is primarily output driven, an important methodological improvement on the previous Western Cape normative model and the earlier proposed national bed norms (personal communication Department of Health). The usefulness of output driven models is that they derive from demand and linked needs. Inputs can then be related to outputs at given levels of technical efficiency. Uncritical use of input norms can institutionalise service configurations that have long departed from the demand and need environments in which they were originally relevant.[11,12,13]

Given the high proportion of expenditure in the sector on personnel, several of these models build on human resource planning and staffing models, the most influential of which has probably been developed by Krause (Human Resource Planner; Personal communication: R. Krause).

The National Treasury is developing a version of this model to inform sector financing. The IHPF has provided strong methodological support to the Hospital Revitalisation programme, a multibillion rand programme to rebuild and rehabilitate South Africa's hospitals. In this regard all nine provinces have developed long term (ten year) Strategic Position Statements based on the methodology of the IHPF. However again, there appear to have been several important constraints in the use of the IHPF model including increasing complexity, reliance on external consultants, token compliance and lack of use by many managers.

All models are by definition simplifications of reality and have limitations. It is important to understand these, since inflexible and unquestioning use of such tools can be problematic, given the complexity of health systems. Nevertheless, these models are likely to have potential applications and it is with this in mind that this paper attempts to describe them, in the interests of strengthening national planning processes and their relevance to health financing.

Virtually none of these models have been published. While some reports, such as the Hospital Strategy Project, produced norms, the models underlying their development were never published and with changes in underlying costs these "norms" became progressively more unaffordable and outdated.

This chapter presents the methodological development of a health sector model for South Africa. A subsequent chapter applies the model to the South African health sector to provide a range of scenarios with cost and funding implications. The version of the planning model described here is based on an earlier version, in whose development the author was substantially involved and which the author has subsequently greatly modified. Since then the Department of Health has also made many changes, so that the model described differs from that currently used by the Department of Health.

OVERVIEW

PRINCIPLES

Drawing from the needs and demands and other aspects of the situational analysis (Chapter 6) and stated health sector policies (Chapter 7) the model to be designed must meet at least the following principles:

- Universal coverage i.e. the entire population should be entitled to use public health services
- High accessibility to users especially at primary care level
- Based on a primary care approach, with primary care gate-keeping except for emergencies and should improve prevention and public health
- A tiered hospital system (district, regional, tertiary) with the exception possibly of dense urban areas
- Must incorporate mechanisms to improve quality of care
- Must consider technical efficiency at all levels of the system
- Must provide for an improved national response to HIV/AIDS
- Must significantly build human resources in health sector
- Must address existing large backlogs in capital infrastructure and provide a basis for sustainable national infrastructure base.
- Must be sustainable in terms of funding as a proportion of GDP, ability to fund recurrent implications of capital projects

System components and characteristics

Key planning authorities would be departments of health at the national, provincial (9) and district health (53) levels.

Basic needs must be met through adequate supply of water, sanitation, basic education, housing, basic income security and so forth. These are not contained in the model, but are a key pre-condition for public health.

Public health services need to operate at the community level to keep individuals and communities healthy, undertake surveillance, investigate causes of ill-health, educate and promote, institute protective measures for communities. These include environmental health, school health services, occupational health (workplace aspects mainly under the Labour Department), health education, malaria control, life-skills programmes in schools, condom distribution, injury prevention interventions, and legislation to mandate exposure limits, controls and protective measures.

The health care system is tiered, with primary care gate-keeping an important component, except for emergencies. Both inclusive and exclusive tiered options must be considered – in the inclusive option hospitals of a giver tier also provide lower tier services e.g. a regional hospital including district hospital care). Because of its tiered nature upward and downward referral and feed-back processes should function effectively.

Table 8.1 Levels in tiered health system

Types of care	Levels	Examples
Primary health care	Public health and community based services	Environmental health HIV prevention Community health workers
	Responsible self-care	Community pharmacies
	Clinics	Fixed Mobile
	Community health centres	
Emergency ambulance service		
Hospitals	District hospital (level 1)	
	Regional hospital (level 2)	
	Tertiary hospital (level 3)	

Responsible self-care must be encouraged as an important demand management measure and to avoid overloading PHC facilities with trivial conditions and unnecessary over-medication. Community pharmacies play a role here. Health education around self-care and the importance of PHC as the entry point into the health system is required.

A two-tiered primary health care model is proposed: clinics and community health centres. The motivation for this will be discussed in more detail later, but mainly revolves around a trade-off between high access (clinics) and minimum efficient scale thresholds (radiology, mid-wife obstetric unit, physiotherapy, full-time doctor services, 24 hour care). Mobiles or part-time satellite clinics are required for rural areas where thresholds for an efficient full-time fixed clinic are not met. Alternate configurations, such as general practitioner based services are considered. Size and distribution of clinics and community health centres will vary with population size, density and distribution. Clinics should be available within 10km and preferably within 5km of over 90% of population (personal communication Department of Health).

Specialists are located at level 2 (regional) and level 3 (tertiary) hospitals. A rapid and effective referral service for specialist opinion, treatment and minor procedures is required. Provision should be made for adequate referral access to the specialist level arising from primary care consultations. Acute hospital services are located in district (level 1), regional (level 2) and tertiary level three hospitals with adequate provision being made for inpatient, outpatient and casualty and day surgery or other day or outpatient procedures.

MODULES

Table 8.2 summarises some of the key modules within the model. The situational analysis in chapter 6 presented a number of key issues of importance at baseline including indicators of need, demand, supply, expenditure and allocative efficiency and unit costs and technical efficiency. The main body of the model focuses on forward looking planning modules for the major parts of the health service that consume over 90% of expenditure, especially primary health care, hospitals and emergency ambulance services.

The broad approach within each module is to firstly identify the current level of utilisation or demand for that service. Then one of a number of approaches is adopted to assess how the quantity of services demanded might change from the baseline to address need. A normative model for each service type is developed and costed, typically based for the personnel component on a workload-based staffing model. This is compared with baseline unit costs. Outputs and unit costs are brought together to determine cost of each service type.

The primary care module covers facility based services, district management and some core components of public health and community based services. The facility- based tool is tiered with clinics and community health centres. It has a workload based staffing tool and approaches to costing medicines, buildings and maintenance, equipment and other items.

The hospital module consists of six basic bed types: district (level 1), regional (level 2), tertiary (level 3), psychiatric, TB and other specialised beds. The module starts with a demand forecasting and planning tool, focussing on hospital admissions and outpatient and casualty workload. This is informed also by a component which assesses the effects of the emerging HIV/AIDS epidemic on admissions. A hospital allocation tool allows hospital workload to be directed to various combinations of the six hospital types. A normative approach to costing is used. Hospital personnel are planned and costed using an updated version of the Hospital HR Planner tool developed by Krause (and previously used in the Hospital Strategy Project) which has been updated to current wage levels. Other components cover capital, equipment, medicines and other inputs. Various combinations of workload, workload distribution and unit costs can be modelled to show effects of particular scenarios.

An emergency medical (ambulance) service module attempts to model and cost a basic ambulance service.

Given the importance of HIV/AIDS in the Southern African context a specific module has been developed to cover many of the aspects of a national prevention and treatment programme.

A demographic module models population forward to 2010/11. A funding module has been presented in Chapters 3 and 4 of this thesis and predicts funding availability to 2010/11. The model also has several other tools including an inflation adjuster to convert input data from various sources into constant prices.

The various modules are brought together in the main model. A scenario input sheet allows various data choices and combinations to be selected. A number of output sheets present results of the model for finances, hospital outputs and human resources. These sheets compare model outputs against baseline thus showing gaps in terms of funding, human resources and workload.

Table 8.2 Summary of modules within planning model

Module	Support modules or sub-components	Function
Situational analysis including analysis of expenditure and unit costs		Summarises actual baseline expenditure in different components of the health system in order to compare against modelled costs
Demographic		Projects total and uninsured population annually to 2010
Inflation		Adjusts prices from various years into real prices in base year (currently in 2005/06 prices)
Financing		Models forward sector funding level projections annually to 2010
Primary health care (PHC)	Clinics Community health centres Mobile clinics District management Community based and public health services	Provides a method for modelling PHC costs including facility based services, district management and community based and public health services including environmental health and community health workers
HIV/AIDS		Models specific costs of national HIV/AIDS programme
Hospitals	District Regional (level 2 specialist) Tertiary (level 3 specialist) Psychiatric TB	Provides a method for modelling hospital services
	Forward output projections	Forward projects admissions and outpatient visits to 2010
	HIV/AIDS and TB	Projects HIV/AIDS and TB admissions and OPD visits to 2010
	Staffing and personnel costs	Provides staffing profiles and costs for different hospital types
	Non-personnel costs	Provides non-personnel costs for different hospital types
	Capital model	Models building, upgrading, maintenance and transformation costs for hospitals, clinics and equipment
	Home based care (HBC)	Project costs of HBC for given levels of visit numbers and workload per team
Emergency ambulance services		Provides a method for modelling ambulance costs
Other costs		To include other cost areas such as management and training.

DEMOGRAPHIC MODULE

The user population for public sector health services has been determined for each year to 2010/11. The module examines the total population, insured population, uninsured user population and contains information on three age groups – elderly (>65 years), children under 5 years and women of reproductive age.

Data for the total population has been obtained from 1996 onwards in order to interpret historical trends. Data for 1996 (40.5 million) and 2001 (44.8 million) have been derived from the censuses held in those years.[14,15] For 2001 the average of the census and the mid-year estimate has been used. The calculated rate of exponential growth over the period from 1996 to 2001 has been used to estimate the interim years. For the years from 2002 to 2006 the mid-year population estimates (including HIV/AIDS) of Statistics South Africa have been used as the main source, given that these are official government estimates[16-20] and supplemented by estimates from the General Household Surveys.[21,22] Because of significant data variability, the data has been smoothed by averaging data over a three year period. Forward estimates of population for 2010 have been sourced from the Actuarial Society (ASSA) model, because of its highly detailed HIV/AIDS and demographic modelling.[23] The interim years between 2006 (mid-year estimates) and 2010 (ASSA model) have been calculated using an exponential (compound growth) function. For sensitivity analysis the resultant population estimates were noted to be higher than the Abt figure of 44.7 million in 2009[54] and lower than the Bureau for Market Research (Personal communication: Bureau for Market Research) estimate of 49.8 million. The latter two have been used to derive low and high estimates for sensitivity modelling and scenario analysis.

The public sector user population proportion has been derived from population surveys conducted by Statistics South (General household survey).[18,19,24,25,26] Although this differs very slightly from beneficiaries reported by the Registrar of Medical Schemes, the latter has not until recently provided provincial estimates. Two recent reports of the Registrar did provide provincial membership data which differ from the survey results in some cases. This appears to be in part because the Registrar reports on location of employed principal members, whereas in some cases beneficiary distribution may differ. Given that there may be some problems with the data the survey data is used for the present.[27,28] For forward estimates of medical scheme coverage a conservative and very gradual 0.1% increase in medical scheme coverage per year (and corresponding decrease in public coverage) is forecast. This estimate may be overly conservative given proposals for social health insurance[29], recent tax changes of the treatment of medical expenditure[30] and the development of proposals for a new category of low income medical schemes. Nevertheless over the past few years real costs of medical scheme membership have continued to increase significantly and membership as a proportion of the population has been declining for some years.[27]

Table 8.3 Population projection

Option 1	Total	Public %	Public sector users
1996	40,583,939	83.6%	33,928,173
1997	41,226,600	83.6%	34,465,438
1998	42,130,400	83.6%	35,221,014
1999	42,897,260	83.6%	35,862,109
2000	43,690,856	84.0%	36,693,996
2001	44,574,050	84.4%	37,607,596
2002	45,468,627	84.8%	38,537,654
2003	46,170,834	85.1%	39,279,813
2004	46,590,907	85.1%	39,656,624
2005	46,932,833	85.1%	39,947,660
2006	47,317,883	85.0%	40,220,200
2007	47,706,092	84.9%	40,502,472
2008	48,097,485	84.8%	40,786,667
2009	48,492,090	84.7%	41,072,800
2010	48,889,932	84.6%	41,360,882

Consideration was given to including the effects of aging on demand in the main model. In developed countries the effect of aging has been an important driver of demand, with persons over the age of 65 years costing approximately four times that of those under 65.[31] However addressing the effects of HIV/AIDS, reversing the historical crowding out of hospital admissions and improving access in all components of the model were found to far exceed the effects of aging – the proportion of elderly increases from 4.8% to 5.1% over the period from 2004 to 2010 (Table 8.4), with relatively limited effect on cost compared to other cost drivers.[20] The proportion of children under five years and women of reproductive age decline slightly over the period to 2010 (Table 8.5). Given the substantial provision made in the model for increasing demand and the increased complexity of an age based model, it was decided that sufficient provision for increasing demand is already factored into the model to more than cover the effects of aging. However the section below on hospital admissions includes a sensitivity analysis based on a regression model taking into account the effects of demographic change.

Table 8.4 Demographic change

Population (thousands)	**1996**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Elderly 65 years and older	1,826	2,233	2,285	2,332	2,373	2,411	2,448	2,490
% of total	4.4%	4.8%	4.8%	4.9%	4.9%	5.0%	5.0%	5.1%
Females 15-45 years	10,336	11,781	11,836	11,876	11,904	11,927	11,949	11,974
% of total	24.7%	25.1%	25.0%	24.9%	24.8%	24.7%	24.6%	24.5%
Children under 5 years	5,040	5,212	5,184	5,157	5,126	5,097	5,057	5,020
% of total	12.0%	11.1%	10.9%	10.8%	10.7%	10.5%	10.4%	10.3%

Source: Actuarial Society 2003[23]

Funding module

The funding module has been presented in Chapter 3 and 4 of this thesis as part of a larger analysis of public sector health service funding.

PRIMARY HEALTH CARE MODULE (PHC)

The primary health care (PHC) module is one of the most important components of the model, given the importance of PHC in the new health system[32,33] and that it constitutes 20-30% of service expenditure. In line with the needs (Chapter 6) and national policy framework (Chapter 7) the module to be designed must provide for the structural establishment of the District Health system, for primary health care visits to increase progressively to approximately 3.5 per capita and for public health interventions and programmes to improve public health.

Previous work

A number of methodological approaches developed in South Africa to model funding requirements for PHC were reviewed. These include:

A national Committee of Inquiry examined several possible PHC delivery models.[34] One of the tools developed was based on an idealised health district of 100 000 persons, with modelled numbers of personnel of various types and other inputs.

An important advance was the development of a package or basket of PHC services. This specified the detailed composition of what was initially called the core and later the comprehensive package of PHC services.[35] A cost model for the package was developed by the Centre for Health Policy Centre (CHP).[36] This was based on an analysis of utilisation and costing of different types of PHC services (e.g. child care, antenatal, adult curative) at clinics and community health centres. The less expensive CHP model cost was based on a PHC visit (headcount) rate of 2.45 per capita at an average cost of R71 per visit (1999 prices). In 2005/06 prices this would amount to a per capita funding level of R251 or R358 at a higher utilisation rate of 3.5 visits per uninsured person. A set of (mainly unquantified) norms and standards was subsequently published by the Department of Health.[37]

Building on the CHP modelling and informed by their own costing of a selection of PHC sites, an official recommendation on the cost of the PHC package was subsequently developed by the Department of Health.[38] This suggested a funding norm of R173 per capita in 2001/02 prices (R218 in 05/06 prices).

A useful staffing model of clinics, community health centres and mobiles of various types and sizes was developed by Krause.[39] It was partially applied in the Eastern Cape Province. Although providing a very useful basis for personnel costing, the complexity in its extensive range of facility sizes and types and lack of non-personnel data has perhaps limited its wide use.

Another PHC costing tool was developed by Equity Project, Collins et al (Management Sciences for Health, USAID).[40] This extremely complex spreadsheet model was based on very detailed costing of inputs for each of a wide range of service areas (e.g. women's health, children's health).

The Department of Health's unpublished 2004 version of the Integrated Health Planning Framework (Personal communication: Department of Health 2004) used facility based surveys in several provinces to determine gaps in the actual provision of the PHC package compared to the nationally defined comprehensive package. It then adjusted existing baseline expenditure upwards to address these gaps and allow for increased utilisation rates to at least 3.4 per capita uninsured. This derived a proposed funding norm of R332 per capita per annum.

A significant recent re-costing of the financial resource requirements for the PHC package has recently been conducted for the Department of Health (Personal communication: Department of Health and Health Economics Unit 2004). This suggested a significantly higher cost of R420 per capita by 2007/08 or R310 if services were delivered only by clinics and community health centres and not district hospitals. This reviewed unit cost data from 16 facility based costs analyses and 21 district health expenditure reviews, finding an average of R63.35 per visit (03/04 prices). This was scaled up to include additional costs of voluntary counselling and testing for HIV/AIDS, scarce skills and rural allowances for doctors, a recent costing of environmental health services and the costs of implementing a national community health worker programme. Unit costs were also significantly upwardly revised because of 16% of visits being costed at district hospital rates of R239-R248 per visit. These brought unit costs up to R93-96 per visit. Most significantly the target utilisation rate of 3.85 visits per capita uninsured was used based on increased utilisation because of HIV/AIDS. The study suggested R300 per capita should be considered the basic benchmark (03/04 prices).

Proposed module: Facility based services

The author has built on previous work to develop a normative costing module for primary care services. The results of the module are used with reference to the outcomes of some of the other funding models described above.

For the facility based services, the approach used has been based on a combination of three facility types: clinics, community health centres and mobile clinics. A tiered model is used in which a number of clinics are clustered around a community health centre. The tiered approach has advantages in that clinics can be placed within close proximity to communities to facilitate access, whereas less frequently used services can be grouped within the community health centre (CHC). The author has modelled thresholds for different service components which help to inform whether a given service should be located within a clinic or community health centre depending on their drainage population. Threshold modelling for a primary care nurse suggest that for a clinic to fully occupy 1 professional nurse (30 consultations per day, 7107 consultations per year) a minimum population of 2000 persons would appear to merit the smallest fixed clinic. (This is also the same size as a typical single GP list in the United Kingdom). Below this community size satellite clinics or mobiles are likely to be more appropriate.

The model starts with a notional population of 100 000 uninsured persons as in the Committee of Inquiry Report.[30] For the purpose of this discussion we will refer to this population as the sub-district.

Currently 77% of households live within 5km of a clinic and 93% within 10 km (Department of Health, Integrated Health Planning Framework 2005). A previous study showed that 62.7% of the population lived within 2km of a clinic, which allows for a half hour walking time.[41,42] Ideally it is assumed that the largest proportion of population possible should live within 2-5km of a clinic.

Visit rates were modelled for options ranging from 2.5 (2004/05 baseline) – 3.85, as recommended by a recent costing paper (personal communication Department of Health 2005)[83]. The proposed norms are partially derived from previous South African work on need for primary care services.[43]

For the purpose of the model varying proportions of projected visits were allocated across three facility types (clinic; community health centre (CHC); mobile clinic), with the starting distribution being in a ratio of 75:20:5 (District Health Information system 2003). Higher use of CHCs is modelled in the more expensive scenarios. The primary user population was distributed using the same proportions. For clinics an average user population of 10 000 per clinic was used generating 7.5 clinics (for a primary user population of 75000, i.e. 100 000 less primary CHC and mobile users). For community health centres a drainage population of 100 000 was used (i.e. 1 CHC for the sub-district). The outcome of this approach for the country suggests a requirement of 3023 clinics and 403 community health centres. There are currently approximately 2827 clinics, 439 satellites and 263 community health centres. This suggests a shortage of approximately 140 community health centres, which should be developed, either by upgrading clinics, downgrading district hospitals or constructing new facilities.

Cost models have been developed for each of these facility types. A central component of the cost model is the staffing model. Various PHC staffing models were available including models by Krause, the Committee of Inquiry model[30], a recent model developed by Daviaud (personal communication: Ms. E. Daviaud) and a Western Cape provincial staffing model. Of these, the Daviaud model has been selected given its firm foundation on detailed assessments of clinical contact time, timing of consultations and workload capacity. This model has been adapted using the Committee of Inquiry staffing model, particularly in the community health centre component in order to make provision for a more diverse range of human resource types (pharmacist, radiographer, physiotherapist, dentist etc.) Table 8.5 shows some of the key staffing ratios. Based on these the staff required for a sub-district population of 100 000 is shown in Table 8.8.

Table 8.5 Primary health care staffing ratios

	Clinic	Community Health Centre
Doctor	8 visits per clinic per month	20% of visits referred to doctor
Professional nurse (PN)	1 full time equivalent (FTE) per 7107 annual visits excluding DOTS (6350-7500);	1 FTE per 7107 annual visits excluding DOTS (6350-7500);
Enrolled nurse	57% of PN/2	57% of PN/2
Enrolled nursing assistant	(57% of PN/2) + 1FTE per 29760 annual DOTS visits	(57% of PN/2) + 1FTE per 29760 annual DOTS visits
Counsellor	1 FTE per 2976 persons councelled	1 FTE per 2976 persons counselled
Administration	1 FTE per 32960 visits	1 FTE per 32960 visits
General assistant	1 FTE per 49 441 visits	1 FTE per 49 441 visits
Security		3.8 per 100 000 population
Pharmacist		2.5 per 100 000 pop
Pharmacy assistant		2.5 per 100 000 pop
Social worker		1.3 per 100 000 pop
Dentist		1.3 per 100 000 pop
Oral hygienist		1.3 per 100 000 pop
Radiographer		2.5 per 100 000 pop
Physiotherapist		1.3 per 100 000 pop

Source: Personal communication E. Daviaud and Committee of Inquiry[30]

Table 8.6 Personnel for a district of 100 000 persons*

	Clinic	Community health centre (CHC)	Mobile	Total
Doctor	2.4	2.1		4.4
Professional nurse	36.3	13.0	3.1	52.3
Enrolled nurse	10.3	2.8		13.1
Enrolled nursing assistant	10.5	2.8	1.8	15.1
Counsellor	6.9	1.9		8.8
Administration	8.0	2.1		10.1
General assistant	5.3	1.7		7.0
Security		3.75		3.8
Pharmacist		2.5		2.5
Pharmacy assistant		1.25		1.3
Social worker		1.25		1.3
Dentist		1.25		1.3
Oral hygienist		2.5		2.5
Radiographer		2.5		2.5
Physiotherapist		1.25		1.3
	79.7	42.6	4.8	127.1

* Based on visit rate of 3.5 distributed 75:25:5 across clinics, CHCs and mobiles

Various alternate models were also explored. A model with nurse-doctor teams was developed based on data suggesting that the existing model has inadequately trained primary care nurses (only 40% of facilities have professional nurses with adequate training[18]), inadequate doctor support (only 30% of clinics are visited by a doctor at least once a week[38,45] and only 10% of patients are referred to doctors (DHIS 2004) and inadequate access to specialist consultations in at least seven of the nine provinces. This alternate staffing model has a full-time doctor (as opposed to 8 doctor visits per month) for each clinic with a workload exceeding 100 patients per day. This would lead to nurse-doctor teams a ratio of 3-4 professional nurses per doctor. This alternate model was costed at an additional R6 per clinic consultation.

Medicine costing is based on the proportion of patients receiving medicines, the average numbers of items per script and the average cost per item. Data for these variables has been sourced from the Community Health Services Organisation in the Western Cape Province (personal communication Mr. V. Titus Department of Health).

Table 8.7 Medicine costing

	Clinic	Community Health Centre
Proportion receiving medicines	90%	90%
Medicines per script	1.3	1.8
Cost per item	11	15
Cost of medicines per visit	13	24

Source: Based on pharmaceutical data from Western Cape Province (personal communication Department of Health)

The approach to assessing annualised building and maintenance costs has been adapted from an approach used the national Department of Health (personal communication Department of Health) and shown in Table 8.8. In this approach building costs are estimated from the average number of planning units (examination rooms) per facility, total area per planning unit and current average building cost per m^2 for facilities of this type. Maintenance costs are estimated at 3% of capital value annually (sensitivity analysis 2%-4%). Capital costs are annualised over a 20 year period. Cost data from a construction of a number of clinics and community health centres in the Western Cape were analysed (personal community Western Cape Department of Health and City of Cape Town) to validate recent building cost data.

Table 8.8 Annualised building and maintenance cost

	Clinic	Community Health Centre
Planning unit number (examination room)	4.6	9.2
Area per planning unit (m^2)	100	125
Area	458	1,144
Building cost per m^2 (Rand)	7,000	8,000
Cost to build facility (Rand)	3,202,614	9,150,327
Maintenance (3%)	96,078	274,510
Depreciation over Lifespan (20years)	160,131	457,516
Total per facility per year	256,209	732,026
All facilities (R million)	1,922	732
Per consultation (Rand)	7.3	10.5

Source: Based on national Department of Health infrastructure planning guidelines and recent Western Cape projects (personal communication National and Western Cape Departments of Health)

Table 8.9 Annualised equipment and furnishing cost

	Clinic	Community health centre
Equipment as % of building value	20%	30%
Equipment value (Rand)	640,523	2,745,098
Maintenance (10% per annum)	64,052	274,510
Depreciation over 10 yrs	64,052	274,510
Total	128,105	549,020
Per consultation	3.7	7.8

Source: Based on national Department of Health planning guidelines (personal communication Department of Health)

Table 8.10 Total normative cost per consultation

Rand per visit	Clinic	Community Health Centre	Mobile	Weighted average
Personnel	36	78	32	
Medicine	13	24	13	
Capital	7	10	10	
Equipment	4	8	4	
Other non-personnel non-capital	8	13	8	
Cost per visit	68	134	67	81
Excluding capital and equipment	57	116	53	

* Includes annualised capital costs of building and equipment

District Management

There are few fully staffed district health offices in South Africa to use as a model for costing. As a potential model two long-established regional offices (Southern Cape and Boland Overberg) with extensive experience in decentralised management were costed. These amounted to R15-20 million per office. These were used as a base to develop the model option shown in Table 8.11. The proposed organogram has been designed to include components for health service management and support, public health, support services and administrative functions. The model makes provision for a staff complement of 76 persons per district management team of which 20 function in the area of public health and programmes. Provision is also made for a number of community specialists such as a paediatrician and psychiatrist who would support clinical services across the district as well as providing higher level contributions to service design and training. Until more definitive work becomes available on the structure of district management offices in South Africa, it is proposed that this be used in the model.

The district management team described here is intentionally fairly large to allow for strong movement towards a decentralised District Health System, given relatively slow progress in establishing an effective system over the first decade of democracy. The structure is provided with sufficient financial, procurement and human resource management skills to enable decentralised management. The sizable programme and professional health service support components are intended to contribute towards significant improvement in quality of primary health care services in the context of fairly large district sizes in South Africa.

Table 8.11 District management team

	N	Unit cost	Cost (rand)		N	Unit cost	Cost
District manager	1	558,306	558,306	**Finance**			
Secretary	2	72,376	449,718	Director	1	473,991	473,991
				Clerks	8	72,376	579,008
Public health and programmes							
Health programs Dir and assistant	2		546,367	**Procurement**			
Public health specialist +registrar	2		1,029,422	Deputy director	1	339,825	339,825
Information officers	2	136,338	272,676	Clerks	8	72,376	579,008
TB DD	1	339,825	339,825				
HIV DD	2	339,825	679,650	**Personnel**			
STDs DD	1	339,825	339,825	Deputy director	1	339,825	339,825
Child health DD	1	339,825	339,825	Clerks	8	72,376	579,008
Maternal health DD	1	339,825	339,825				
Family planning DD	1	339,825	339,825	**Domestic**			
Health promotion DD	1	339,825	339,825	Cleaning	4	65,129	260,515
Mental health DD	1	339,825	339,825	Groundsmen	1	65,129	65,129
infectious diseases DD and outbreak response	3		714,625	Kitchen	2	65,129	130,258
Chronic diseases of lifestyle DD	1	339,825	339,825				
Trauma DD	1	339,825	339,825	**Pharmacy**			
				District pharmacist	2		449,718
				Store workers	8	72,376	579,008
Health service support				**Transport and logistics office**			
Clinical services director and support+secretary	2		556,100	Manager	1	238,462	238,462
Health service planning and evaluation	2	339,825	679,650	Drivers	4	72,376	289,504
Community paediatrician	1		558,798				
Community psychiatrist	1		558,798	**Maintenance**			
Community obst	1		558,798	Clinical engineer	2	136,338	272,676
Surgeon	1		558,798				
Physician	1		558,798				
				Personnel: total	76		16,514,916
				Non-personnel			6,605,966
				Total			**23,120,883**

PUBLIC HEALTH SERVICES AND COMMUNITY CARE SERVICES

Public health services include a wide range of activities such as environmental health, health promotion, school health services, infectious disease control and management of outbreaks, malaria control activities, nutrition programmes and so forth. Community based care services include community health workers generalist or specialist cadres such as home based care workers, tuberculosis treatment supervision (DOTS), rehabilitation programmes. Also included are community based supervision of psychiatric patients discharged from long term psychiatric care etc. Many of the components of these important areas have not been adequately costed for the country as a whole and require attention.

The model envisages a network of community based and public health services consisting of amongst others:

- A component in each district office dealing with public health and programmes of 20 persons as described above. This would include a public health specialist and registrar in every district as well as managers of a range of strategically important health programmes.
- Two community health nurses per community health centre providing public and community health nursing and supporting community health workers
- One environmental health officer per 15000 user population. The model is based on work by Haynes.[46] This was costed with further provision for laboratory and other non-personnel costs. In 2005/06 prices, estimates ranged from R478-R662 million or between R11-16 per capita.
- A network of community health workers based on one community health worker and two auxiliary workers per 250 households (sensitivity analysis from 100-300), with associated costs of materials and equipment, training, management and support. The model is based on work by Friedman.[47] Coverage of only 50% of the population is assumed and the costing is based on a stipend of R1000 per month. It is intended that Community Health Workers play a role in improving adherence to TB treatment which is currently a serious concern (48% cure rate in 2005/06[48]).
- School health services based on a team of two nurses serving twenty schools. For 25 582 schools this would cost R462 million.
- Further provision for a number of other programmes including preventive programmes for chronic diseases which are major causes of death such as cardiovascular disease, stroke and diabetes including lifestyle actions such as anti-smoking measures. Other areas for which some provision is made, but which require more detailed costing include community based mental health services, further outreach to institutions such as old age homes, malaria control, improvements to the national TB programme[49] and other aspects of health promotion.

HIV/AIDS MODULE

The HIV/AIDS programme should contain a range of effective and cost-effective preventive and treatment interventions (Table 8.12).[50-55] Various specific interventions were modelled as part of a national programme. A selection of these is discussed in the sections which follow.

Table 8.12 HIV/AIDS Interventions

Prevention	Type	Motivation
Condoms	Purchase; primary and secondary distribution	Decrease HIV transmission by 80-90%
Sexually transmitted disease programs		Critical co-factor in HIV transmission in Africa
Information and education programs (IEC)	Mass media etc.	
Targeted	-School based programmes e.g. life skills -Work-place based programmes :firms, civil service, military -Women's health and organisations - Homosexual -Occupational exposure e.g. needle stick injuries -Sex worker - Infected persons	Each target group has particular focus. Sex workers and other high frequency transmitters are critical in epidemic propagation.
Voluntary counselling and testing		
Mother to child transmission prevention program		Decrease transmission by 50% or more depending on regime
Care after sexual abuse		
Care		
Home and community based care		Substitute for expensive hospital care
Step-down facilities		Substitute for expensive hospital care
Development of protocols and referral pathways		
Medications for opportunistic infections		
Secondary prevention	E.g. INH for TB; Cotrimoxazole	
Hospitalisation		
Antiretroviral treatment		
Management		
National and provincial programme management		
Research		
Vaccine development	South African AIDS Vaccine Initiative (SAAVI)	
Behavioural surveillance		
Evaluation of programme components		

CONDOMS

There is clear evidence of effectiveness of condoms in reducing pregnancy, HIV and STD transmission, for example through meta-analyses of studies of condoms in preventing HIV infection in couples with discordant HIV status.[56] The method used to cost condoms is based on volume projections and unit costs. The number of condoms distributed increased from 130 million in 1997 to 347 million in 2004/05.[57] This has accompanied increasing mass awareness of the epidemic. Various increasing uptake projections were modelled and Table 8.13 shows an option with gradual levelling off of uptake. Based at 22c per item this would require R137 million by 2010. Normative modelling is unlikely to be reliable, but for comparison purposes note that if 70% of the uninsured male population from 15-45 years used an average of 100 condoms per year, this would require 683 million condoms in 2005/06.

Table 8.13 Costing of male condoms

	Male condoms million	Annual change	Condoms per uninsured male15-45 years per annum	Rand million
97/98	130		15.8	28
98/99	150	15.4%	17.8	32
99/00	198	32.0%	22.8	43
00/01	274	38.4%	30.8	59
01/02	209	-23.7%	22.9	45
02/03	267	27.8%	28.5	58
03/04	302	13.1%	31.6	65
04/05 actual	347	14.9%	36.1	75
05/06 projection	392	13%	40.5	85
06/07	439	12%	45.0	95
07/08	487	11%	49.5	106
08/09	536	10%	54.0	116
09/10	584	9%	58.4	127
10/11	631	8%	62.5	137

The use of female condoms has been piloted in 27 sites over the past 3 years. Only 1.1 million were used in 2004/05. They are relatively expensive (R6.50 per condom), but can be re-used several times and are indicated only when male partners refuse to use male condoms. The Department now intends to rollout to 114 sites.

Table 8.14 Female condoms

	2006/07	2007/08	2008/09
Number	3,000,000	4,000,000	5,000,000
Cost R000	19,494	25,992	32,490

*Based on R6.50 per female condom, targets are derived from Department of Health

MOTHER TO CHILD TRANSMISSION PREVENTION

The case of the mother-to-child prevention programme has presented a fascinating yet tragic case of public financing and policy. The Department of Health proposed that the programme be extended to 100% of mothers in 2006/07.[58] A unit cost of R321 per public birth is costed in Table 8.15 below.

Table 8.15 Mother-to-child prevention programme

05/06	Cost per item R	Scale	Number	Total R000
Births per year			860,863	
Rapid HIV test	12.6	90%	774,777	9,738
Confirmatory	12.6	32%	247,929	3,116
Child test	12.6	30%	232,433	2,921
Confirmatory	12.6		232,433	2,921
Infant feeding	565.6	30%	232,433	131,466
Counsellor	45,248	1 per 1000	861	38,953
Niverapine	33.9		247,929	8,414
Cotrimoxazole for infant	56.6		232,433	13,147
Training per counsellor	6,284		861	5,410
Stationary	5.0	Per birth	774,777	3,874
Training of obstetric personnel	5.0	R5 per birth	774,777	3,895
3 visits per child	75	3	232,433	52,586
Total Rand 000				**276, 442**
Total per birth (Rand)				321

Table 8.16 compares this estimate with three other unpublished sources and finds it to be comparable. These include the costing of the initial 18 pilot sites undertaken by the Department of Health. The pilot sites cost on average R314 per birth (05/06 prices). Costing undertaken by the Western Cape provincial department suggested that the intervention can be offered at R225 per birth and work by Professor N. Natrass[54] (personal communication Department of Economics, University of Cape Town) suggested R230 per birth.

Table 8.16 Comparison of estimates prevention of mother-to-child programme

05/06 prices	Department of Health Costs of pilot sites	Natrass	Western Cape provincial model	Authors estimate
Births per year	860,863	860,863	860,863	860,863
05/06	314	230	225	321
Total Rand 000	270,540	197,798	193,670	276,442

Table 8.17 suggests that the intervention costs approximately R 7938 per infection averted. New data suggests that dual therapy used for a limited period for prevention is however far more effective and it is likely that provision will need to be made for this improvement.

Table 8.17 Cost per infection averted

Births to infected women (29.5% prevalence)	228,559
Transmission rate	33%
Infected children without intervention	75,425
Transmission rate after intervention	18%
Reduction	15%
Infections averted annually	34,284
Cost per child infection averted (Rand)	7,938

It is worth noting that although prevention with Niverapine is the current national policy, that dual prevention which adds AZT is more effective and should preferably rapidly be introduced as a preferred regimen.

Home based care (HBC)

Since repeated hospital based care for terminal AIDS is expensive and not particularly effective, it is important to develop cheaper care substitutes. One of these is home and community based care. Several different models of HBC have been developed, largely by Non-governmental Organisations. The module used below is a joint one of the Department of Health and the Department of Social Development (personal communication Department of Health).

The module is based on HBC teams. Each team has 8 HBC workers, a vehicle, a supervisor, one child and youth care worker, one part time social worker, one part-time nursing support and provides some infrastructural support for a child care forum operated by volunteers. HBC workers are paid a stipend of R1000 per month. The total team is costed at approximately R708,423 per year, with R322 000 set up costs. The stipends paid are fairly low in this model and should almost certainly be increased.[60]

Table 8.18: Operating Costs of One Community and Home Based Care Team and Support Services

Set-Up Costs	(One off)	Personnel	(Annual)	Non-Personnel	(Annual)
Equipment		**Core Team**		**Admin & Transport**	
Computer equipment	40,000	1 x Manager	106,805	Phone & Fax	9,600
Fax machine	5,000	Child & Youth Care Worker	14,400	Vehicle maintenance	12,000
Photocopier	8,000	Admin. Worker	14,400	Fuel	12,000
Vehicle	131,000	8 x CCGs (R1000 per month)	96,000	License	200
		10 x Child Care Cttee members (R500)	60,000	Insurance	3,600
Training				Bus & Taxi fares	21,600
Manager (10 days x R500)	5,000	**District Support**		Premises (rent / maint /rates)	41,400
8 CCGs (59 days x R250)	118,000	0.5 x Professional Nurse	68,169	Community meetings	13,000
Child & Youth Care Worker	5,000	0.5 x Social Worker	68,169		
Child Care Committee members	10,000			**Materials**	
				HBC supplies	60,380
				IEC materials	25,000
				Fund	
				Self-help / income generation	43,200
				Training	
				In-service training / refresher	9,000
				Attrition replacement	29,500
Set-Up Sub-Total	322,000	Personnel Sub-Total	427,943	Non-personnel Sub-Total	280,480
Set-Up Sub-Total	322,000	Operational total (personnel plus non-personel)			708,423
Total cost per team including capital annualised over 5 years					772,823

The model is constructed on 1 team caring for 400 AIDS sick per annum at an average of six visits per person. Table 8.19 shows an increase of HBC to 623 teams by 2010. If the output of a team is 2400 home visits per year, then the average cost of an admission substitute is R1932 and at an average of six visits per team visit cost is R322. This is much cheaper than hospitalization, but much more expensive than a facility based primary care visit, suggesting that home based care should be used for patients who are not ambulant and that attention must be given both to the output and efficiency of these teams.

Table 8.19 Cost of home based care

Year	AIDS admissions diverted to home based care	Home based care Teams	Cost Rand thousand
1996/97	10,436	26	14,506
1997/98	18,237	46	25,349
1998/99	29,905	75	41,568
1999/00	46,312	116	64,373
2000/01	67,954	170	94,456
2001/02	93,916	235	130,543
2002/03	123,116	308	171,131
2003/04	153,630	384	213,546
2004/05	183,963	460	255,709
2005/06	201,632	504	280,268
2006/07	216,810	542	301,366
2007/08	228,223	571	317,230
2008/09	236,365	591	328,547
2009/10	241,153	603	335,202
2010/11	249,080	623	346,221

It should be noted that there is an overlap between the home based care model depicted and the community health worker (CHW) model described in the section on primary health care. In general Department of Health Policy is shifting to a generic CHW cadre[41]. However the two models are both presented here pending final resolution of this matter.

Antiretroviral treatment for HIV/AIDS

Antiretroviral (ARV) treatment for AIDS is effective. A systematic review and meta-analysis of 54 randomised controlled trials done on ARVs[61] found 18 trials which compared AZT against placebo with reduced disease progression and death (OR 0.7). Sixteen subsequent trials compared 2 drug versus single drug regimes. People on dual therapy had less chance of death and disease progression compared to those on a single agent (OR = 0.6). Twenty trials compared triple therapy with dual therapy. People on triple therapy again had less chance (OR=0.6) of disease progression or death compared to dual therapy.

Several South African treatment sites have shown efficacy in the South African context. The AID for AIDS programme provides disease management programmes for several of South Africa's largest medical schemes. It has the largest South African cohort of patients with AIDS on treatment and has shown remarkable success rates, (personal communication 2003). The pilot sites established by Medicines sans Frontiers in Khayelitsha have shown good survival patterns on treatment in a poor township setting.[62] Approximately 190 South African public sector sites provide treatment to 178 000 persons by July 2006 (www.health.gov.za). A local cost-effectiveness study found an annual cost of R9359 per year, with lifetime cost of R93000 on ARVs vs. R24000 for those without treatment, with modelled life expectancy of 8.33 years on treatment.[63]

The author has developed a module to cost ARV treatment. This has contributed to National Treasury decisions in funding the treatment strategy[63] (e.g. the 2003/04 Medium Term Expenditure Framework budget allocated R500 million, R1 billion and R1.5 billion over three years). The approach is based on numbers of cases on treatment (progressively addressing need) and unit cost. Need for treatment has been assessed in a model considering numbers of AIDS cases (baseline and annual incident), treatment coverage (reflecting uptake and supply constraints) and adherence and survival. Because of the wide variability in projected costs of the treatment programme an approach has been developed which allows for easy simulation of different uptake and adherence options.

There have been several epidemiological and demographic models of HIV/AIDS developed in South Africa. Amongst the best known are the Actuarial Society of South Africa (ASSA) model developed by Dorrington[64] and the Metropolitan Life model developed by Doyle and subsequently adapted and utilized by the Abt group for modelling the epidemic in South Africa. The Department of Health previously developed a model with the support of UNAIDS known as Spectrum. Given the high level of development of the existing models, their outputs have been used as a basis for determining numbers of prevalent AIDS cases in the base year and incident cases for each year thereafter. The ASSA model has been selected based on its regular updating and calibration against various data sources.

Substantial uncertainty pertains to the level of uptake of ARVs, given demand and supply constraints in South Africa and to adherence and survival rates once treatment has commenced. Given the wide variation in ARV costing a "treatment numbers calculator" has been developed and a near maximum assessment of need using this tool is shown in Table 8.20.There is little data in the literature on uptake of anti-retrovirals. Data from private sector medical schemes in South Africa have suggested that take-up and participation in disease management programmes is lower than anticipated.[65] The International Monetary Fund has suggested that even 10% coverage in Africa would be a positive development but that without donor support several African countries will have difficulty achieving this.[66] In the year to September 2006/07 124 985 persons commenced ARV therapy, equivalent to 26% of incident AIDS cases for the year. In the options which follow phasing up to 50%-90% treatment coverage for new stage 4 cases has been modelled.

While international programmes[67] and private sector AID for AIDS data (personal communication: Aid for AIDS, 2003) suggests adherence of 95% and survival of 95%-98% of remaining cohort per year this is far higher than adherence rates in South Africa's TB programme, where six month adherence rates amount to 65-70% annually[68]. Adherence and survival rates on treatment were modelled at levels between 65%-93% annually.

Table 8.20 Maximum assessment of need for anti-retroviral treatment*

	Model assumptions		Coverage by 2010		90%		Annual adherence and survival				93%
	Year	New AIDS (stage 4)cases per year	% initating ARV treatment	Starters Yr1	Yr 2	Yr 3	Yr5	Yr6	Yr7	Yr8	Cumulative number on treatment
1	03/04	345,479	0%	0							0
2	04/05	396,472	7%	28,443	0						28,443
3	05/06	439,661	17%	73,531	26,452	0	0	0	0	0	99,983
4	06/07	474,012	26%	124,985	68,384	24,600	0	0	0	0	217,969
5	07/08	499,377	60%	299,626	116,236	63,597	22,878	0	0	0	502,338
6	08/09	515,370	90%	463,833	278,652	108,100	59,145	21,277	0	0	931,007
7	09/10	522,687	90%	470,418	431,365	259,147	100,533	55,005	19,787	0	1,336,255
8	10/11	522,737	90%	470,463	437,489	401,169	241,006	93,495	51,155	18,402	**1,713,180**
Cumulative starters				1,931,300							

* Based on 93% annual adherence and survival and 90% of new AIDS cases initiating treatment by 2008

Table 8.20 shows that in a maximum scenario of need with 90% coverage of incident new cases by 2010 and 93% annual adherence, 1,713,180 persons would be on treatment by 2010/11. A low option (Table 8.21) has 563,526 persons on treatment by 2010/11 (although cumulative starters exceed 1 million). The main option is shown in the next chapter.

Table 8.21 Number of persons on treatment (low option)

	Model assumptions		Coverage by 2010		50%		Annual adherence and survival				65%
	Year	New AIDS (stage 4)cases per year	% initating ARV treatment	Starters Yr1	Yr 2	Yr 3	Yr5	Yr6	Yr7	Yr8	Cumulative number on treatment
1	03/04	345,479	0%	0							0
2	04/05	396,472	7%	28,443	0						28,443
3	05/06	439,661	17%	73,531	18,488	0	0	0	0	0	92,019
4	06/07	474,012	26%	124,985	47,795	12,017	0	0	0	0	184,797
5	07/08	499,377	31%	154,807	81,240	31,067	7,811	0	0	0	274,925
6	08/09	515,370	37%	190,687	100,624	52,806	20,193	5,077	0	0	369,388
7	09/10	522,687	43%	224,755	123,946	65,406	34,324	13,126	3,300	0	464,858
8	10/11	522,737	50%	261,369	146,091	80,565	42,514	22,311	8,532	2,145	**563,526**
Cumulative starters				**1,058,577**							

Medicines have until recently been the largest cost in ARV programmes, so the methodology focuses on this area. Clinical protocols were compiled by an expert clinical panel constituted by the Bilateral Taskteam and are based on WHO recommendations.[69] Medicine prices were derived from a range of sources including AID for AIDS (personal communication), Medicines sans Frontiers[61] and quotes received from a range of companies. Table 8.23 shows reduction in prices of these medicines in the year preceding the award of the first large national tender. For each medicine a series of prices is shown: differential prices by the patent holder (private sector, corporate or Non Governmental Organisation rate), cheapest international and local generics and the final public sector price. For a period a large number of substantially cheaper generic medications were not used either because they were not yet registered or licensed in South Africa. For example the South African private sector during one period paid R729 per month for Lamivudine (3TC) whereas the cheapest international generic cost R41. Government at one stage paid R410 per month for Niverapine whereas there was a registered (but unlicensed) generic for R40 per month!

Table 8.22 Evolution of anti-retroviral medicine prices from 2003/04 to award of national tender (Per person cost in rand per month)

Rand per month	SA private sector 2003	SA corporate or NGO rate	Cheapest international by patent holder#	Minimum international price generic#	Sept04 Local generic producer	Public sector price after tender award
Stavudine (D4T)	100	100		19	22	20
Lamivudine (3TC)	729	96		41	36	34
Niverapine	410	369	274	40	42	42
Effavirens	346			Not cheaper than innovater		214
Zidovudine (AZT)	553	253	171	88	78	78
Didanosine (DDI)	262	262		116	96	65
Rotinovir/ Liponavir (Kaletra)	477	477	313			313

*Cheapest international prices from Medicines sans Frontiers[70]

Table 8.23 shows the cost of combination regimens. One first line regimen with Niverapine (for women of child-bearing age) cost R1239 in the private sector in early 1993 and this was reduced to R95 by the time the tender was awarded.

Table 8.23 Costs of combination regimens per person (Rand per month)

Rand per month	SA private sector 2003	SA NGO or corporate cost 2003	Minimum international price generic#	Tender per month
Stavudine+Lamivudine+Niverapine	1,239	565	100	95
Stavudine+Lamivudine+Effavirens	1,175	542	270	268
AZT+DDI+Kaletra	1,292	992	516	456
AZT+3TC+Niverapine	1,282	718	168	153

Table 8.24 shows weighted costs given estimated proportion of persons using different treatment regimens. This suggests a weighted average medicine cost of R2,832 per month. Provision is made in the costing for 15% of patients to use second line therapy.

Table 8.24 Weighted medicine unit costs

Rand per month	Distribution	SA private sector 2003	SA NGO or corporate cost 2003	Minimum international price generic#	Public sector price
Stavudine+Lamivudine+Niverapine	30%	372	170	30	29
Stavudine+Lamivudine+Effavirens	50%	588	271	176	134
AZT+DDI+Kaletra	15%	194	149	77	68
AZT+3TC+Niverapine	5%	64	36	8	8
Weighted average per month		1,217	625	292	239
Weighted average per year		14,605	7,502	3,501	2,862

An estimate for other costs is shown in Table 8.25, largely based on costing by Cleary.[86] This suggests a total unit cost of R6,534 per annum. This estimate is consistent with other recent sources.[54]

Table 8.25 Total unit costs for antiretroviral treatment 2005/06 prices

Unit cost	Rand per year
Medicines	2,862
Laboratory tests	724
Personnel	1,420
Nutrition	608
Other costs (capital, programme costs, administration)	492
Sub-total	6,106
Contingency margin 7%	427
Total	6,534

These low and high cost estimates are now combined with the estimates of numbers on treatment to provide cost options. The unit costs in the previous table are shown in the middle option in the 6 below. Sensitivity analysis around this figure is shown as low and maximum options with all costs declining by 2%-3% annually as medicine prices decrease. If resistance levels to first line therapy increase to above 15%, this will exert upward pressure on unit costs. The results of the low and maximum options show great divergence, given the large range of variables involved with costs ranging from R2.751 billion to R12.8 billion in the low and maximum options.

Table 8.26 Low cost estimates (low volumes low unit costs)

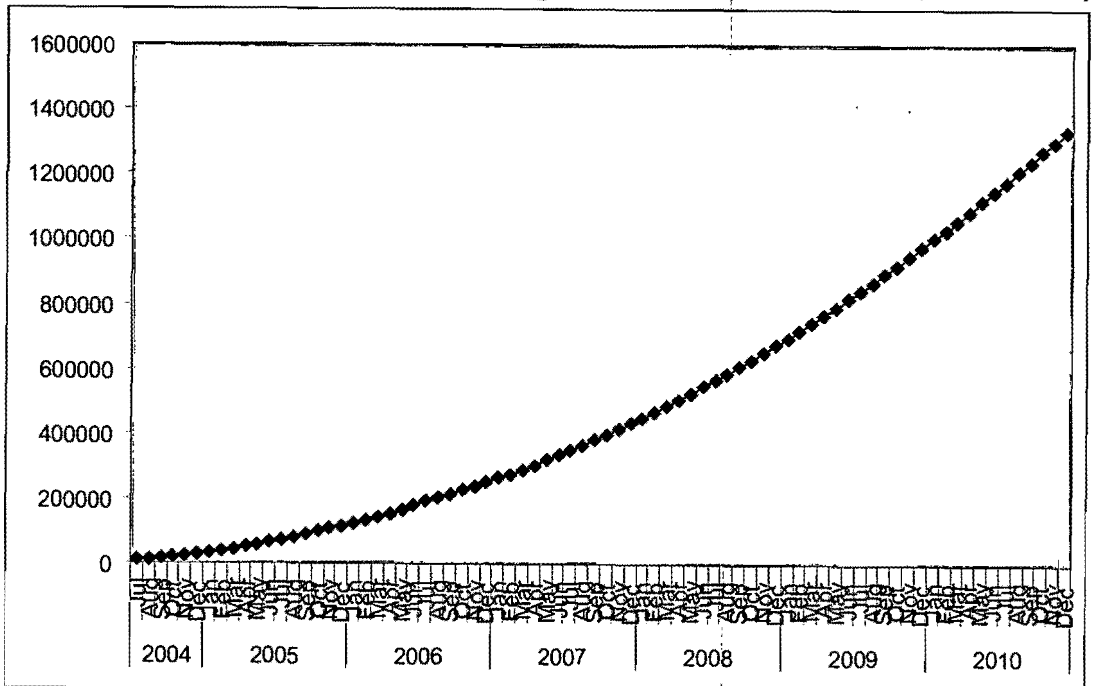
Year	Year	Numbers on treatment	Low unit cost	Total cost R000	Mid unit cost	Total Cost2 R000	Expensive unit cost	Total Cost
1	03/04	0	10,158	0	11,174	0	11,732	**0**
2	04/05	28,443	5,940	168,940	6,534	185,834	7,514	213,709
3	05/06	92,019	5,761	530,159	6,338	583,175	7,514	691,393
4	06/07	184,797	5,589	1,032,752	6,147	1,136,027	7,514	1,388,491
5	07/08	274,925	5,421	1,490,344	5,963	1,639,379	7,514	2,065,674
6	08/09	369,388	5,258	1,942,347	5,784	2,136,582	7,514	2,775,431
7	09/10	464,858	5,101	2,371,022	5,611	2,608,125	7,514	3,492,750
8	10/11	563,526	4,948	**2,788,055**	5,442	3,066,860	7,514	4,234,103

Table 8.27 Maximum cost estimates (high volumes high unit costs)

Year	Year	Numbers on treatment	Low unit cost	Total cost R000	Mid unit cost	Total Cost2 R000	Expensive	Total Cost
1	**03/04**	0	10,158	0	11,174	0	11,732	**0**
2	**04/05**	28,443	5,940	168,940	6,534	185,834	7,514	213,709
3	**05/06**	99,983	5,761	576,043	6,338	633,647	7,514	751,231
4	**06/07**	217,969	5,589	1,218,135	6,147	1,339,949	7,514	1,637,731
5	**07/08**	502,338	5,421	2,723,126	5,963	2,995,439	7,514	3,774,358
6	**08/09**	931,007	5,258	4,895,497	5,784	5,385,046	7,514	6,995,203
7	**09/10**	1,336,255	5,101	6,815,612	5,611	7,497,173	7,514	10,040,069
8	**10/11**	1,713,180	4,948	8,475,989	5,442	9,323,588	7,514	**12,872,132**

Given supply side constraints in the South African health service as well as the level of demand likely to be below what might be expected from need, the maximum option will be difficult to achieve. A more likely option is shown in the results section of the next chapter. Its results are comparable with forward projections based on actual experience on the national programme over the first 28 months. Data from July 2004 to September 2006 are sourced from consolidated provincial reports (personal communication Department of Health 2006) and forward numbers thereafter are derived using a smoothed 6 month uptake acceleration rate. This is shown in Figure 8.1 and in the following chapter.

Figure 8.1. Projected numbers starting anti-retroviral treatment (cumulative)



HOSPITAL MODULE

The hospital module is the most important and complex part of the health sector model, given that in South Africa, 60-70% of health system costs are incurred by hospitals.[71]

The aim of the hospital model is to:

- Link key hospital outputs, inputs, process and cost variables into a coherent planning and funding model. The model should take into account the informational constraints of the South African health care system. For example hospital modelling by Denton and Wanless in the UK and Canada[5,7] use age and disease specific utilisation rates both of which are not available from routine information systems in South Africa. Developing a planning tool for developing and middle income countries with less developed informational systems would add to the existing planning literature which tends to focus on developed countries. In addition the specific implications of HIV/AIDS on hospital bed planning in Africa merits attention.
- Determine the cost implications of an adequately funded hospital model and determine a range of scenarios for hospital provision within given budget limits. Development of methods which link hospital planning, staffing and budget requirements in a quantitative way would contribute to the planning literature.
- Determine norms for hospital beds by type and benchmarks for efficiency e.g. cost per admission.

For the purposes of the model it is proposed that the function of hospitals be:

- Location of specialists at regional and tertiary hospitals to provide specialist diagnosis and treatment on an outpatient basis.
- Delivering procedures and operations on a day case basis that are too complex for community health centres and where these can be performed more cost-effectively than through admission.
- Inpatient admissions for patients who are too ill to be cared for at home or where the intensity of treatment required is such that it would be more expensive to provide at home or in other sites.[72]

As a general principle for the purposes of the model it is suggested that with respect to hospital services emphasis should be given to strengthening capacity for competent and well equipped outpatient and day case treatment in order to provide the interventions required while reducing the associated costs of lengthy hospital inpatient and accommodation costs.

Step 1: Baseline hospital data

Data from the national hospitals dataset was analysed for 1999/00 to determine baseline values for key hospital variables. This analysis involved detailed hospital by hospital data checking and regrouping, to address inconsistency in classification between financial and hospital output datasets. Because of this reclassification some of this data differs from Chapter 6 in which admission rates across provinces, regions and internationally have been analysed and compared. In 2003/04 admission rates varied from 72/1000 in North West to 176/1000 in Northern Cape.

Table 8.28 Outputs actual 03/04 (and other data from hospitals dataset)

	Total	District	Regional	Tertiary	Psych	TB	Specialised unclassified
Hospitals	399	245	55	15	24	32	28
Usable Beds	110,143	41,081	26,915	15,094	15,043	5,700	6,310
Bed distribution (%)	100.0%	37.3%	24.4%	13.7%	13.7%	5.2%	5.7%
Beds/1000	2.80	1.05	0.69	0.38	0.38	0.15	0.16
Admissions	3,742,808	1,442,768	1,518,548	599,796	54,324	27,926	99,446
Admissions/1000	95.29	36.73	38.66	15.27	1.38	0.71	2.53
Admission distribution (%)	100%	38.55%	40.57%	16.03%	1.45%	0.75%	2.66%
Inpatient days	24,069,753	6,651,410	6,792,669	3,433,544	3,878,430	1,699,535	1,614,165
Length of stay	6.4	4.6	4.5	5.7	71.4	60.9	16.2
Outpatient visits	21,364,985	7,039,178	9,085,193	4,554,436	193,546	23,397	469,235
OPD/1000 pop	543.9	179.2	231.3	115.9	4.9	0.6	11.9
Outpatient visit: admission	5.71	4.88	5.98	7.59	3.56	0.84	4.72
Outpatient visit: inpatient day	0.888	1.058	1.337	1.326	0.050	0.014	0.291
Outpatients distribution (%)	100%	32.9%	42.5%	21.3%	0.9%	0.1%	2.2%
Expenditure 03/04 in 05/06 prices Rmil	24,523	7,717	8,444	6,552	935	239	636
Bed occupancy rates	59.9%	44.4%	69.1%	62.3%	70.6%	81.7%	70.1%
Expenditure per patient day equivalent R	726	791	793	1221	219	129	332
Expend per patient day equivalent in 2005/6	786	748	839	1351	237	140	359
Expenditure per admission R	5056	3450	3753	7735	16927	8525	5833
Expenditure per outpatient visit R	301	249	280	450	79	47	120

STEP 2: SELECTION OF KEY WORKLOAD INDICATORS

In the hospital module two key output variables are the primary drivers of the model, namely hospital admissions and outpatient (including casualty) visits. The former are used with length of stay to derive hospital inpatient days. Day cases are dealt with as a sub-type of admission. The use of outputs as primary drivers is a methodological advance on the Western Cape normative model, in which the hospital model was constructed around a series of input (bed and staffing) norms for different bed types.

The selection of these variables as key measures of hospital workload is supported by international literature. Hospital admission rates are an internationally comparable indicator of hospital service workload and reflect in part epidemiological need as well as supply issues[73]. For example Wanless modelled hospital costs using variables of elective and non-elective admissions, day cases, outpatients and accident and emergency attendances.[7] Denton focused directly on bed utilisation by age and gender.[5] Navarro's systems analysis uses a fairly basic categorisation of primary medical care, consultant care, hospital care and nursing home care.[6] Hensher examines admissions, days of stay and hospital beds.[74] More detailed approaches are possible. Blake added additional variables of surgical operations and case mix within a surgical division of a hospital.[75]

Various approaches were attempted to forward project and plan admission rates going forward. However before outlining the preferred approach, it is necessary to consider the effects of HIV/AIDS on hospital admissions, also previously shown in Table 6.16. An HIV/AIDS module was developed in order to build in admissions due to the epidemic. This work builds substantially on demographic, epidemiological and utilisation modelling by the Actuarial Society and the Abt group.[76] In the first approach the results of the Actuarial Society's AIDS and demographic model was used to produce estimates of AIDS cases by stage. These were brought together with utilisation data by stage derived from research by Cleary (personal communication: Cleary 2006) with a 15% downward reduction for patients treated by home based care. HIV admissions calculated by this approach are shown in Table 8.30 and show an AIDS related admission rate of 34.1 per 1000 uninsured population by 2010/11. This estimate was cross-checked against the results of the Abt model which is based on the Metropolitan Life AIDS model and utilisation data from mine hospitals.[62] Even with a reduction for home based care this produced a higher estimate of 40.2/1000 AIDS admissions by 2010/11.

Table 8.29 Total admission rate trends (per 1000 public population)

	Non-HIV related admissions	HIV related admissions	TB Admissions	Total admission rate
96/97	103.8	1.7		105.6
97/98	102.7	3.0		105.7
98/99	93.3	4.8		98.1
99/00	90.2	7.3	1.0	97.5
00/01	90.2	10.5	1.1	100.7
01/02	88.4	14.2	1.2	102.6
02/03	81.4	18.1	1.4	99.5
03/04	74.9	22.2	1.5	97.0
04/05	69.6	26.3	1.7	95.9
05/06	66.3	28.6	1.9	94.9
06/07	69.6	30.5	2.0	102.2
07/08	73.1	31.9	2.1	107.2
08/09	76.8	32.8	2.2	111.9
09/10	80.6	33.3	2.3	116.2
10/11	84.7	34.1	2.4	121.2

In a third option a scenario was developed to determine the implications of further rolling out ARV treatment for persons with AIDS. In this option numbers on treatment are derived from the option shown in Figure 8.1 and admission rates by stage are again derived from Cleary. In this option HIV/AIDS admissions will be reduced to 25 per 1000 by 2010/11. Admission rates are still relatively high because of the large number of people still not on treatment in this option.

Table 8.30 Hospital admissions by persons with AIDS*

	People		Admissions			Admission rate
	On ARV	Not on Rx	On ARV	Not on Rx	Total	
2004/05	52,188	399,240	15,656	938,213	953,870	24
2005/06	153,542	388,963	46,063	914,064	960,127	24
2006/07	244,320	413,015	73,296	970,586	1,043,882	26
2007/08	351,575	407,240	105,472	957,015	1,062,487	26
2008/09	471,548	393,271	141,464	924,187	1,065,652	26
2009/10	599,945	372,162	179,983	874,580	1,054,564	26
2010/11	739,669	354,365	221,901	832,758	1,054,658	25

*Admission rates for patients on and off HAART derived from Cleary
(personal communication Health Economics Unit, University of Cape Town)

The approach that was adopted to model admission rates is as follows. Table 8.29 shows that admission rates, among the non-HIV infected population (calculated as total admissions less AIDS and TB related admissions), appear to have been squeezed out significantly, reducing from 103.8/1000 in 1996/97 to 66.3/1000 in 2005/06. Further evidence for this is provided by surveys of HIV prevalence among hospital inpatients.[77,78] The combined effect of reducing total admission rates and rising HIV/AIDS admissions is potentially compromising access to hospitals. In an attempt to reverse this crowding out effect, improve access to tertiary care in disadvantaged provinces[70] and shorten waiting periods, the model makes provision for recovery in admission rates by 5% per year from 2005/06 to reach 84.7/1000 by 2010/11 (in the non-AIDS population). An increase in admission rates is also required because of the existing inadequate provision for acute psychiatric admissions[89] and the increasing effects of HIV/AIDS on TB admissions (personal communication Abt). AIDS related admissions are projected in Table 8.29 or Table 8.30 above depending on the scenario selected. In the one option hospital admission rates are projected to rise from 94.9/1000 in 2005/06 to 121/1000 nationally by 2010, mainly because of the implications of HIV/AIDS (Table 8.29). However in most of the scenarios which follow, substantial ARV rollout is factored in and so admission rates are projected to rise to 110/1000 (84.7 non AIDS plus 25 AIDS related – Table 8.30).

Several other alternate approaches were developed for modelling admission numbers but were found to not adequately reflect priorities. A multiple regression model was run in an attempt to predict the effects of demographic change, HIV and other factors on admissions. This approach was adopted also because of the lack of reliable age related utilisation data for public hospitals in South Africa. The methodology of the regression model is described in Chapter 3. The following regression equation was a fairly good predictor of historical admissions (R^2=0.9984).

Admissions = 0.5752*(Females 15-45 years)+0.2328*(children under 5 years) + 0.323*(elderly 65 years and older) –0.1168*(weighted population) + 1.534
(Weighted population = uninsured population + (insured population)/5)

This equation predicted, when used with the demographic changes shown in Table 8.4, that hospital admissions would reduce from 108.4 per 1000 in 1996/97 to 98.7 in 2004/05 and to 93.2 per 1000 by 2010/11. The effects of aging by 2010/11 are more than offset by the reduction in population of children under 5 years and women from 15-45 years. However the regression models were unable to explain the effect of HIV/AIDS on admissions. Indeed in several regression equations HIV sero-prevalence and AIDS cases emerged as negative predictors of hospital admission. Instead in the best fitting regression equation for admission rates, the most significant independent variables which predicted admission rates were supply and income indicators such as GDP per capita, doctors per capita and better educational performance.

Outpatients

With respect to outpatient visits there appears to be a strong case to significantly increase specialist outpatients. Firstly total outpatient and casualty visit rates have declined since 1996/97 from 650/1000 to 485/1000 (Table 8.31). At the same time HIV/AIDS visits have risen. The latter have been modelled from the Actuarial Society and Abt HIV/AIDS models and data on hospital utilisation from a long-established Cape Town AIDS cohort (personal communication S. Cleary) and Abt. The resultant effect is that outpatient visits excluding HIV related conditions have declined significantly, reflecting declining access. There is a need to redress the reductions that have occurred and to make provision for increasing HIV related workload.

Table 8.31 Outpatient visit rates per 1000 uninsured persons

	Outpatient visit rate excluding HIV visits	HIV related outpatient visit rate	Total outpatient visits per 1000 population
96/97	615	35	650
97/98	572	50	622
98/99	441	65	506
99/00	489	81	570
00/01	472	95	567
01/02	466	109	574
02/03	459	120	580
03/04	401	131	532
04/05	372	141	513
05/06	335	150	485
06/07	365	157	522
07/08	398	162	560
08/09	434	166	600
09/10	473	169	642
10/11	516	172	688

Secondly there is substantial inequality in access to specialist outpatient care across provinces, with visit rates ranging from 110/1000 in Limpopo to 560 in Gauteng (Table 6.11). Greater access to specialist outpatients is required in disadvantaged provinces.

Thirdly access to specialist outpatient services is a critical form of support for primary care services to function well. The baseline rate in 2004/05 was 0.31 per uninsured person. Assuming a 4-8% referral rate from PHC to specialists, an average of 2-2.5 visits (private sector is 3.9[24]) per person using OPD services and some direct self-referral for casualty etc, a rate of 0.4-0.6 appears reasonable. Although the current rate is 0.31 the 66th to 80th centile of local hospitals studied in the Modernisation project[57] ranged from 0.44-0.67 (Table 8.32).

Based on these arguments Table 8.33 proposes a gradual recovery of OPD visits from the baseline in 2004/05 to 2010/11.

Table 8.32 Specialist OPD visits

Regional Hospitals	33 percentile	Mean	Median	66 percentile	75 percentile	80 percentille
Casualty	26.37	34.66	49.69	75.91	94.97	113.7
Total	71.7	87.56	99.41	134.88	169.53	231.23
Total regional	98.07	122.22	149.1	210.79	264.5	344.93
Tertiary 1 hospitals	**33 percentile**	**Mean**	**Median**	**66 percentile**	**75 percentile**	**80 percentille**
Burns	0.11	0.13	0.18	0.23	0.29	0.35
Critical Care & ICU	0.41	0.29	0.45	0.66	0.77	1.19
Dermatology	1.09	4.03	2.19	3.54	4.72	5.89
Diagnostic Radiology	1.34	3.35	2.26	2.46	3.2	5.27
Ear Nose & Throat	1.86	1.87	2.76	2.84	4.85	5.53
Gastroenterology	0.62	0.13	0.92	0.96	0.99	1
Infectious Diseases	0.4	0.55	1.02	1.72	2.12	2.8
Neonatology	0.06	0.11	0.11	0.25	0.38	0.45
Nephrology	0.99	2.49	1.49	4.12	6.21	6.7
Obstetrics & Gynaecology	1.76	6.65	2.97	13.14	14.29	14.76
Ophthalmology	2.71	6.22	5.31	11.02	13.05	13.74
Orthopaedics	3.16	6.08	5.56	9.92	12.58	12.72
Paediatric Surgery	0.33	0.72	0.47	0.8	1.13	1.25
Rehabilitation Centre	0.29	0.1	0.34	0.46	0.52	0.56
Respiratory Medicine	1.14	1.58	1.2	3.24	3.62	3.82
Trauma	17.82	29.69	25.32	30.58	34.55	35.92
Vascular Surgery	0.15	0.36	0.45	0.79	1.27	1.34
Other OPD Visits	33.22	111.77	58.8	123.97	152.9	163.46
Total	**63.71**	**177.01**	**101.13**	**200.1**	**247.43**	**283.98**
National Referral Services	**33 percentile**	**Mean**	**Median**	**66 percentile**	**75 percentile**	**80 percentille**
Cardiology	1.32	3.46	1.33	1.33	1.34	1.76
Cardiothoracic Surgery	0.12	0.45	0.15	0.36	0.48	0.52
Clinical Immunology	0.11	1.64	0.15	0.32	0.41	0.46
Craniofacial Surgery	0.94	0.45	0.99	1.04	1.07	1.09
Endocrinology	0.53	1.4	0.55	1.14	1.47	2.07
Haematology	0.17	0.65	0.34	0.7	0.89	1.24
Human Genetics	0.08	0.11	0.09	0.22	0.29	0.33
Medical & Radiation Oncology	3.09	5.84	4.93	7.82	9.45	10.1
Neurology	0.44	2.6	0.5	0.5	0.5	0.64
Neurosurgery	0.7	0.84	1.11	1.53	1.76	3.24
Nuclear Medicine		1.82				
Plastic & Reconstructive	0.52	0	0.74	0.92	1.03	1.08
Renal Transplant	0.44	0.32	0.54	0.63	0.98	1.18
Rheumatology		0.67				
T2 Paediatrics	10.32	0	14.4	14.46	14.49	20.16
Total T2 services	18.78	20.25	25.82	30.97	34.16	43.87
Total Regional+tert1+tert2	180.56	319.48	276.05	441.86	546.09	672.78

STEP 3: ALLOCATION OF WORKLOAD BETWEEN VARIOUS HOSPITAL BED TYPES

The two output variables (hospital admissions and outpatient visits) are subdivided (allocated) between a range of different bed types:

- Acute: district (community, level 1), regional (level 2), tertiary (level 3), Sub-acute or step-down
- Psychiatry, TB and other specialised hospitals.

The reason for this level of differentiation is the very different cost structures that exist for each bed type. Beds are a primary service unit in the model and hospitals are considered as a mix of various numbers of beds of different bed-types.

The ability to model allocation of admissions from between various levels of care and bed types in a range of configuration scenarios is a useful features of the model. A range of options are tested varying amongst others in the proportion of patients admitted to high level tertiary care, the degree to which sub-acute care options are developed and the extent to which psychiatric and TB patients are treated in general as opposed to dedicated hospitals.

STEP 4: DERIVING HOSPITAL BED NUMBERS

Hospital admissions are linked to bed numbers for each hospital type. There is a mathematical relationship between hospitals beds (B) and hospital admission rates (A), bed occupancy (bo) and average length of stay (los).

B = (A*los)/(bo*365)

For example in a simplistic acute bed scenario, 1.71 hospital beds per thousand population will be sufficient to accommodate 100 admissions per thousand per year for an average of 5 days at an average occupancy of 80%.

Efficient hospitals should operate at occupancy rates of 80-85%.[79] There is substantial international theoretical and empirical evidence for this. Where overall bed occupancies rise above 85% the risk of not having any beds open during periods (e.g. seasonality) of high use becomes significant.[79] Where admission rates vary over time more complex mathematical and statistical tools may be useful in modelling bed requirements. Theoretical modelling in this area typically distinguishes between elective and non-elective admissions and examines the distribution of admissions, whether by Poisson distribution or by examining daily and seasonal variations.[80] Modelling by Baghurst showed that at

85% bed occupancy an average hospital would be short of beds on four days a year but at 90% there would be regular bed crises.[70] District hospitals in South Africa operated at 57% occupancy in 2000 and 64% in 2001 (Department of Health, 2002). Despite this improvement, this is an indication of substantial inefficiencies.

Length of stay in hospitals in South Africa has progressively shortened over two decades. This is in keeping with international trends with increased day surgery and managed care. Various options for length of stay for each bed type are shown in the model.

The model allows for various configuration scenarios of bed numbers and types based on the admission rates, level of care, length of stay and bed occupancy levels selected. These are useful for helping to inform decisions around whether particular provinces should be considering adding beds and building new hospitals or reducing beds and consolidating hospitals.

Step 5: Hospital staffing and personnel costing

Hospital cost norms may be determined through a range of methodologies.[81,78,79] These include by benchmarking existing institutions (e.g. district hospitals). Adjustments can be made for variation in length of stay or bed occupancy. More complex forms of analysis to adjust for confounding factors include multiple regression or econometric techniques to explore determinants of costs. Various economic or accounting costing approaches may be used to cost inputs required to deliver services of a given type, cost hospital packages, specific specialities and related case mix or patient groups with specific diagnoses or therapeutic interventions. Long and short run cost functions may be derived. Engineering approaches include building up production norms for specific activities. Modelling of production functions may provide insights into optimal resource mixes. Competitive tendering may provide a market related indication of pricing and costs.

Given that personnel costs amount to around 70% of hospital costs in South Africa, several South African models have developed cost norms by developing and modelling staffing establishments for each hospital or bed type. The most influential work in this regard in the Southern African context has been by Krause, which was used in the Hospital Strategy Project report[8] and by several provinces for human resource planning. Krause's work is based on the detailed staffing of each unit within a hospital e.g. a surgical ward, an intensive care unit (ICU), a hospital kitchen etc. A typical mix of units is combined into an average hospital type. Costs are attributed to each personnel category based on public sector wage scales. This allows for the complete personnel costing of a model hospital or bed type. The models allow for a range of staffing levels, so that optimal levels can be scaled down, given budget constraints. It is advised that staffing levels not be scaled down below 80% of the proposed staffing norm.

The personnel models have recently been updated and recosted at current salary scales by Krause for the National Treasury (personal communication R. Krause 2006) and these are used as a basis for personnel costing in hospitals within this model. Some summary personnel staffing and cost norms, derived from Krause, are shown in Table 8.33 and Table 8.34.

Table 8.33 Selected summary workload ratios from HR Planner model

	PDE / Post				
Post Category	District >250	Regional	Tertiary	Psychiatric	Chronic
Administration Management	93.33	154.00	40.38	144.67	
Administration Production	6.22	5.50	2.16	11.42	16.35
Administration Supervisor	56.00	27.50	17.31	54.25	81.75
Health Professional Dietetics	280.00	385.00	141.33		
Health Professional Management	70.00	24.84	6.47	54.25	163.50
Health professional medical laboratory		24.84	848.00		
Health Professional Medical Practitioner	18.67	8.46	4.14	86.80	81.75
Health professional: medical specialist		22.00	9.12	108.50	
Health Professional Nursing	3.22	2.32	1.17	2.65	7.43
Health Professional Occupational Therapy	280.00	256.67	121.14	144.67	327.00
Health Professional Other Allied Services	280.00	96.25	13.90		
Health Professional Pharmaceutical Services	93.33	59.23	31.41	217.00	327.00
Health Professional Physiotherapy	280.00	192.50	60.57	434.00	327.00
Health professional: psychologist		385.00		28.93	
Health Professional Radiography	70.00	45.29	12.29		163.50
Health Professional Social Work	280.00	192.50	141.33	86.80	109.00
Health Professional Speech Therapy	280.00	385.00	282.67		
Midlevel Health Worker Clinical Support	21.54	20.81	19.27	39.45	40.88
Midlevel Health Worker Non-Clinical Support	70.00	110.00	53.00	217.00	
Midlevel Health Worker Nursing	1.90	1.89	1.97	2.70	3.17
Technical Operations Management	93.33	45.29	36.87	62.00	109.00
Technical Operations Production	1.63	1.86	1.44	2.00	3.11
Technical Operations Supervisor	15.56	16.74	9.32	17.36	20.44
Technical professional			282.67		
Total:	0.53	0.46	0.28	0.64	1.03

PDE= patient day equivalent

Table 8.34 Costs derived from staffing models (2006 prices)

Facility Type	Beds	% occup	PDE /day	Cost per PDE per day	Personnel cost per bed per day	Health workers per bed per day
Chronic Diseases Hospital Small	80	95	76	R 273	R 260	1.0
Chronic Diseases Hospital Large	337	95	327	**R 233**	R 226	0.9
Psychiatric Hospital Chronic	280	90	255	R 294	R 268	1.2
Psychiatric Hospital Acute & Chronic	480	90	434	**R 393**	R 355	1.4
Psychiatric Hospital Acute Academic	200	90	181	R 466	R 426	1.5
Psychiatric Hospital Acute without Forensic Unit	200	90	181	R 466	R 427	1.4
Psychiatric Hospital Acute with Forensic Unit	200	90	181	R 481	R 440	1.6
District Hospital Small	10	90	12	R 642	R 771	2.6
District Hospital Small	20	90	24	R 513	R 590	2.2
District Hospital Medium	50	80	53	R 450	R 478	1.9
District Hospital Large	100	80	107	**R 498**	R 498	2.1
District Hospital Large	250	84	280	R 459	R 514	2.1
District Hospital Large L1 & 2	250	85	281	R 535	R 602	2.3
Regional Hospital Combined L1 & 2	670	85	770	R 666	R 766	2.5
Regional Hospital L 2 only	670	85	770	**R 686**	R 788	2.5
Regional Academic Hospital Combined L1 & 2	735	85	956	R 626	R 815	2.7
Provincial Hospital Combined L2 & 3	670	85	867	R 690	R 892	2.9
Central Academic Hospital L2 & 3 (42:58)	777	80	1010	R 1,125	R 1,462	4.2
Central Academic Hospital L2 & 3 (47:53)	950	80	1235	R 1,075	R 1,398	4.1
Central Academic Hospital L3 only	646	80	848	**R 1,353**	R 1,776	4.7

PDE = patient day equivalent

Source: Personal communication Krause 2006

In the model, base costs are adjusted to prices of the relevant year using the inflation index and the projected wage drift to 2010/11. Scenarios for wage drift have been tested ranging from 0%-2.5% per annum, with 1.5% in the main option. Actual average cost per employee increased 1.4% annually from 1996/97 to 2005/06 or by 3.2% annually from 1995/96. This issue is discussed in detail in the model scenarios (and in Appendix 1), which show that wage drift is of importance to sustainability of services.

STEP 6: NON-PERSONNEL COSTING

No completely reliable norms exist for non-personnel costs for hospital services in South Africa. The Department of Health working group that developed the Integrated Health Planning Framework model developed benchmarks for expenditure per admission on pharmaceuticals, laboratory and other services based on actual expenditure in the better resourced provinces, where hospital services are considered to function better. This was an advance on the Western Cape normative model which used a simple ratio of personnel: non-personnel costs as a measure of non-personnel costs.

Using better resourced settings as a benchmark does pose some risks. These levels may not be affordable in provinces where health services are funded at lower levels. Also more detailed work on technical efficiency in these areas would be worthwhile and it is possible that the higher expenditure province may reflect inefficiencies.

Table 8.35 Hospital non-personnel costs per patient day equivalent 05/06 prices (rands)

	District	Regional	Tertiary	Psychiatric	TB Specialised
Medicines	49.22	77.30	193.65	13.35	8.08
Laboratories	9.94	12.10	27.01	6.95	4.81
Other non-personnel costs (excluding capital and maintenance)	74.73	79.96	107.45	44.14	50.05
Total non personnel cost per patient day equivalent	133.90	169.36	328.12	64.44	62.94

STEP 7: CAPITAL COSTING

A simplified method for costing of capital and maintenance expenditure has been designed for the model based on extensive work and much more detailed modelling by Bennett (unpublished work) on hospital infrastructure in the South African health system. This has been partly based on the findings of the National Health Facilities Audit. The core of the method is as follows.

For hospital buildings the planning unit for hospital construction is a hospital bed. Each bed unit is linked to a large number of service and support services. For each hospital type (and there is considerable variation across types), the cost of construction of a hospital planning unit is the product of the building cost per metre squared (based on actual costs on similar recent projects) and the area norm per bed. The cost of construction is considered equivalent to the (replacement) value of the asset. Annual replacement costs per bed are estimated as cost of construction divided by average lifespan of a hospital of that type before replacement. Annual maintenance costs per bed are calculated as a product of the cost of construction and the selected percentage of maintenance. Maintenance and replacement costs per admission are calculated using the relationship between hospital beds, admissions, length of stay and bed occupancy described above. All variables have ranges, which were utilised for sensitivity analysis incorporating various actual and modelled values for that parameter.

The total replacement value of equipment (per bed) is modelled as a percentage of capital value of the bed planning unit, based on actual costs of equipping recently constructed new hospitals in South Africa. Annual equipment replacement cost requirements are calculated as the dividend of equipment replacement value and annual lifespan of equipment. The latter has been estimated to average 10 years with sensitivity analysis at higher and lower values. Annual maintenance costs of equipment are estimated at 10% of the replacement value.

Table 8.36 Capital costs of district bed

	Value used	Formula	Range
Building cost per metre squared (Rand)	5,000	A	4000-6000
Area per bed (m2)	60	B	52-96
Replacement cost per bed (Rand)	300,000	c=a*b	
Average facility lifespan (years)	60	D	40-60
Annual replacement cost per bed (Rand)	5,000	E=c/d	
Annual maintenance percentage required	3.5%	F	2.5%-4.5%
Annual maintenance required per bed (Rand)	10,500	G=c*f	
Equipment - replacement cost as % building value	20%	H	15%-25%
Equipment replacement cost per bed (Rand)	60,000	I=c*h	
Equipment average lifespan (years)	10	J	8-12
Equipment replacement per year (Rand)	6000	K=I/j	
Equipment maintenance required per year as a proportion of asset value	9%	L	8%-10%
Equipment maintenance per bed per year	5400	M=I*l	

STEP 8: TOTAL UNIT COSTS

Personnel, non-personnel and capital costs are brought together to determine the cost per patient day equivalent (PDE) for each hospital type. Estimates of cost per admission and cost per PDE are derived from:

Cost per admission = Cost per PDE*target length of stay

Cost per OPD visit = Cost per PDE / 3

The relationship between outpatient visit and inpatient day costs in the PDE measure is derived from South African and international costing studies which have typically found ratios between 3-4.[82,83] Tables 8.37, 8.38 and 8.39 below show, in real 05/06 prices, trends in historical unit costs compared to the derived planning cost norm for each hospital type. Results derived from another normative approach, the Modernisation of Tertiary Services report[84], which have been built up from detailed speciality-specific modelling, is also shown.

Table 8.37 District hospitals: baseline and norm (05/06 prices)

	00/01	01/02	02/03	03/04	04/05	05/06	Planning framework
Admissions per 1000	39.4	39.9	38.2	36.7	39.5	37.7	40-44.1
Cost per admission	3,233	2,973	2,614	2,863	2,606	2,835	3183-3360
Outpatient visits per capita	0.18	0.17	0.17	0.16	0.18	0.19	0.21
Cost per OPD visit	227	211	192	221	213	235	230-243

Table 8.38 Regional hospitals: baseline and norm

	00/01	01/02	02/03	03/04	04/05	05/06	Planning framework	Modernisation of tertiary services report
Admissions per 1000	42.5	40.3	38.8	37.6	39.8	38.5	41.7	40.6-45.4
Cost per admission	3,501	3,532	3,604	3,836	3,993	4,348	4785-5050	4,755
Outpatient visits per capita	0.23	0.24	0.24	0.21	0.18	0.19	0.24-0.27	0.16-0.21
Cost per OPD visit	268	268	284	289	303	330	319-337	456

Table 8.39 Tertiary hospitals: baseline and norm

	00/01	01/02	02/03	03/04	04/05	05/06	Planning framework	Modernisation of tertiary services report
Admissions per 1000	15	16	16	15	15	14	15-17	17.2-21.6
Cost per admission	8,295	7,468	8,542	7,961	8,905	10,505	12,450-13,048	10,466
Outpatient visits per capita	0.13	0.13	0.12	0.12	0.10	0.09	0.12-0.13	0.13-0.15
Cost per OPD visit	475	442	491	464	522	631	725-760	801

For district hospitals the normative costs per admission (R3183-R3360) is only slightly above the actual cost. For regional hospitals the normative costing from this model (R4785-5050) and from the Modernisation of Tertiary Services (MTS) report (R4755) is above the actual unit cost in the base year (R3993 in 2004/05). For tertiary hospitals the model developed in this thesis proposes higher cost norms (R12,450-R13,048) than the baseline (R8,905 in 2004/05). The proposed cost norm is also higher than that calculated from the MTS report, but the proposed admission rates are lower.

STEP 9: BRINGING TOGETHER OUTPUTS AND COSTS

Outputs, inputs, process variables and costs are brought together in a model, which allows for a range of choices for each variable. For any given budget level a range of scenarios can be developed around potential affordable service configurations.

MODEL FOR EMERGENCY AMBULANCE SERVICES

The design of planning models for ambulance services in South Africa is hindered by poor information systems. Development of information systems for emergency services is essential and the national District Health Information System has recently initiated an emergency medical service (EMS) module.

OTHER PEOPLES WORK

The Department of Health's Integrated Health Planning Framework noted that emergency medical services, which require well resourced ambulances and personnel, must be separated from routine patient transport. Early versions used a simple approach of output and cost norms (personal communication, Department of Health).

A more complex approach was subsequently developed by Bennett and Furie of the Department of Health (personal communication: Department of Health, 2004) with the support of Africon which used a Geographic Information System (GIS) and travelling distances on the national road network to find an optimal solution for the locationing of ambulances to allow for the required response times. This was combined with a resourcing model which identified and costed the inputs required for each ambulance and ambulance base.

A Western Cape provincial EMS model modelled mission rates as the proportion of hospital trauma and emergency visits reliant on such services added to the proportion of seriously ill patients requiring inter-hospital transfers. This generated a utilisation rate of 98-108 per 1000 persons per annum. For urban areas the model was required to meet a response time of 15 minutes in 90% of cases and an average total mission time of 60 minutes was measured. For rural areas a response time of 45 minutes was required and average mission time amounted to 110 minutes. An analysis of workload by eight hour shift showed that 41% of daily work occurred on average during the peak shift and the total number of ambulances needed to accommodate this. Further provision was made for ambulances not in use. The model calculated that an urban ambulance would do on average 12 missions per day and a rural ambulance 6. The staffing model was varied to address the different workloads across shifts.

MODEL

The baseline incidence of ambulance use ranged from 60-70 per 1000 over the past three years. The highest rates were in the Northern and Western Cape at around 120 per 1000. The model is based on incidence rising to 85 per 1000 as shown in Table 8.40, based on 50% of accident and emergency visits being transported by ambulance and 10% of hospital admissions requiring inter-hospital transfer. This would be a 20% increase on the present baseline and would constitute a substantial upward revision for provinces such as Limpopo, which has a very low rate (22.5 per 1000).

Table 8.40 Estimation of ambulance incidence rate

		Incidence rate (trips per 1000)
Accident and emergency rate at hosp per 1000	150	
% transported by ambulance	50%	75
Inter-hospital transfer as % of admissions	10%	
Admission rate per 1000	97	10
Utilisation rate		85
Ambulance missions	3,503,267	

In Table 8.41 a method is laid out for determining ambulance numbers, a key intermediate variable in the costing model. Ambulance missions are divided between urban and rural areas, given the different target response times for these areas set by national norm (15 minutes and 45 minutes), based on the distribution of the population.[81] The different nature of ambulance services in urban and rural areas has been recognised in other models.[83] Mission time is estimated from its component stages, based mainly on Western Cape data.[86] Provision is made for ambulance numbers to be determined from the peak shift which comprised 41% of trips in the Western Cape data. An assumption is made that the waiting times between trips is at least 50% of average mission time, with somewhat higher levels in rural areas. Despite this seemingly inefficient assumption, the model generates a workload (16, 12 and 8 trips per ambulance per 24 hour period across the three area types shown in the table) significantly higher than the 5-6 patients currently being transported per ambulance per day according to baseline provincial data (personal communication National Treasury).

This approach generates a requirement for 1062 ambulances or 1328 after mark-up for vehicles temporarily unavailable for use. This provides a ratio of one ambulance to 31 147 people which is more favourable than the 1:50 000 recommended by McSwain, the 1:100 000 ratio described in Mexico and 1: 3 million ratio in Hanoi.[87] However a different approach used by the Department of Health using the GIS approach described above, based on national population distribution, drive times on the road network and 90% of missions accomplished within the set response times required a somewhat higher number of ambulances, namely 1551 (1 ambulance : 26 667 population). The higher option is used in the cost calculation.

Table 8.41 Calculation of ambulance requirements

	Urban	Peri-urban	Rural	Total
Distribution of trips by area type	43%	17%	40%	100%
Trips	1,437,398	568,274	1,337,115	3,342,787
Trips per day	3,938	1,557	3,663	9,158
Trips in busiest shift	1,638	647	1,523	3,808
Response time minutes	15	25	45	
Travel speed	50	55	70	
Radius from base	13		53	
Pick up time and stabilisation	5	5	5	
Time to hospital	15	20	45	
Time to base	10	10	15	
Clean and restock	10	10	10	
Mission time	55	70	120	
Mission time (Western Cape)	60	75	110	
Wait between missions	30	45	77	
Mission time including waiting periods	90	120	187	
Trips per day	16	12	8	
Trips per shift	5	4	3	
Distance per trip (km)	33	50	123	
Distance total per year (km)	47,913,273	28,650,466	163,796,540	240,360,279
Ambulances required	307	162	593	1,062
Out of action scale up	384	202	742	1,328

The costing model is summarised in Table 8.42. The number of ambulances are a key cost driver. Each ambulance requires 9.6 personnel (based on a two person ambulance for 24 hours a day, 7 days a week). These are divided between basic, intermediate and advanced paramedics using a ratio of 40%:40%:20%. The latter reflects an intention to increase skills levels, since the existing system is based largely around Basic Ambulance Assistants who currently receive very short periods of basic training. Attention is placed on improving communication systems, with costing based on a sophisticated automatic dispatch system recently installed in the Western Cape Province. Provision is also made for regular vehicle replacement.

Table 8.42 Costing of ambulance system

	Basis of calculation	R thousand
Basic ambulance assistant (BEA)	9.6 personnel per ambulance yields 14890 ambulance personnel of which 40% are BEAs; Unit cost R65 000	389,526
Intermediate	40% of ambulance personnel at R81 225 unit cost	483,760
Advanced paramedic	20% of ambulance personnel at R121,055 unit cost	360,492
Other personnel rescue vehicle drivers, control centre operators, managers:		246,756
Vehicles	Depreciate over 4 years; R300 000 per vehicle	240,793
Petrol and maintenance	R1.70 per kilometer	408,612
Consumables	15% of personnel costs	185,067
Communication systems	Costs of hardware, software, installation in 53 control centres	326,858
Air ambulances		79,299
Ambulance bases	Based on Department of Health costing	49,446
Rescue equipment	Based on Department of Health costing	31,067
Total		2,801,676

With improved data and greater understanding of the planning requirements, further progress in improving funding of this service is anticipated. The total cost requirement of R2.8 billion estimated for the public service is higher than the cost model developed by Kobusingye.[83]

OTHER SECTOR COSTS

Hospital, primary care and emergency ambulance services amount to over 90% of health sector costs.[52] However to allow for a complete sector model, provision must be made for other costs. Although several of these components are amenable to modelling, at this stage they are inserted only as cost variables with amounts for inclusion. Costs used are derived from the National Health Accounts project[52] amongst others. Other costs include:

- Management – mainly the national and nine provincial departmental head offices.
- Training – especially for nursing colleges
- Capital transformation

SCENARIO DEVELOPMENT

A range of scenarios may be developed starting from a baseline scenario using existing current values for all variables. Typical variables which are explored in the scenarios include:

- Modifying admission rates depending on implications of HIV/AIDS and use of more outpatient procedures
- Modifying level of care (bed type) at which admission are treated. This is a key factor in service

configuration and is one of the key differences in service configuration between the nine provinces.

- Increasing efficiency through improving bed occupancy, shortening length of stay e.g. by increasing day surgery
- Modifying staffing – the model suggests that many of our existing hospitals have inappropriate staff mix, with shortages in several areas.
- Examining effects of HIV/AIDS and implications of various care models and costs and savings of interventions such as home based care and step-down care
- Modelling effects of various interventions which affect cost per admission
- Adequacy of funding envelope – and exploring potential changes in service configuration should the funding envelope be increased or decreased.
- Modelling shortfall in PHC funding by province in order to address these

VALIDITY CHECKS

Several approaches were used to check overall validity of the model.

The model was run for the 2004/05 year using all the baseline demand and unit cost data. This generated an expenditure level for 2004/05 that was within 1% of actual expenditure (R43.851 billion in 2005/06 prices). This provided evidence for the integrity and internal consistency of the model. The availability of baseline data for all the key utilisation and unit cost variables in the model also assists in interpreting the cost drivers of various future scenarios.

Secondly the outcomes of the model were checked against a number of other key sector funding and cost models. The outcomes of the funding model (chapter 4) are highly compatible with the latest Treasury projections of health care funding to 2008/09.[30,88] The outcomes for the primary health care funding module (R397 per capita) are comparable but slightly higher than the latest proposals supported by the Department of Health (R325 in 2005/06 prices)[57]. This is because the model developed here includes a more extensive tier of community health centres, costing of district offices and a broader package of community based and public health services. The model outcomes for cost of regional and tertiary hospitals was tested against the results of the Modernisation of Tertiary Services report[78] and found to be comparable in terms of overall cost implications (approximately R8 billion additional funding by 2010/11). The model outcomes for psychiatric hospitals was cross-checked against a set of national norms for psychiatric care developed by Flisher and Lund.[79,80,81] Although the overall cost and inpatient days of the two approaches were similar, the latter approach makes provision for higher acute admission rates but considerably shorter length of stays and for greater use of group homes and supportive community psychiatric services.

The outcome of the model for rollout of AIDS treatment was crosschecked against the Department of Health's long term plan for treatment rollout and a recently updated recosting.[82,83] The approaches are comparable in terms of unit costs. However the costing in the main option of this thesis is somewhat lower (but within the range of the sensitivity analysis), given that the treatment targets in the other approaches appear unlikely to be achieved, namely 1.08 million persons on treatment by 2008 while only 178 000 persons had actually commenced treatment by July 2006 (personal communication Department of Health). The results of the model for emergency medical services corresponds fairly well to the ambulance model developed by the Department of Health (personal communication Department of Health).

Thirdly an illustrative probabilistic flow model was developed to cross-check the inter-relationships between the primary care and hospital compartments. Table 8.43 provides an illustrative flow summary between the primary care and hospital parts of the system. This form of analysis may be presented with equivalent results as a Markov model. This form of stochastic modelling provides a useful cross-check for the model. This example is based on a target PHC utilisation rate in 2010 of 3.7 per capita which is in line with targets of the Department of Health[33,93] but based on an initial visit rate of 3.4 and a 16% referral rates from clinics to community health centres. The overall referral rate from primary health care to specialists or hospital is set at 5% which is lower than other published sites in the UK, US and the South African private sector.[27,94,95] Referrals are mainly modelled to come (17%) from community health centres. Once referred to a hospital outpatient department an overall average number of visits is set at 2 (South African medical scheme data 3.9)[27], providing a specialist referral rate of 0.36 per 1000 population, which is again lower than published data. Adding in casualty and self-referrals a total OPD rate of 0.64 per 1000 (baseline rate 0.48-0.53) is derived. If 18% of outpatient and casualty visits are admitted (as at baseline, also regression co-efficient is 0.176) this provides an admission rate of 115 per 1000 population (baseline 97). This compares well with the model.

Table 8.43 Illustrative stochastic flow model

PHC	Distribution of PHC visits before referral	PHC visit rates before CHC referral	Refer to CHC	PHC utilisation rate	PHC visits	Referral rate to specialist or hospital	Referral rates per 1000 population
Clinic	78%	2.65	16%	2.65	109,689,060	1%	0.03
CHC	14%	0.48		0.92	38,138,043	17%	0.16
Mobile	4%	0.14	16%	0.14	5,625,080	1%	0.00
Subtotal		3.26			153,452,183	5.0%	0.18
Hospital self-referral or emergency	4%						0.14
Total	100%	3.4	100%	3.71	153,452,183		0.32
PHC	**Referrals**	**Average OPD visit rate per referral**	**OPD or casualty visit rate**	**OPD visits**	**Proportion of OPD visits requiring admission**	**Admission rate per 1000**	**Admissions**
Clinic	1,096,891	2	0.05	2,193,781	18%	9.5	378,610
CHC	6,483,467	2	0.31	12,966,934	18%	56.4	2,237,875
Mobile	56,251	2	0.00	112,502	18%	0.5	19,416
Subtotal	7,636,609	2	0.37	15,273,217	18%	0.0	2,635,900
Hospital self-referral or emergency	5,625,080	2	0.27	11,250,160	18%	49.0	1,941,588
Total	13,261,689	2	0.64	26,523,377	18%	115.4	4,577,489

Fourthly the results were compared with the logistic regression model described in chapter 6.

CONCLUSION

This chapter has described the methodological development of a health sector planning model. In the next chapter (9) the model is applied to examine required funding levels. Methodological strengths and limitations of the model are considered in the discussion chapter (10).

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CHAPTER 9: RESULTS OF APPLICATION OF PLANNING MODEL-REQUIREMENT FOR PUBLIC SECTOR HEALTH CARE FUNDING

INTRODUCTION

The previous chapter described the development of the core components of a quantitative national health sector planning model. This is a complex spreadsheet model based on outputs and unit costs in various parts of the public sector health service. It consists of several modules (such as hospitals, primary health care, emergency ambulance services) and support modules (e.g. HIV/AIDS, staffing, costing). It builds on a wide range of planning tools in the South African health sector and combines them within a single overarching summative sector model.

This chapter applies the model described in chapter 8 to explore the resource implications of various scenarios for the health service in 2010/11. The model shows the cost implications of increasing demand for care, such as rising primary care utilisation, the formidable implications of HIV/AIDS for the health system, increases in hospital admission rates and population growth. At the same time, resource implications arise from various initiatives to improve health services and deliver them at appropriate staffing levels and unit costs, with modern capital infrastructure and medical equipment, faster ambulance response times and so forth. Further financial pressures arise from the effects of health inflation and real wage growth, both of which tend to exceed inflation, given pressures to improve wages of health workers. The combined effects of increasing demand, improving services up to appropriate levels and cost norms and increasing cost of factor inputs has substantial financial implications, which might not be affordable and sustainable for the country. The model then goes on to explore the effects of various efficiency measures which might be introduced such as improving bed occupancy, reducing length of stay, for example through increasing use of day surgery and better admissions management, adjusting the level of care mix and use of home based care. Finally the model explores the possible additional funding that the public health system might receive over time and the net effect of the combined changes.

The baseline values of the model have been set as for actual outputs and unit costs in 2004/05. This is used also to check the integrity of the model and to calibrate it - i.e. to ensure that the sum of costs projected are equal to actual sector expenditure for the base year. Various interventions or stresses are then added in various combinations to test their impact on finances, personnel and hospital beds and to create various scenarios for the future health service. The model is constructed so that each of the component modules is built up from various inputs, outputs and costs. The effects of single variable changes on the cost envelope are explored first. To undertake a sensitivity analysis for the effects of changing each variable a number of values is available for selection on the input sheet, derived from various data sources. The model focuses primarily on a long term scenario in the 2010/11 year, but does have the capacity to examine other years. All prices are given in real 2005/06 values.

A number of scenarios were developed, using combinations of variable changes along the lines of the conceptual theme of that scenario. Cost drivers were progressively added and then the effects of efficiency improvements (including service reconfiguration) and cost reduction measures progressively added. The model allows for output sheets to be printed out for each scenario developed (e.g. Tables 9.5-9.7 below).

RESULTS

One of the advantages of the model is its ability to analyse system wide changes. However before proceeding to more complex analyses, the next section deals with individual compartments of the model.

PRIMARY HEALTH CARE (PHC)

By 2005/06 actual primary care utilisation had reached 2.6 visits per capita uninsured per annum, a significant increase from 2.2 in 2000/01. Western Cape has by far the highest rates at 4 and all provinces now exceed 2 visits per uninsured person, with Gauteng province being the lowest at 2.1 visits per capita. In the module, PHC utilisation is progressively increased to 3 and then 3.5 visits per capita. The cost implication arising from this is R2.1-R3.9 billion per annum, taking expenditure on facility based PHC services from R6.6 billion in 2004/05 to R9.3 billion in 2010/11 (real 05/06 prices). Higher visit rates were found to be the most sensitive factor influencing PHC costs and thus budget requirements in the PHC component of the model.

Improving the level of resourcing of PHC facility-based services to the modelled norm of R64 per clinic visit and R133 per Community Health Centre visit and changing the distribution of visits between clinics and community health centres has cost implications of R2.2 billion over and above the 2004/05 baseline.

The combined effect of raising utilisation rates to 3.5 visits per capita, bringing unit costs up to the proposed norm and increasing the proportion of PHC visits to be managed in community health centres from 19% to 25% has a cost implication of R5.1 billion annually by 2010/11, an increase from R6.6 billion to R11.8 billion.

The primary care model is a tiered one, based on clinics clustered around a community health centre (CHC), which provides services such as radiology, full-time doctors, maternity and rehabilitation. Using a ratio of 1 community health centre (CHC) per 100 000 population, the country would require 409 CHCs, 129 more than the present. This suggests that to establish the CHC tier properly additional CHCs will need to be constructed or a number of clinics upgraded into CHCs. In some areas where there are excess district beds (Table 9.6) and low district bed occupancies (chapter 6) it may be appropriate to downgrade district hospitals to CHCs. A wider CHC network would also provide a suitable location for rollout of chronic AIDS treatment. Of the additional funding required for PHC, R2.5 billion is required for community health centres. If a higher ratio of CHCs is used, such as 1 per 6-7 clinics, the financial implications are even larger.

The 2010/11 scenario for facility based primary health care would require 51,435 personnel in the categories shown in Table 9.1.

Table 9.1 Staffing requirements for primary health care

	Medical doctor	Midwife	Professional nurse	Enrolled nurse	Enrolled nursing assistant	Counsellor	Adminstrative	General assistants	Security	
Clinic	903		13,827	3,941	4,007	2,642	3,041	2,027		
Community health centre	1,053	1,278	5,037	1,435	1,435	962	1,086	852	1,227	
Mobile			1,259		718					
Total	1,955	1,278	20,123	5,376	6,160	3,604	4,127	2,879	1,227	
	Pharmacist	**Social worker**	**Dentist**	**Dental therapist**	**Oral hygienist**	**Pharmacy assistant**	**Radiographer**	**Physio-therapist**	**Physio assistant**	**Total**
Clinic										30,386
Community health centre	818	409	818	409	409	818	409	205	409	19,071
Mobile										1,977
Total	818	409	818	409	409	818	409	205	409	51,435

The model for district management offices suggests that the cost of 53 district offices at an estimated R23 million per office would be R1.25 billion in 2010/11 as compared to R874 million baseline expenditure in 2004/05.

The model for community services and public health activities including community health workers, environmental health, school health, prevention programmes to address chronic diseases (a key cause of the worsening mortality trends) and other programmes is estimated to cost R2.6 billion annually by 2010/11, which exceeds the baseline expenditure of R1.6 billion in 2004/05. This includes the cost of environmental health services, based on 1 environmental health worker per 15 000 population costed at R661 million or R16 per capita. The cost of a community health worker programme was costed at between R410-R466 million per annum in the main options or R9-10 per capita. This option is based on one community health worker per 250 households.

The overall modelled costs of primary health care (excluding HIV/AIDS, which follows) is shown in Table 9.2. The model suggests that to achieve the significant utilisation increases and service improvements specified that primary care funding will need to rise 72% from R9 billion to R15.6 billion by 2010/11 (05/06 prices). Although this might at first sight appear an enormous increase, strong growth in baseline budgets already make provision for combined PHC budgets of R12.3 billion by 2008/09.

Table 9.2 Primary health care costing 2010/11

Rand million	Model 2010	Baseline 04/05	Difference	Difference %
Facility based Primary health Care	11,765	6,537	5,229	80%
District Management	1,225	874	352	40%
Community based and public health serivces	2,597	1,646	951	58%
Total	15,588	9,056	6,532	72%
Per capita (rand)	375	228	146	64%

HIV/AIDS PROGRAMME

The anti-retroviral treatment component is the most expensive part of the dedicated programme to address HIV/AIDS. In the cost option shown in Table 9.3, based on 818,299 persons on treatment by 2010/11, total cost will amount to R4.45 billion per annum. This option is based on the assumptions shown in Table 9.4 which include 75% annual adherence and survival and uptake of 66% of new cases by 2010/11. This growth trend is compatible with the continuation of the growth pattern demonstrated in the first 28 months of treatment and shown in Figure 8.1. Preventive programmes such as condoms, mother-to-child prevention, voluntary counselling and testing together with home based care are costed at R1.1-1.6 billion per year. This includes provision for substantially scaling up health education, media, community and other programmes to achieve greater behavioural change. It is viewed as essential to invest in preventive programmes and appropriate evaluation and behavioural surveillance and research in order to impact more effectively on the epidemic.

Table 9.3 Cost estimate for AIDS treatment programme

Year	Year	Numbers on treatment	Low unit cost	Total cost R000	Mid unit cost	Total Cost R000	Expensive	Total Cost
1	03/04	0	10,158	0	11,174	0	11,732	0
2	04/05	28,443	5,940	168,940	6,534	185,834	7,514	213,709
3	05/06	94,863	5,761	546,546	6,338	601,201	7,514	712,763
4	06/07	196,132	5,589	1,096,099	6,147	1,205,709	7,514	1,473,659
5	07/08	317,025	5,421	1,718,565	5,963	1,890,422	7,514	2,381,998
6	08/09	465,295	5,258	2,446,652	5,784	2,691,317	7,514	3,496,035
7	09/10	634,097	5,101	3,234,234	5,611	3,557,658	7,514	4,764,346
8	10/11	818,299	4,948	4,048,548	5,442	**4,453,403**	7,514	6,148,362

The numbers of persons in treatment shown in Table 9.3 is based on the commencement and adherence assumptions shown in Table 9.4 and Figure 8.2. In this option 1,239,132 persons will have started treatment since 2004/05, but 818,299 remain adherent and are survivors. Sensitivity analysis around these estimates was presented in chapter 8 (with cost estimates ranging widely from R2.8 billion-12.9 billion largely depending on uptake and adherence).

Table 9.4 Modeling numbers on treatment

	Model assumptions		Coverage by 2010		66%		Annual adherence and survival				75%
	Year	New AIDS (stage 4)cases per year	% initating ARV treatment	Starters Yr1	Yr 2	Yr 3	Yr5	Yr6	Yr7	Yr8	Cumulative number on treatment
1	03/04	345,479	0%	0							0
2	04/05	396,472	7%	28,443	0						28,443
3	05/06	439,661	17%	73,531	21,332	0	0	0	0	0	94,863
4	06/07	474,012	26%	124,985	55,148	15,999	0	0	0	0	196,132
5	07/08	499,377	34%	169,926	93,739	41,361	11,999	0	0	0	317,025
6	08/09	515,370	44%	227,526	127,445	70,304	31,021	9,000	0	0	465,295
7	09/10	522,687	55%	285,126	170,645	95,583	52,728	23,266	6,750	0	634,097
8	10/11	522,737	66%	342,726	213,845	127,983	71,688	39,546	17,449	5,062	**818,299**
Cumulative starters				**1,252,263**							

EMERGENCY MEDICAL SERVICES

The model generates an annual funding requirement of R2.8 billion, significantly more than actual baseline expenditure of R1.7 billion in 2005/06. The increase is driven by a 20% increase in utilisation rates, a step up of emergency service personnel from 8,030 to 17,868 with an increased proportion at higher skills levels, improved communication systems and vehicle replacement. The costed amount of R2.8 billion is fairly comparable to the Department of Health's emergency medical service model, which was costed at R3.1 billion (Personal communication Department of Health). The model generates a relatively small requirement for ambulances (1371 for the public sector health service) and has instead been substituted by the slightly higher number (1581) arising from the Department of Health's Geographic Information system model. However despite relatively low ambulance numbers, the model generates significantly more ambulance mission outputs and operates more efficiently than in the existing system.

HOSPITALS

Hospital data trends suggest a substantial squeezing out of admissions by the HIV/AIDS epidemic. Over a decade total hospital admission rates have declined from 104 to 95 per 1000 uninsured persons. At the same time HIV related admissions are estimated in the model to now comprise 23.9-34.1 per 1000 uninsured persons. This suggests that non-HIV related admissions have been reduced from 102.3 to

66.4 per 1000 uninsured, a very substantial reduction which is likely to be compromising access to hospital services. It is not entirely clear what has caused this, but declining health personnel numbers and lack of real growth in hospital budgets particularly in the late 1990s (chapter 6) may have caused supply side constraints.

The model makes provision for hospital admissions to recover to rates between 102-121 per 1000. There are two aspects of this. Non-AIDS admissions are allowed to recover to 81-90 per 1000 to compensate for the squeezing out that has occurred. AIDS admissions level off at 25 per 1000 even as numbers on anti-retroviral treatment grow simultaneously to 818,299 by 2010/11. Even with fairly rapid treatment rollout, in the model significant numbers of people remain untreated. The recovery of previously squeezed out admission rates has substantial additional cost implications of R1.9-3.7 billion.

Table 9.5 shows the results of the model on some basic hospital workload measures. In this scenario as admission rates rise from 94.9 to 110.2 per 1000 uninsured persons total admission rise from 3.79 to 4.6 million. As provision is made for outpatient visits to recover towards previous levels as well as to ensure adequate provision for specialist outpatient and casualty visits in addition to the effects of HIV/AIDS, visits rise from 19.3 million to 25.8 million.

Table 9.5 Hospital workload measures at baseline and 2010/11 model

	District	Regional	Tertiary	Psychiatry	TB	Step Down	Specialised other	Total
Admission rate model	43.0	42.4	14.9	1.7	1.1	7.1	0.0	110.2
Admission rate actual 05/06	39.9	37.7	14.2	1.0	0.9	0.1	0.4	94.2
Admissions model	1,780,204	1,752,364	616,743	68,340	45,560	292,765	0	4,555,976
Admission actual 05/06	1,606,282	1,516,967	572,943	40,443	37,447	2,413	14,421	3,790,916
Length of stay model	4.2	4.4	5.5	45	37	5.0	16	
Length of stay actual	4.3	4.6	5.6	77.6	37.1	20.3	34.4	
Inpatient days model	7,476,857	7,710,402	3,392,089	3,075,284	1,690,008	1,463,825	0	24,808,464
Inpatient days actual 05/06	6,945,579	7,051,331	3,181,082	3,137,695	1,389,071	49,012	496,438	22,250,207
Outpatient and casualty visits model	8,503,695	11,092,394	5,560,653	193,546	23,397		469,235	25,842,920
Outpatient and casualty visits actual 05/06	7,157,907	8,233,965	3,775,353	7,697			201,988	19,365,640

* Efficiency gains scenario

Projections of hospital bed requirements for 2010/11 in the model are shown in Table 9.6. This shows that bed occupancy rates in South Africa are still generally below required levels, although they have improved somewhat since previous years. Because of this, the country in general has sufficient hospital beds to cope with the higher admission levels modelled for 2010/11, provided that occupancy levels can be brought up to efficient levels. The 83,147 beds required is very similar to what is currently available. If more efficient bed occupancies are not achieved an additional 7000 hospital beds might be required. The table also shows that bed numbers have declined by over 20 000 over several years. Many hospitals have unused capacity that is currently not being used for operational beds.

Table 9.6 Hospital bed projections*

Beds	District	Regional	Tertiary	Acute	Psychiatric, TB, stepdown, other	Total
Inpatient days model	7,476,857	7,710,402	3,392,089	18,579,347	6,229,116	24,808,464
Bed occupancy model	80.0%	80.0%	80.0%	85%	87%	
Bed occupancy actual 05/06	63.0%	72.7%	74.8%			
Beds Required (model occupancy)	25,606	26,405	11,617	63,628	19,519	83,147
Beds Required (actual 05/06 occupancy)	32,501	29,072	12,428	74,000	19,759	93,759
Actual beds 2005/06	30,191	26,587	11,655	68,433	17,380	86,325
Actual Beds 1999/2000	41,081	26,915	15,094	83,090	27,053	110,143
Beds per 1000 model 2010/11	0.62	0.64	0.28	1.54	0.47	2.01

* Efficiency gains scenario

Projections of hospital costs for admissions and ambulatory (outpatient) visits for 2010/11 (in real 05/06 prices) are significantly above baseline unit costs for 2004/05. The overall effect of the higher workloads, higher unit costs and population growth on expenditure within the hospital module is an increase of 39% from R25.9 billion to R34.3 billion over the period. This is shown in Table 9.7. Regional hospital costs in the module rise from R8.6 billion in 2004/05 to R11.5 billion in 2010/11 and tertiary hospital costs from R7.3 to R10.2 billion. The combined increase is comparable with the recommendations of the Modernisation of Tertiary Services report for this period.[6]

Table 9.7 Hospital costs

	Step Down	District	Regional	Tertiary	Psychiatry	TB	Specialised other	Total
Cost per admission model (Rand)	2,398	3,518	4,107	10,503	32,671	18,065	9,377	
Inpatient cost per admission actual 04/05	1,168	2,921	3,997	8,411	22,539	11,351	2,921	
Outpatient cost per visit model	180	289	384	672	174	113	188	
Outpatient cost per visit actual 04/05	239	239	303	516	105	62	159	
Total hospital cost model 2010 (R 000's)	702,014	8,719,885	11,453,433	10,213,618	2,266,355	825,658	88,021	34,268,984
Actual hospital cost 04/05	135,863	7,795,740	8,590,128	7,279,078	1,542,728	355,435	225,290	25,924,263

Projections for hospital staffing for 2010 arising from the hospital staffing model are shown in Table 9.8.

Table 9.8 Hospital staffing requirements for 2010 model by hospital type

Post Category	District	Regional	Tertiary	Psychiatry	TB	Total
Administration Management	339	163	363	75		940
Administration Production	5,090	4,570	6,774	946	583	17,963
Administration Supervisor	566	914	847	199	117	2,642
Health Professional Dietetics	113	65	104	0	0	282
Health Professional Management	452	713	847	199	58	2,269
Health Professional Medical Laboratory	0	1,012	17	0	0	1,029
Health Professional Medical Practitioner	1,697	2,970	3,542	124	117	8,451
Health Professional Medical Specialist	0	1,763	3,024	100	0	4,887
Health Professional Nursing	9,841	10,837	12,563	4,082	1,282	38,605
Health Professional Occupational Therapy	113	98	121	75	29	436
Health Professional Other Allied Services	113	261	1,054	0	0	1,428
Health Professional Pharmaceutical Services	339	424	467	50	29	1,309
Health Professional Physiotherapy	113	131	242	25	29	540
Health Professional Psychology	0	65	0	373	0	439
Health Professional Radiography	452	555	1,192	0	58	2,258
Health Professional Social Work	113	131	104	124	87	559
Health Professional Speech Therapy	113	65	52	0	0	230
Midlevel Health Worker Clinical Support	1,471	1,208	760	274	233	3,946
Midlevel Health Worker Non-Clinical Support	452	228	276	50	0	1,007
Midlevel Health Worker Nursing	16,629	13,317	7,448	4,007	3,001	44,403
Technical Operations Management	339	555	397	174	87	1,553
Technical Operations Production	19,457	13,546	10,161	5,401	3,060	51,624
Technical Operations Supervisor	2,036	1,501	1,572	622	466	6,199
Technical Professional	0	0	52	0	0	52
Total	59,840	54,771	51,979	16,901	9,237	192,728

MODELLING SINGLE VARIABLE CHANGES

Table 9.9 shows the effects of single variable change on the overall level of expenditure in the sector. Changes are shown in four categories of cost drivers. Increasing demand includes increasing primary care visit rates, anti-retroviral treatment and recovery of hospital admission rates. Improving services deals with improving resourcing of services through application of staffing and other norms outlined in the various modules. Increasing unit costs refers to increasing salaries and other input costs.

The table indicates the large cost pressures on the sector. Chapter 4 indicated that in a low end funding option an additional R11.4 billion might be made available to public sector health services from 2004/05 to 2010/11. Table 9.9 shows that a small number of policy issues could easily consume this entire amount of additional funding. For example extensive roll-out of antiretroviral treatment (R11.4 billion), increased unit costs (R7.3 billion) or increased hospital costs alone could consume a significant proportion of the additional funds.

It should be noted that the single variable changes, are slightly less than when multiple variable changes are combined. For example, if population growth alone might increase costs by 10% and increased admissions similarly, the combined effect is 21%.

Table 9.9 Summary of annual additional costs of single variable changes

Cost drivers	Annual cost increase - R million			% of total expenditure		
	Low	Selected	High	Low	Selected	High
Increase demand						
Population increase (39.7 to 41.4 million)	412	1,114	2,907	0.9%	2.5%	6.6%
HIV/AIDS: Anti-retroviral treatment 556,000 -1.5 million on treatment	2,788	4,453	12,872	6.4%	10.2%	29.4%
HIV/AIDS hospital and other costs	4,375	4,900	7,082	10.0%	11.2%	16.1%
Increased primary care utilisation from 2.5 to 3-3.5 visits per capita	2,100	3,064	3,900	4.8%	7.0%	8.9%
Increase in hospital admission and Outpatient rates	0	5,702	5,702	0.0%	13.0%	13.0%
Improving resources						
Improving primary health care services	541	2,200	3,300	1.2%	2.7%	7.5%
Improve Emergency medical Services	511	1,402	1,635	1.2%	3.2%	3.7%
Improve hospital resourcing	2,874	4,400	6,985	6.6%	10.0%	15.9%
Forensic services	400	496	496	0.9%	1.1%	1.1%
Increased unit costs						
Wage drift (1%-2.5% per annum)	1,924	2,060	5,111	4.4%	4.7%	11.7%
Health inflation (1%-2% per annum)	1,050	1,434	2,164	2.4%	3.3%	4.9%
Subtotal	16,975	30,210	52,154	38.7%	68.9%	118.9%
Improve efficiency						
Level of care	-2,042	-1,644	550	-4.7%	-3.7%	1.3%
Level of care - HIV (Home based care 30%), stepdown care (20.5%)	-2,439	-1,220	0	-5.6%	-2.8%	0.0%
Decrease length of stay	-4,001	-2,067	-133	-9.1%	-4.7%	-0.3%
Increase bed occupancy	-895	-674	-452	-2.0%	-1.5%	-1.0%
Total	7,598	24,606	52,119	17.3%	56.1%	118.9%

OVERALL MODEL PREDICTIONS FOR 2010/11

The overall effect of the simultaneous application of a full set of interventions by 2010/11 varies with the scenario selected. The results of one of the main scenarios (named later as efficiency gains) are shown in Table 9.10. This shows expenditure requirements growing from R43.9 billion to R67.2 billion (in real 05/06 prices). This would represent a substantial real average annual growth of 7.7%.

Table 9.10 Funding requirements for health system by 2010/11 (real 2005/06 prices)#

Category	Expenditure Model 2010 Rand thousand	Expenditure actual 04/05 Rand thousand	Change (%)
Primary Health Care			
Primary Health Care (facility based)	11,765	6,129	92%
HIV/AIDS subprogramme	6,198	1,194	419%
District management	1,225	947	29%
Pubic health and community care	2,597	1,622	60%
Forensic pathology	500	4	
Primary Health Care facilities	Included above	511	0%
Subtotal	22,286	10,407	114%
Hospitals			
Tertiary care	10,218	7,279	40%
Regional	11,458	8,701	32%
District	8,723	7,279	20%
Psychiatric	2,266	1,543	47%
TB	826	355	132%
Stepdown	702	110	538%
Other specialised	88	38	129%
Hospitals sub-total	34,281	25,306	35%
Dental	187	187	0%
Facilities and backlog	1,440	1,759	
Hospitals total	35,907	27,252	32%
Emergency medical services	2,802	1,398	100%
Planned patient transport	32	32	0%
Training	1,235	1,235	0%
Health care support services	649	649	0%
Subtotal	64,345	40,971	57%
Management provincial office	1,763	1,763	0%
Management national	1,117	1,117	0%
Total	67,225	43,852	53%
Modelled Funding Envelope 2010	57,940		
Surplus / Deficit	-9,285		

This table corresponds to the Efficiency gains scenario shown later

HUMAN RESOURCE PLANNING

Since virtually all the constituent parts of the model contain an element of staffing planning, the model allows for these to be consolidated providing a national picture of human resource requirements for 2010/11. This scenario includes a national PHC visit rate of 3.5 per capita uninsured and hospital admission rates of 110 per 1000 uninsured persons. The consolidated human resource model suggests that the public sector health services require 42 105 additional employees, including addressing a shortfall of 2490 doctors (of which 1122 are specialists), 22,013 nurses, 766 pharmacists, 9,352 emergency service personnel, 812 radiographers and others as shown in Table 9.11 below. This analysis provides a useful complement to the National Human Resource Plan, which did not contain quantitative human resource targets of this type.[1]

Table 9.11 Human resource requirements of national health system

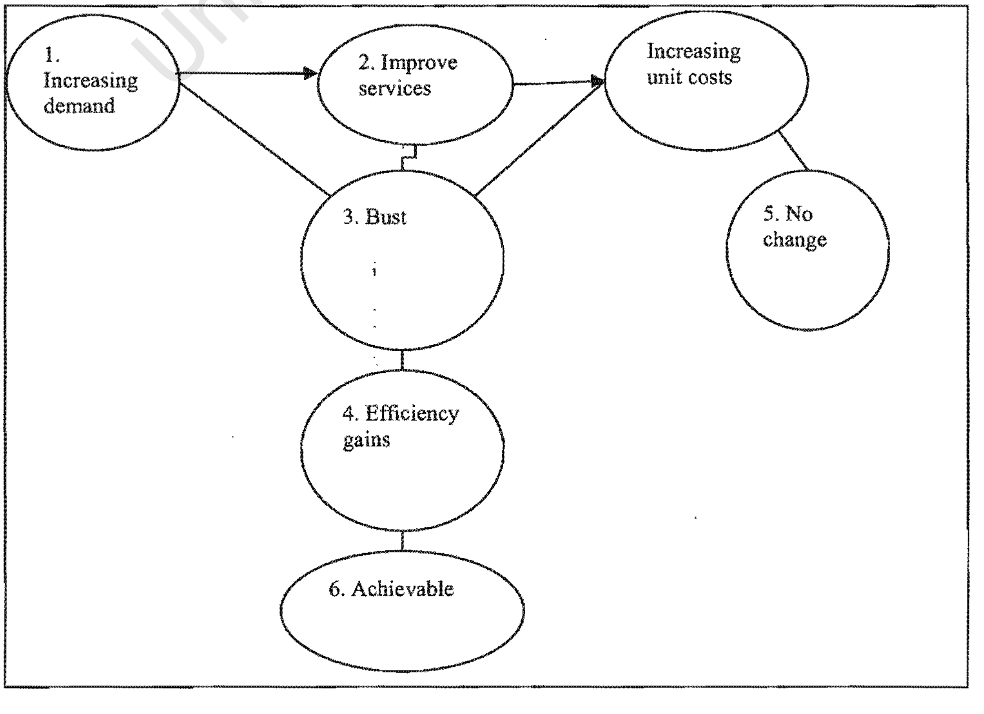
	Hospitals	Primary care	HIV/AIDS treatment	Emergency medical services	District and provincial offices	Total personnel required	Actual 2005/06	Difference	Difference %
Health Professional Medical Practitioner	8,451	1,781	725			10,956	9,588	-1,368	-14.3%
Health Professional Medical Specialist	4,887					4,887	3,765	-1,122	-29.8%
Doctor total	13,337	1,781	725			15,843	13,353	-2,490	-18.6%
Health Professional Nursing	38,605	21,062	2,175			61,842	44,641	-17,201	-38.5%
Midlevel Health Worker Nursing	44,403	11,353	2,900			58,656	53,843	-4,813	-8.9%
Nurse total	83,008	32,415	5,075			120,497	98,484	-22,013	-22.4%
Administration Management	940				1,563	2,503			
Administration Production	17,963	4,062	1,450		1,563	25,037			
Administration Supervisor	2,642					2,642			
Health Professional Dietetics	282	201	363			846	517	-329	-63.7%
Health Professional Management	2,269				3,125	5,394			
Health Professional Medical Laboratory	1,029					1,029			
Health Professional Occupational Therapy	436	403				838	664	-174	-26.3%
Health Professional Other Allied Services	1,428					1,428			
Health Professional Pharmaceutical Services	1,309	805	363			2,477	1,711	-766	-44.8%
Health Professional Physiotherapy	540	403				942	762	-180	-23.7%
Health Professional Psychology	439	403				841	409	-432	-105.7%
Health Professional Radiography	2,258	805				3,063	2,251	-812	-36.1%
Health Professional Social Work	559	403	363			1,325			
Health Professional Speech Therapy	230	201				432	274	-158	-57.5%
Midlevel Health Worker Clinical Support	3,946		5,397			9,343			
Midlevel Health Worker Non-Clinical Support	1,007		363			1,370			
Technical Operations Management	1,553					1,553			
Technical Operations Production	51,624	2,833				54,458			
Technical Operations Supervisor	6,199					6,199			
Technical Professional	52					52			
Dentist		805				805	725	-80	-11.1%
Dental therapist		403				403	151	-252	-166.6%
Oral hygienist		403				403	133	-270	-202.7%
Emergency medical service				17,382		17,382	8,030	-9,352	-116.5%
Total	193,050	46,324	14,099	17,382	6,250	**277,105**	**235,000**	**-42,105**	-17.9%
Professional	107,771	39,429	12,286	17,382	3,125	179,994	139,418	-40,576	-29.1%

SCENARIO DEVELOPMENT

The results of a set of more complex effects and interventions which cross model compartments will now be presented. These are presented in six broad groups or scenarios focusing on 2010/11. Each scenario is developed by combining a set of variable selections within the model. Some of the main scenarios which in turn can be further grouped into particular combinations include:

1. Increasing demand
2. Improving services
3. Increasing unit input costs especially wages of health workers
4. Efficiency gains
5. No change
6. Achievable

The first scenario of increasing demand models a number of factors that contribute to increasing utilisation of primary health care and hospital admission rates including population growth, the effects of HIV/AIDS, increasing access and addressing long waiting times. The scenario of improving services examines a number of interventions to improve services such as by resourcing them at appropriate staffing and normative unit cost levels developed through the model. The third scenario of increasing input costs explores the effects of a number of cost-drivers which impact on the unit costs of inputs, particularly labour costs. The simultaneous application of the first three scenarios create a bust scenario with huge and probably unaffordable financial implications. The fourth scenario explores a number of efficiency gains in an attempt to create an affordable option with improved technical and allocative efficiency. The final or achievable scenario incorporates the efficiency gains with more moderate increases in demand than previous scenarios and a higher funding option. The no change scenario incorporates a low level of funding growth associated with increasing wage costs and escalating hospital admissions due HIV/AIDS.



The model begins with a baseline level of sector expenditure of R44.43 billion in 2004/05 expressed in 2005/06 prices. This includes expenditure by national, provincial and local government health departments.

SCENARIO 1: INCREASING DEMAND

The first scenario examines the effects of increasing demand. A number of factors appear likely to lead to increases in demand for services by 2010/11. These include population growth and the effects of HIV/AIDS. Underlying this scenario also are policy priorities of improving access to services, addressing historical inequities, mitigating the effects of HIV/AIDS and reducing lengthy waiting times. The model suggests that HIV/AIDS has squeezed out hospital admission rates to levels that are potentially compromising access and that some recovery is required here. The model makes provision for increasing primary care visits, hospital outpatient visits and admissions and ambulance missions.

The key changes explored here are:

- Population growth (R1.1 billion),
- Primary care utilisation increasing progressively from the baseline 2.5 to 3.5 visits per capita.
- HIV/AIDS – increasing uptake of anti-retroviral treatment and effects on hospital admission rates
- Hospital outpatient and admission rate increases to address previous crowding out, long waiting times and improve access to specialist outpatient services
- Improved access to emergency ambulance services

The combined effects of scenario 1 is to increase costs of the health service from the 2004/05 baseline by 30.6% or R13.4 billion in real terms by 2010.

POPULATION GROWTH

Population has the potential to increase total expenditure by 2.7% (R1,1 billion) (range: 1-7%, R412million – R2.9billion) by 2010. This range is fairly wide given varying estimates of the effect of HIV/AIDS on population estimates to 2010. The lower estimate, as contained within the model, is based on population growth declining to 0 by 2010. Sensitivity analysis was performed around various alternate options. Population estimates from the Actuarial Society and Medical Research Council produce similar low population estimates and similar effects on expenditure.[2,3] The Bureau for Market Research population estimate provides an intermediate (3.7%) effect on cost. The higher estimate is based on Statistics South Africa's 2003 mid year estimates[4] and slow (0.1% annual) decline from annual growth in that year.

Increasing Primary Health Care (PHC) utilisation

Increasing PHC visit rates from 2.4 to 3 and then the Department of Health's target of 3.5 visits per capita would cost an additional R2.1-R3.9 billion. Additional funding for PHC would allow for additional clinics in underserved areas, for example Mpumalanga province and under-served pockets in Gauteng, addressing gaps in delivery of the basket of services prescribed in the national comprehensive PHC package and developing gateway clinics in areas which are overly reliant on hospitals for primary care delivery.

HIV/AIDS

HIV/AIDS exerts a profound influence on expenditure in the model. Its effects are reflected in the model by the cost of anti-retroviral treatment and prevention programmes and increasing hospital inpatient, outpatient and primary health care (PHC) utilisation.

The costs of the dedicated AIDS programme to provinces for antiretroviral treatment and prevention programmes is estimated by the model to increase from R1.1 billion in 2004/05 to R5.9 billion by 2010. In addition the epidemic is projected to cost an additional R4.3-7.1 billion annually by 2010 through its effects on hospital services in excess of spending in the baseline year 2004/05.

Increasing hospital utilisation

Provision is made in the model for some recovery in hospital admission rates among non-HIV infected persons to 85/1000 after several years of crowding out. Provision is also made for recovery of outpatient visit rates which have also come under pressure due to crowding out by HIV/AIDS and increasing specialist outpatient services.

Increased hospital inpatient and outpatient utilisation (over and above the effects of HIV/AIDS presented above) are estimated at R5.7 billion.

SCENARIO 2: IMPROVING SERVICES

The second scenario explores improving services at existing utilisation levels. Included here are resourcing primary health care, hospital and emergency ambulance services at appropriate levels or cost norms. The areas which receive attention in the model include:

- Improved primary health care services, with personnel, non-personnel and capital costs at normative levels presented in the previous chapter. In addition a wider network of 409 community health centres will be developed to provide a higher tier of PHC services.
- Improved resourcing of hospitals to the staffing, non-personnel and capital norms
- Improved ambulance model
- Forensic pathology services substantially upgraded

The cost of improving services in scenario 2 is an increase in the cost of the health service by 23.7% or R10.4 billion.

The simultaneous application of increasing demand (scenario 1) and improving services (scenario 2) is to increase the cost of the health service by 59.9% or R26.3 billion.

Primary health care (PHC)

The model suggests improving standards of PHC services along with greater use of community health centres would cost R2.2 billion above baseline without any increase in utilisation, with this reducing to R1.6 billion, given the higher 2005/06 level of actual expenditure. Improving district management teams and community based and public health services would cost R1.2 billion over baseline.

Better resourcing of primary health care will allow for greater use of community health centres, adequate levels of personnel and other inputs and improved resourcing of existing clinics and community health centres to provide the complete PHC package. Increasing use of community health centres will allow for greater access to a range of service offered at this level including doctors on-site, better diagnostic facilities, radiology, rehabilitation, dentistry, psychology, social work etc..

Hospital services

Strengthening hospital services to reasonable levels of staffing, equipment, medicines, building maintenance and replacement is projected to cost R3.1-4.3 billion, at current admission levels. District hospitals appear to be functioning at expenditure levels close to the funding norm despite reductions in length of stay and at higher costs on average than a number of hospitals costed by the Department of Health in an on-site costing study[5]. Regional hospitals are functioning at cost levels below that of the model (see Chapter 6) and the norms of the Modernization of Tertiary Services Report[6], with a shortfall of R1.4bil-R2.4 billion. Tertiary hospital services appear significantly under-funded when compared to the norms of this planning model and the Modernisation of Tertiary Services report (see Chapter 6).

This may be partially because many of the existing services are in fact mixed level 2 (regional) and 3 (tertiary) services. Tertiary services are very inequitably distributed (see Chapter 6). Even at existing cost structures, extending basic tertiary services to under-served provinces will have significant cost implications. Psychiatric hospital expenditure is also below normative funding levels.

AMBULANCE SERVICES

Emergency ambulance services are currently very inequitably distributed across the country. Improving resourcing is estimated to cost R439mil – R1.2 billion. Costing of this is presented in the previous chapter. The higher estimate of the sensitivity analysis is based on the Department of Health's 2004 emergency services model with 4 shifts per day, 2 person ambulances and a decentralized model of ambulance bases, improved communication systems and regular vehicle replacement (personal communication, Department of Health 2004).

SCENARIO 3: ESCALATING INPUT COSTS

Increasing costs of inputs has been a significant issue over the past decade in the context of limited fiscal resources (Chapter 4 and 6 and Appendix 1). The model builds in ongoing real wage escalation of 1-2.5% annually. This amounts to R1.9-R5.1 billion. Pressure on wages is likely to be exerted, amongst others, by the fact that salaries are currently linked to inflation (CPIX) plus 0.5% plus pay progression of 1%. In addition a higher subsidy for medical scheme cover has recently been introduced and plans for an improved wage dispensation for health services are far advanced.[7]

Escalating wage costs appear likely to cost R3-4 billion in real terms by 2010/11. The combined effects of this (scenario 3) with increased demand (scenario 1) and improved services (scenario 2) will be to increase the costs of the health service by 68.6% or R30.1 billion by 2010.

Real cost increases for "health inflation" on non-personnel items has also been an ongoing issue for the sector (see Chapter 6). The model suggests that if input costs escalate by 1-2% in real terms annually, this will amount to a further R1.1 billion.

The funding model developed in chapter 3 and 4 allow for the cost estimates to be set alongside projections of future funding. The effect of the R14.5 additional funding from 2004/05 to 2010/11 (see Table 3.1 in Chapter 3) on top of the combined scenarios 1,2 and 3 is to reduce the projected deficit from R30.1 billion to R15.4 billion a level still 26.6% above budget!

SCENARIO 4: IMPROVING EFFICIENCY

The last scenario showed that the additional funding likely to be available, although substantial, is still far smaller than what is required to address the envisaged increases in demand, improved services and increasing unit costs of inputs. Indeed in some pessimistic scenarios the additional R14.5 billion is virtually fully consumed by the effects of HIV/AIDS, population growth and increasing costs of inputs, with little if any room for service improvements and increasing demand.

The fifth scenario build on the fourth but builds in a range of interventions to improve efficiency. These include:

- Improving bed utilisation through shorter length of stay, improved bed occupancies, better bed planning, use of day surgery and step-down care.
- Treating at lowest appropriate level of care with an improved system of referrals (allocative efficiency)
- Cheaper care options for HIV/AIDS care

Length of stay is significantly reduced by increasing day cases, better admission and discharge planning etc. Hospitals are operated at high bed occupancy. Patients enter at the appropriate level of care and only 14% of admissions are managed at tertiary level (as opposed to 15.8% in other scenarios). For HIV/AIDS 9.5% are managed by stepdown care, particularly after failed ARV care.

The cumulative effect of all these efficiency measures is to reduce over-expenditure to 15.7% or R9.1 billion in 2010/11.

Length of stay, day cases, bed occupancy

Decreasing length of stay through greater use of day cases, improved admission and discharge planning, more streamlined procedures etc. has the potential to achieve savings. In the model savings are achieved through smaller numbers of patient days in hospital, cheaper admissions and fewer hospital beds. Savings through reduced length of stay has been modelled as between R133m and R4 billion depending on the level of the reductions achieved (3, 3.6 and 5 days are the targets of the most challenging option for district, regional and tertiary hospitals) and how the savings are estimated. The main option uses the approach recommended in the Modernisation report which suggests that a 30% -40% reduction in length of stay may lead to an 11%-14% decrease in average cost per admission.[6] A proportional reduction, as in the optimistic option of the sensitivity analysis, is likely to over-estimate savings given that the relationship between length of stay and cost per admission is not linear. Length of stay has already declined significantly over the past decade and this is likely to be one of the key ways hospitals have dealt with budget pressures.

Operating excessive bed numbers at low occupancy incurs unnecessary costs. Increasing bed occupancy with reduced costs on building maintenance and replacement alone was shown by the model to potentially achieve savings of R542-R895 million. This excludes other savings (grounds maintenance, heating etc.) but also costs incurred in transformation.

ALLOCATIVE EFFICIENCY AND LEVEL OF CARE

An area where greater efficiencies and savings can be made is through treating in-patients at the lowest appropriate level of care. The model was used to explore the effects of changing level of hospital care for inpatients. Table 9.12 shows that an option with lower tertiary care and 5.5% of inpatient treatment in step-down/sub-acute care could save R1.2 billion. Both Gauteng and Western Cape provinces, which use higher levels of care, have recently attempted to develop district hospital services. A change in the opposite direction is greater specialization. Recent years have seen a trend from district to regional hospital use (Chapter 6) and there is a case to be made for this as an intervention to improve quality of care. Similarly there are compelling arguments for extending the delivery of basic tertiary services (e.g. ophthalmology, ENT) to disadvantaged provinces and this will increase tertiary utilization and thus costs. One such option shown in Table 9.12 would cost an additional R1.3 billion.

Table 9.12 Changing level of hospital care

Option	Stepdown	District	Regional	Tertiary	Other beds	Total	Change Rand million
03/04	0.8%	38.5%	40.6%	16.0%	4.1%	100.0%	
Lower level of care	5.5%	40.0%	38.0%	14.0%	2.5%	100.0%	-1,166
Specialisation	1.0%	31.0%	45.0%	19.0%	4.0%	100.0%	1,336

Appropriate use of home based and step-down care has the potential to limit cost increases, particularly in the context of HIV/AIDS. Appropriate use of these care options has the potential to save R610 million - R2.2 billion. In addition if the current (crowding out) scenario continues, in which total admission rates have declined from 1996/97 to 2005/06 while persons with HIV/AIDS constitute an increasing proportion of inpatients, access to hospital services will reduce to unacceptably low admission levels for other patients. If HIV/AIDS, because of clinical complexity, is referred upwards and treated at high levels of care (e.g. tertiary) costs will be higher and the R9.3 billion annual projection (Table 9.9) begins to approximate the estimate by Abt.

SCENARIO 5: "NO CHANGE"

The assumptions of this scenario are:

- Low funding growth option of 3.9% per annum generating an additional R10.7 billion by 2010/11
- Increase real wage costs of 2% per year, relatively untargeted
- "Health inflation" – non-personnel unit costs increase by 2% real per annum
- Population growth to 2010 – ASSA model projections
- Worsening crowding out of hospital admissions and outpatients by HIV/AIDS complications
- Only very limited additional HIV prevention or additional anti-retroviral treatment rollout
- Forensic pathology function shift from South African Police Service to Health sector increases costs R500 million per annum compared to 2004/05 baseline
- No other increases in demand/supply or service improvements or efficiency gains

This scenario costs R11 billion and is thus affordable. However it continues the negative trend of the past decade described in Chapter 6, where limited funding increases have been substantially consumed by the effects of population growth, increasing costs of labour and HIV/AIDS.

SCENARIO 6: "ACHIEVABLE"

Scenario 4, even with efficiency savings, remains above budget, unless the high end funding option is used which requires 6.4% real funding growth per year.

Scenario 6 modifies scenario 4 allowing more limited demand increases. It encompasses the same variable selection as scenario 4 except:

- The Primary care visit rate is raised to 3 per uninsured per capita rather than 3.5 as a medium term intervention.
- The hospital admission rate recovers from 96/1000 to 102/1000 as opposed to 110/1000 in the higher scenario.
- Hospital outpatient and casualty rates recover from 513 to 553 per 1000 as compared to 619 per 1000 in the higher scenario
- The funding envelope is increased to the high end option modelled in chapter 4.

This scenario costs R64.3 billion or 3.3% of GDP. It comes within budget by means of less ambitious demand targets and a higher budget. Importantly, provision is made for all the service improvements (normative staffing levels and unit costs) in this option.

Possible lessons from option 6 are:

- It is possible to find a scenario that is affordable and encompasses significant service improvements, some provision for progressive increases in demand and in input costs
- The scenario is possible because of a combination of significant efficiency gains and higher budgets.

SUMMARY OF SCENARIOS

The main financing model makes provision for a real increase in health budgets of R14.1 billion from 2004/05 to 2010/11 to R57.9 billion. Each of the "improved demand" or "improved services" or "increased unit costs" scenarios is affordable alone. However when combined together the three cause a bust scenario with over-expenditure of R15.6 billion (27%) despite the significant growth in budget. Even with efficiency savings, the cost implications are still R9.3 billion (16%) over budget. However an achievable scenario can be found which encompasses service improvements, moderate increases in demand and unit costs. This is made possible through efficiency improvements and use of higher funding option.

Table 9.13 Summary of scenarios (Rand thousand real 05/06 prices)

Scenario		Budget 05/06 prices	Expenditure 05/06 prices	Expenditure increase over baseline	Expenditure as % GDP	Over-expenditure	Over - expenditure %	Real annual expenditure increase (%)
0	Basline 04/05	43,851,669	43,851,669		3.0%	0		
1	Increased demand	57,939,583	57,258,904	30.6%	2.9%	-680,680	-1.2%	4.5%
2	Scenario 1 and improved services	57,939,583	70,131,415	59.9%	3.6%	12,191,832	21.0%	8.1%
3: Bust	Scenario 2 and increased input costs	57,939,583	73,568,569	67.8%	3.8%	15,628,985	27.0%	9.0%
4: Efficiency gains	Scenario 3 and efficiency savings	57,939,583	67,224,938	53.3%	3.4%	9,285,355	16.0%	7.4%
5 No change	Low funding, high input costs, HIV, population growth	54,887,228	54,887,228	25.2%	2.8%	0	0.0%	3.8%
6 Achievable	Scenario 4 with less ambitious demand increases, higher budget	63,050,508	63,050,508	43.8%	3.2%	0	0.0%	6.2%

Given that scenarios 1 and 2 are based on increased demand and improving services it is sensible that particular attention be placed on achieving these in regions which currently perform lowest. This would have positive equity implications which are likely to require progressive equity of funding allocations. It is clear that with the existing variability of funding levels across provinces (Western Cape is funded at a level twice that of North West -chapter 5) that different health service configurations would be required across provinces. A version of the model adapted to each individual province would ideally show how as funding becomes progressively more equitable how options for different service configurations might evolve.

CONCLUSION

This chapter has laid out the results of the application of the planning model to the South African health care system. It has presented the results of single variable service changes on expenditure and six complex scenarios. These range from a pessimistic "no change" option to a big change "bust" option to an "achievable" scenario, which also encompasses a range of efficiency gains. It applies the model to propose quantitative staffing requirements for the sector and key areas of shortage which must be addressed.

The scenarios demonstrate a complex mix of increasing needs and demand, growth in input costs and cost implications of requirements to improve various parts of the health service towards the normative costing targets. Some of these additional costs can be addressed through a number of efficiency improvements, but continued real funding growth will also be essential.

The following chapter discusses these results, also with reference to the findings of earlier chapters.

CHAPTER 10: DISCUSSION

The health service planning model addresses many, but not all, of the problem areas identified in *the* situational analysis (Chapter 6) and the policy priorities identified in Chapter 7. In particular, the model provides a quantitative framework for Primary Health Care services structured as three levels: clinics, community health centres and community based services with an increased PHC utilisation rate (3-3.5 per capita). Provision has been made for a strong network of 53 district offices to enable the management of a District Health System and for a set of public health services and interventions. HIV/AIDS interventions are considerably strengthened with provision for over a million persons on ARV treatment by 2010/11 and improved prevention programmes. The hospital model allows for improvements in staffing, infrastructure and other aspects of resourcing as well as for recovery in outpatient and admission rates. Provision is made for significant strengthening of ambulance services to enable emergency patients to be stabilised and transported rapidly to hospital. Most importantly the model provides a quantitative planning framework for the South African public sector health service, which allows different scenarios to be explored and to which other interventions may be added.

Previous chapters (6 and Appendix 1) show that the South African health sector has faced substantial pressures over the past decade. Exploration of the decade ahead using the results of the planning model provides insights into potential future directions for the health care system. Clearly demonstrated is the substantial need for additional expenditure and the shortfall from the funding level likely to be available. Several of the scenarios, especially when applied cumulatively (e.g. increased demand plus improved services and increasing input costs) involve large deficits implying that they are in effect unsustainable "bust" scenarios for 2010/11. Also clearly apparent is the requirement to achieve greater efficiency in order to make the necessary increases in supply, service improvements and remuneration improvements affordable and attainable. Also obvious is the need to make critical choices between competing priorities.

The model demonstrates that large cost pressures exist, which have the potential to substantially affect and disrupt the sector, including through the HIV/AIDS epidemic, rising input costs and population growth. The model and its scenarios help to depict the difficult choices that the sector will face. If inappropriately handled, this could have a variety of adverse consequences including more patients being denied treatment through crowding out, worsening staffing and resourcing of services and a "bust scenario". On the other hand, if appropriate choices are made within an appropriate financing envelope, the sector will be able to deal with the challenges it faces and provide better quality services more efficiently.

Improving management and management systems will also be important to bring about efficiency changes in practice. The model clearly demonstrates that initiatives to improve resourcing of services must be matched by a range of interventions to improve efficiency. Improving primary health care, ambulance services and resourcing of regional and tertiary hospitals will be costly, and is only likely to be affordable if savings are achieved through efficiencies. These include appropriate level of care of treatment, increasing use of day procedures, shorter length of stays, associated with better admission and discharge planning, and improved bed occupancies. It is important that the sector develops detailed norms, standards and guidelines for technically efficient and appropriate delivery.

Securing adequate levels of real funding growth to 2010/11 will be essential to address the complex mix of cost pressures and desired service improvements.

FUNDING AND EXPENDITURE

TOTAL LEVEL OF EXPENDITURE OF PUBLIC HEALTH SYSTEM

The scenarios presented in the previous chapter and summarized in Table 9.13 show spending levels ranging from R54.9 billion – R73.3 billion or from 2.8%-3.8% of GDP and involving spending increases ranging from R11-R29.5 billion. Again, compared to its peers, even the highest option, although above the average for health spending as a proportion of GDP, is not out of their league and would be comparable to funding levels in countries such as Poland or Turkey (chapter 4).

In many of the scenarios expenditure exceeds budget, reflecting multiple potent cost drivers which reflect increasing demand, attempts to improve services and increasing input costs. Thus the need for funding exceeds the availability of funding in many cases.
Yet at the same time these expenditure projections are collectively conservative because:

- They are constructed from a broad sector quantitative planning framework but exclude a range of other more specific policies and requirements, some described in chapter 7 and others of national or local relevance. Amongst these are investments in improving information technology systems. Specific programmes, such as reducing hospital cardiovascular or trauma mortality rates, are likely to generate other specific costs in addition to the broader improvements contained in the "improved services" scenario. In this respect the thesis has developed a quantitative planning framework rather than a complete plan.
- The higher estimates used for escalation of input costs is conservative, given the possibility of major wage increases along with annual wage improvements, recent escalation of rapid

increases in unit construction costs in the national Hospital Revitalisation programme, the possibility of higher medicine prices in the public sector given pricing limits on private sector pharmaceutical prices, increasing costs in the National Health Laboratory Service and South African National Blood Transfusion Services, wider access to high technology medical equipment and other cost pressures (personal communication: Department of Health).

- The unit costs used in the model are based largely on technically efficient delivery options operating at scale, where-as parts of the country have very low population densities which are likely to require higher unit costs.
- The projections for rollout of antiretroviral treatment, although exceeding 1 million persons by 2010 still fall considerably short of need.[1]
- The potential for efficiency savings in the model may be exaggerated and not achieved. An example of this is the potential for savings through shorter length of stay. Given that cost are highest in earliest days, early discharge cuts cheaper days and replaces them with larger number of admissions with early high cost days.[30]

INTER-PROVINCIAL INEQUITIES

Chapter 5 of this thesis described and analysed the basis of substantial inequities between provinces, with North West provincial health services funded at half of the Western Cape. The model presented in this thesis deals with the country as a whole and its detailed adaption to the nine provincial health services goes beyond the scope of this thesis. However it is immediately apparent that, even with some centralization of tertiary specialist services, that a single set of norms will not apply meaningfully to both Western Cape and the North West provinces. This has implications both for progressive reform of public health financing systems to achieve greater equity based on need and for adaption of planning norms to match particular funding envelopes. Planning models, such as developed in this thesis, can also assist in motivating for reform to funding mechanisms and allocations because of their explicit linkage of costing and funding to acceptable service norms.

SCENARIOS

The scenarios throw up a number of instructive lessons.

"NO CHANGE" SCENARIO

The "no change" scenario is of concern and depicts a possible outcome which might result unless effective interventions are applied. It shows that despite R10.7 billion additional funding by 2010/11 with 3.9% annual real growth (low funding option chapter 4), this could be fully consumed by poorly focused rising costs of labour and other non-personnel and capital costs, the effects of a poorly managed HIV epidemic leading to escalating hospital admissions with very limited antiretroviral rollout and the effects of population growth. This scenario is a continuation of the worst features of the past decade in which these same factors predominated (chapter 6). The scenario offers virtually no service improvement, increases in access and quantity of services supplied or efficiency gains. The scenario also encompasses failure of the health sector to successfully motivate for the higher funding levels envisaged in some of the other options.

While focused wage improvements are no doubt a critical tool to recruit and retain key groups of professionals, large increases in unit costs can occur easily. Chapter 6 described the effects of the large 1996 national wage agreements. The simultaneous implementation of proposals to increase sector wages (original estimate of R5 billion for 2007/08: personal communication Department of Health), wider uptake and improved subsidization of medical scheme cover for employees under the new Government Employees Medical Scheme (GEMS), annual wage increases benchmarked to inflation plus 0.5% and provision for annual pay progression (1%) could raise unit costs significantly.

The key lessons of this scenario are:

- While wage and benefit increases are a critical tool to attract and retain staff and incentivise performance and efficiency, they need to be carefully crafted to achieve these effects also noting the competing importance of other priorities.
- Greater attention needs to be given to quantifying "health inflation", understanding its causes and developing appropriate interventions.
- Poorly planned responses to HIV/AIDS lead to significant increases in hospital costs with limited health gain, while more appropriate treatment such as anti-retroviral treatment may be foregone
- Lack of focus on potential efficiency gains does not free up resources for service improvements
- Without great resolution to change it is very possible for the health service to continue along the "no change" scenario.

"Bust" scenario

This scenario achieves many important gains: increasing service outputs in PHC, HIV/AIDS, hospitals and emergency medical services, improving the resourcing and quality of services and increasing wages of health workers. However the scenario involves overspending of R15.4 billion (26.6%), despite funding improvements of R14.1 billion (4.9% annual real increase, see Table 9.13). In terms of South Africa's Public Finance Management Act, over-spending is considered unauthorized expenditure and can lead to serious consequences for managers.[2] Therefore this is an unachievable scenario within the constraints of the budget available.

The lessons of this scenario include:

- Without efficiency gains it will be difficult to achieve the desired improvement in services, envisaged increase in demand and deal with likely pressures on input costs.
- There are difficult prioritization choices to be made. All the intended priorities may not be achievable by 2010 and are likely to need to be planned over a longer period.
- Making a very strong case for additional funding may be an essential difference between the "bust" and more successful scenarios.

"Efficiency gains" scenario

The "efficiency gains" scenario is an extremely important one. It builds on the increased demand, improved services and increased input costs of the previous scenario, but brings the scenario closer to affordability through a range of efficiency gains. These efficiency gains not only release funds for other important priorities, but also better match resources to demand and need, leading to other gains. If this scenario is further modified to increase funding levels to the high end funding option described above (R63.1 billion, 6.4% annual real growth) then this scenario could present a "high road" solution.

This thesis has presented several aspects of technical and allocative inefficiencies in the health service. Figure 7.11 showed huge variability in admission costs across regional hospitals. Outpatient visits in Gauteng are equivalent to 22.5% of all primary care visits, suggesting significant bypassing of PHC facilities. For the country as a whole general outpatient visits at hospitals (largely primary health care) outnumber specialist outpatient visits by 28% (District Health Information System 2005). Chapters 6 and 8 showed low occupancy rates and unused capital estate particularly in district hospitals. The ambulance module in chapter 8 showed unduly long response times yet low daily trip rates. Hospital admissions have had admissions crowded out by patients with AIDS (chapters 6 and 8) while antiretroviral therapy has been slow to initiate and roll out. Long waiting periods exist in parts of the health system. None of the above deny that the health system requires more resources and personnel and chapter 8 defines these in some detail.

The model builds in several aspects of efficiency gains:

- Treatment at lower level of care e.g. tertiary admissions comprising only 14% of admissions. Better resourcing of regional hospitals to prevent unnecessary demand for expensive tertiary services.
- Primary care visits as far as possible take place out of hospitals allowing specialist outpatient services to recover and perform their intended function.
- Strengthening of lower levels of care to reduce bypassing. For example 409 community health centres are developed to provide well resourced centres of excellence in PHC with radiology, rehabilitation, AIDS treatment and midwifery, amongst others.
- Shorter length of stay through better admission, discharge and bed planning, greater use of day surgery.
- More use of stepdown and home based care to reduce length of stay and provide more alternate paths to hospital admission, also for a proportion of persons with HIV/AIDS.

The main lessons from this scenario are that:

- Efficiency gains are an essential requirement for all the successful scenarios modelled.
- Effective referral systems[25] and demand management strategies[3] need to be developed and implemented. Information about patient flows within the health system need to be built into routine health information systems such as the existing district health information which cannot report on basic flow dynamics such as the proportion of hospital outpatients referred from primary health care.
- A range of improved hospital bed management strategies need to be developed including clear admission and discharge criteria and efficient processes.
- Greater use of day surgery.
- The role of outpatient departments needs to be thoroughly reviewed, with the existing substantial load of primary health care patients largely shifted to PHC facilities, especially community health centres or gateway clinics. Properly resourced and well equipped specialist outpatient clinics need to be built up to provide strong support to PHC and avoid unnecessary hospitalization. It is likely that communication between primary health care and hospitals around upward and downward referrals will need to be significantly improved.
- Clear approaches to HIV/AIDS management need to be put into place to diagnose earlier, maximize appropriate antiretroviral treatment and minimize unnecessary hospital admissions.

- Lower level services such as community health centres and regional hospitals need to be properly resourced and functioning to prevent inappropriate use of higher level facilities (e.g. hospital outpatients and tertiary hospitals)[21]
- A system of norms and standards needs to be developed for much of the health system to provide much clearly guidance on appropriate levels of resourcing, technical efficiency and performance targets.[4]

"ACHIEVABLE" SCENARIO

The achievable scenario shows that a much improved health service is potentially obtainable, but in the context of:

- Progressive but realistic increases in demand. For example achieving an increase in PHC visits of 3 as opposed to 3.5 visits per capita in the medium term is not only more affordable, but also much more logistically feasible, since the higher option requires an increase of 40 million visits (40%) which will presumably have longer term capital and other implications. Similarly increasing ART access to just over 1 million persons by 2010 is probably attainable, where-as doubling this target will be extremely difficult.
- Significant improvements in services are possible and provision for this (scenario 2 and 6) of almost R14 billion is made in the model. However this will require strong leadership and clear norms, standards, guidelines and specifications for each area that requires improvement. Unless this is done and clear and detailed agreement is reached on what constitutes the required service improvement in each area, the additional funding may well be used for other pressing purposes.
- Provision is made for increasing input costs of 1.5%-2% per year, but great attention will need to be placed on ensuring these are well utilized and to control the risk of much larger increases making the scenario unachievable.
- The scenario is made possible by a range of efficiency gains. These will only be possible by strong management, clear norms and standards, benchmarking and implementation of a range of complex interventions to better match resources to workloads, ensure patients are in the main treated at the appropriate level, ensure much smoother upward and downward referrals across system compartments and greater provision for day surgery. These will also require strengthening of basic services at community health centres, regional hospitals and various other sites.
- Motivations and lobbying for the high-end funding option will need to be compelling.

There are a number of potential obstacles which also need to be considered. One of the most important of these is limitations in human resource (HR) supply, regardless of funding availability. A detailed HR supply plan needs to be developed and implemented with urgency to avoid critical skilled personnel constraints, for example in numbers of medical specialists (see human resources plan section in chapter 9 and 10).

PRIMARY HEALTH CARE (PHC)

Chapter 6 showed that primary health care funding has increased substantially in recent years. However the model shows that significant further funding increases are required for facility based services, community based and public health and for district offices. Overall the PHC system is found to require resourcing at R397 per capita in 2005/06 prices. Although an increase from previous estimates[5,6] the model is based on a larger, stronger layer of community health centres, a broader community-based services and public health model and adequately resourced district offices. Although the outcome of the primary care module, with a 72% increase in cost from 2004/05 to 2010/11 may appear to be unfeasible, it should be noted that provision for significant increases in PHC budgets has already been included in baseline budgets up to 2008/09.[7] However as discussed above, logistical constraints in terms of expanding human resources and numbers of examination rooms by 2010/11 are also likely to limit the rate at which visit numbers can be expanded.

A key innovation in the model is a much more extensive system of community health centres, of which at least 409 are required. This would provide a higher tier of PHC services including full-time doctors, radiology, laboratory, rehabilitation, psychologist and social worker, maternity and other services. In addition this would allow for a substantial shift of chronic HIV/AIDS care out of hospitals into PHC and facilitate a restructuring of hospital outpatient workload to focus more on specialist visits and effective casualty and emergency services.

Provision is made for a deepening of community based and public health services, with an extensive network of community health workers, environmental heath offices, community nurses, school health services and programme managers and public health specialists within each District office.

Baseline levels of PHC utilisation are 2.5 visits per capita and the thesis module has planned on the basis of the Department of Health's national need norm of 3.5-3.8 visits per capita.[5,8] Further research in this area would be useful. Several years of utilisation data has accumulated in the District Health Information system which could be used to revisit some of the original detailed need norms[8]. It would be useful to understand the implication of uninsured persons supplementing public sector PHC visits by a further 38%-43% in the private sector as is currently the case[9,10]. Further audits of existing gaps in service delivery against the proposed core package of primary care services (personal communication Department of Health) would be useful.[11]

HIV/AIDS

The model makes provision for continued strong escalation of the antiretroviral treatment programme as well as significant expansion of preventive interventions. Based on current acceleration rates, by 2010/11 over 1 million persons will have started treatment. Although this is below targets proposed in a national operational plan, the latter has already fallen almost two years behind the envisaged schedule, partly because of human resource constraints.[12] The funding for this option takes resources for dedicated HIV programmes at provincial level to R6.2 billion, an almost R5 billion increase on the 2004/05 baseline and a significant proportion of the total additional funding available.

The research demonstrates the significant medicine pricing reductions which were achieved in the national anti-retroviral medicines tender. This is compatible with other recent research.[19] Reducing prices make extensive treatment rollout progressively more achievable. However the research shows that cost is strongly driven by uptake, adherence and survival[13]. As the modelling is extended out further beyond 2010/11 costs continue to escalate substantially as an increasing proportion of the 4.5-5.2 million HIV positive South Africans progressively require treatment and particularly if adherence and survival levels are high.[14] This underscores the importance of preventive interventions and continued efforts to reduce treatment unit costs. Recent reports have emphasized the need to increase numbers of health professionals to support treatment rollout.[5,12] Low levels of adherence place the programme at risk because of the potential for development and spread of resistant strains and are likely to require attention.[15,16]

The model contributes to the literature on affordability of HIV/AIDS interventions amongst others by showing the difficult budgetary trade-offs between multiple competing policy priorities for a middle income country with high HIV/AIDS caseload[17] and opportunity costs of such decisions. The simple numbers on treatment calculation tool developed helps to demonstrate how different uptake and adherence options drive cost.

The model demonstrates that developing an appropriate response to HIV/AIDS is centrally important. The model, if anything, under-estimates the cost of the epidemic (R4.9-7 billion annually) on health services by 2010 and this estimate may be compared to the R14 billion estimate of the Abt group.[18] The discrepancy is partly because the Abt costing is based on (higher) unit costs in mining and Chris Hani Baragwanath tertiary hospitals. The model demonstrates the need to make provision for some increase in hospital admissions. Flatness of baseline admission trends for the years 1996/97 to 2005/06 strongly suggest that a major way the sector is dealing with the epidemic has been to limit access of patients with HIV/AIDS to hospital while significantly reducing admissions in non-AIDS patients (chapter 6 and 8). Admission rates in the non-infected have been shown to have potentially already declined from 103.8 to 66.3 per thousand uninsured persons. As the epidemic unfolds further, it seems likely that if adequate provision is not made for increasing admissions, access to inpatient services will become a critical problem. Clear protocols should be designed to show when admission is necessary and when it can be avoided. Alternatives to hospitalization need to be developed, including home based care and step-down care (including sub-acute, respite and hospice care), especially for selected late stage patients. By 2010 the model suggests these can save R2.4 billion annually. Referring up and treating AIDS admissions at tertiary as opposed to lower levels of care will significantly affect cost. Skills must be built at lower levels of the health system, particularly at primary care level.

The existing policy and module realistically assumes that only some of the people who could benefit from anti-retroviral (ARV) treatment would receive it. This has equity dimensions and raises questions of fairness. This matter was considered by the Joint Health and Treasury Task team, which received expert bio-ethical and constitutional legal opinion, and recommended the initiation of ARV therapy in South Africa. The task team considered that phased implementation complied with the constitutional notion of progressive realization of rights.[19,20] In terms of the Constitution of South Africa the State must take reasonable measures within its available resources to achieve progressive realization of the right of access to health care services[17]. The principle of rationing is acceptable in medical practice and could be applied if necessary.[16,21] However, progressive declines in medicine prices are likely to enable wider rollout.[22]

HOSPITALS

It has been argued in chapters 6 and 8 that rapidly increasing HIV related workload in the context of declining hospital admission rates are crowding out access to hospital in both the inpatient and outpatient compartments. At the same time downsizing of 20 000 health personnel in the internal structural adjustment programme of the mid 1990s (chapter 6) has reduced supply capacity. It is likely that these are associated with excessive waiting times and an increasing threshold for admission. Also, hospitals are still clogged with patients requiring primary health care, with the data showing that general outpatient visits exceed specialist visits. The results suggest that unless these trends are reversed, the progressively increasing pressures of HIV on hospitals will seriously compromise hospital access. The relationship between rising primary care and hospital utilisation is complex and merits further research. Although increased supply at primary care level is expected to lead to increasing referrals, there is also a potential substitution effect, where for example improved malaria, TB and AIDS treatment can reduce hospital admissions.[23] This emerged also from the regression analysis described in chapter 6 and 8.

The model thus builds in provision both for improved hospital services and increased demand (and matching supply). The first is achieved through a normative approach to hospital staffing, non-personnel costs, medical equipment, capital and provision for addressing capital backlogs. The second is modelled through a recovery in hospital admission and outpatient rates. The HIV model suggests that even with acceleration to over 1 million persons starting antiretroviral treatment by 2010 that admission rates will continue to rise partly because of the size of the still untreated population.

It also emerges clearly that a range of efficiency related interventions are required. These include:

- Mechanisms to reduce bypassing of PHC facilities need to be introduced. These include improved referral processes and admission criteria (e.g. referral letters except for emergencies). A stronger community health centre layer and gateway clinics located close to hospitals are included in the model. Information systems at hospitals should report on proportion of patients which are referred. These steps are in keeping with literature which suggests that improving quality at lower level hospitals, e.g. through locating specialists there, may help to address the problem of by-passing.[24] Understanding community perceptions of care options can help to reduce this problem and unnecessary upward transfers.[25]
- Hospital outpatients especially at regional and tertiary hospitals need to be refocused on specialist activities and casualty and emergencies. The model makes provision for them to be better resourced and equipped to enable them to better support primary health care and reduce unnecessary admissions. Relatively low levels of specialist outpatient services in South Africa exist compared to several other settings.[26,27,28]
- Mechanisms to reduce length of stay need to be strengthened including more day surgery, improved admission and discharge procedures.
- The use of step-down (sub-acute) care and home based care needs to be expanded as an alternate to lengthy admissions. Given that inpatient care is expensive, admissions should clearly be appropriately used. This is in line with other literature that reports between 1-27% of admissions and 14.6%-61% of bed days to be inappropriate.[29] Similar findings have been reported in South African hospitals.[30] Strategies to manage admissions include improved skills at primary care level, better cooperation between general practitioners, specialists and

hospitals, day surgery, improved admission and discharge planning, subacute care and patient hotels.[26]

- Chronic HIV/AIDS care needs to progressively shift to primary health care as capacity is built up there, especially at the community health centre level.
- Community mental health services should be strengthened to reduce the need for long stay institutionalization
- A comprehensive set of norms, standards, guidelines and specifications is required for many parts of the health care system. This research has provided potentially useful information in some of these areas. Regular use of benchmarking to compare hospitals of similar types against each other and against these standards for performance and technical efficiency will assist in monitoring and guiding managers.
- Wide variations in unit costs across institutions of similar type (e.g. figure 6.13) suggest that greater use should be made of performance based budgeting approaches to better match funding to outputs. According to Lee some of the greatest successes he has experienced in planning come from better matching of personnel distribution to workloads.[31] Vissers argues for a similar process even within hospitals.[32]
- Greater attention to efficient use of capital will be essential. The sector is currently operating almost 24 000 fewer beds than in 1999/00 (chapter 9) and clearly has significant unused space which is costly to maintain. Similarly low occupancy rates in many district hospitals suggest that some rationalization is required at this level. Indeed higher quality hospital services may result from fewer hospitals operating at scale and with sufficient skilled resources.

Specialist Regional and Tertiary Hospital Services

The most useful comparator for the model for regional and tertiary hospital services is the Modernisation of Tertiary Services (MTS) report.[34] This comprehensive study examined outputs and unit costs for specific specialist areas in conjunction with groups of medical specialists and determined specific gaps by service area. The funding requirement for implementation of the MTS programme was costed as increasing expenditure on regional and tertiary hospital services from R14.9 billion in 2004/05 to R22.4 billion in 2009/10 to R26.7 billion in 2014/15 (2005/06 prices).[30] These figures are similar but slightly lower than those arising from scenario 4 (Table 9.6 projects a figure of R21.7 billion for the total of these two hospital types) and are almost identical to those of scenario three.

The MTS proposals are however targeted at 2014 which would allow for several additional years of funding growth to attain this target. Both the MTS proposals and scenario 2 and 3 involve higher levels of admissions to specialist hospitals (regional and tertiary) than in the 2004/05 baseline (around 59-

60/1000). Because of funding constraints, in the efficiency gains scenarios (4 and 6) a greater proportion of the workload is dealt with at lower levels including district hospitals, step-down and home based care while tertiary care is somewhat rationed as compared to scenarios 2 and 3. There are trade-offs here between affordability and quality, with specialist hospital care typically being of higher quality and as funding progressively improves, specialist services are increasingly likely to be selected. The balance between district and regional hospitals is of particular relevance in large urban areas where several provinces are attempting to develop district hospitals because of affordability constraints, although their large populations do provide the critical mass required to fully occupy specialists. More work is required to optimally define this balance for each given funding envelope.

The MTS proposals are also compelling because of their location within a Geographic Information System (GIS) planning model which includes the national road network and travel times. This has allowed it to determine catchment populations for each regional and tertiary hospital and identify gaps where regional and tertiary services should be developed.

The close correspondence of scenario 2 and 3 to the MTS proposals suggest that scenario 3, although a bust scenario for 2010/11, may be an option for 2015/16 with its correspondingly higher budget envelope. Some of the efficiency gains of scenarios 4 and 6 set a foundation for this, and as the budget envelope progressively increases greater progress can be made on building up basic tertiary services in all provinces. However strengthening regional (level 2) hospital services throughout the country by 2010/11 is likely to be necessary in all approaches.

HUMAN RESOURCE PLANNING

The service model is based on detailed staffing ratios in almost all of its compartments. This has allowed it to derive total human resource requirements for the country. These are presented in Table 9.9. This shows the requirement for health personnel in 2010/11 and detail on deficits for each category of professional compared to baseline e.g. medical specialists 29.8% and professional nurses 38.5%. The ability of the model to provide staffing ratios for each part of the health service and for the country overall is potentially a useful addition to the National Human Resources (HR) Plan, which did not provide quantitative targets of this type.[34] The human resource deficits indicated by the model are compatible with recent published international comparisons which demonstrate that South Africa has lower levels of certain personnel categories than compared to other similar income countries.[35,36]

Given the long lead times to train health personnel, it is unlikely to be possible to produce sufficient additional numbers of skilled graduates to fully address these gaps by 2010/11. This shows the necessity of developing and implementing a linked HR production plan as an early step and suggests that some of the required improvements may only be possible by say 2015/16 as opposed to 2010/11. The emerging policy of the Department of Health makes it difficult for foreign health professionals to practice in South Africa (personal communication Department of Health 2006) and this is likely to hinder supply and requires review.

PLANNING, MANAGEMENT AND INFORMATION SYSTEMS

There are numerous potential constraints to the use of planning models such as the model developed in this thesis. These include management, planning and information issues.

The ability to lead public sector health services away from the "no-change" to the "efficiency gains" or "achievable" scenarios will require a great deal of management capacity at many levels within the health service. Ability to envision and manage change processes is a critically important management function that will be required to achieve a favourable outcome.[37] Other critical challenges for management are likely to include the need to encourage more autonomous managerial decision-making. The importance of improving managerial morale and soft skills such as communication and inter-personal skills should not be under-estimated.

Deepening planning skills will also be essential. Several provincial departments have already made significant progress in strategic planning and developing long term service plans.[38] The national Department of Health's Integrated Health Planning Framework, strategic planning guidelines and methodology for business cases for Hospital Revitalisation projects have contributed to improving skills in this area.[39] However there is considerable international experience with sophisticated planning models which have ultimately had limited usefulness.[40] Presentation of planning models in accessible formats, training and support are all likely to be important for their use. There is also the need to translate the targets into detailed programming (what needs to be done when, by who etc.).

The critical importance of improving health information systems stands out as a priority. Inadequate quality of basic information hinders understanding of key health service trends (such as hospital admission rates, chapter 6). In some cases basic data is completely absent in existing systems, such as on hospital referral rates, patient diagnoses and age-specific utilisation trends. Inadequate data for planning services, such as on specialist inpatient and outpatient outputs and expenditure, significantly limit planning models. In addition improved information systems will be required to properly monitor and guide the implementation of sector plans and performance related management systems.

METHODOLOGICAL AND EMPIRICAL STRENGTHS AND WEAKNESSES

STRENGTHS

The research and model presented in this thesis provides substantial methodological advances and insights. These include the development of a sophisticated planning tool with modular components that has applications for resource allocation and budgeting, physical planning and human resource planning for the health sector as a whole and for its component parts. Drawing from the literature review, the model has attempted to use a planning and systems approach to develop a health sector planning model and to apply it to determine sector funding requirements.

The tool is developed in a South African context but makes a contribution to both local and international health planning literature along the lines of authors such Denton, Segall, Navarro and Wanless.[41-44] It contains an updated hospital and primary health care costing and staffing model set to current wage levels. In his review of the planning literature Denton found no other similar published quantitative planning models for the overall health system.[36]

This thesis provides a planning framework in which planning targets across the sector are consistently linked to costs so that the resource implications of different policy choices are apparent. The methodological tool and findings from its use may inform decisions on funding health services as well as in allocative and budgetary decisions within the sector. A funding model has also been developed (chapter 4) to predict future potential funding levels for the health sector, which could assist the sector in planning and budget negotiations. The planning model also adds to the literature because of its location in a middle income country that does not have the advanced health information systems which inform the modelling of authors such as Denton and Wanless, and has a large burden of HIV/AIDS.[36,39]

A set of scenarios have been developed which illustrate a number of critical policy choices the South African health sector faces with a range of very different macro outcomes.

Quantitative targets for human resource requirements for the South African health sector for 2010/11 have been derived and analysis of gaps against baseline staffing numbers by occupational group undertaken. These are based on detailed human resource modelling in the context of a broader framework model of service levels and funding. These provide a useful contribution to the National Human Resources Plan which did not provide quantitative targets of this type.[45]

Historical patterns of utilisation and unit costs across a range of service types have been described and modelled norms or targets for many of these areas developed. These are potentially useful to other researchers.

The model is based on demand trends and projections and normative cost structures for various parts of the health system. The approach used to develop the cost models is based on model staff establishments for different facility types and workloads and costing of key non-personnel and capital elements. In some cases benchmarks from well resourced provinces such as Western Cape have been used. A considerable focus is on exploring the costs of complex scenarios. The model is a powerful tool which provides important insights into the funding requirements, planning and priority choices of the sector in the years ahead.

The model and findings have potential applicability to a number of settings. Firstly it has already been useful to the Treasury Department in making funding decisions. Secondly it is of potential use to planners, managers and health economists in the South African national and provincial Departments of Health. Thirdly it contributes to academic literature on health sector planning and funding. Lastly, several of the approaches have potential applicability to other countries – the basis of the model in quantifiable output and input (e.g. human resources) measures provides opportunities for a range of comparative work across health systems.

Limitations

In its modelling of an entire public health service there are no doubt aspects that could be strengthened and improved or validated by further research. Each of these introduce additional levels of complexity and a balance needs to be found between complexity of specific purpose models and simplicity of use of a macro- sector model such as that developed here. Experience from other sites has sometimes shown that overly complex models are not used by managers.[46] Some of these methodological limitations that could benefit from further research include the following.

The approach taken to modelling focuses predominantly on demand rather than need, with the exception of modifications for unmet need in specific services such as for primary health care visits, hospital admissions and for HIV/AIDS. This is in line with Navarro's structural production approach, which pointed out the difficulties of modelling need.[38] However although it would introduce additional complexities, there are advantages to focusing more on need. Development of tools to better link need (e.g. burden of disease) and demand at different levels of the health system would be useful. The World

Health Organisation's DisMod tool may hold promise in this area.[47] Although the effect of aging was found to be not that significant in the period of the model, also given the far larger effects of HIV/AIDS, for longer term modelling it would be preferable to include an age based aspect to the demographic modelling. Again this also reflects a gap in existing sector information systems which in the main do not report on utilisation by age. Deepening information about patient diagnoses and procedures is also required. Existing public sector hospital information systems in South Africa in the main do not provide this crucial information which inhibits planning for specific health problems.

In its approach to formulating multiple variable combinations within the spreadsheet model the approach taken is deterministic. In some cases statistical and in particular multivariate regression approaches have been used to provide corroborating evidence and strengthen understanding of relationships between a range of variables, such as between primary care visit and hospital admission rates. However further detailed work in this area is required. This is likely to require several major research projects for which in many cases data are currently not available. All too often even basic data required to understand the system have been found lacking and this has implications for health information systems as well as future health systems research.

The level of modelling of costs and outputs has been located at the level of service types such as district and regional hospitals. Part of the difficulty in deepening the level of the analysis to the level of the speciality and diagnosis is because of lack of or inadequate cost centre accounting systems, reporting on specialist service outputs or recording of diagnoses and treatments within existing information system by hospitals. These areas require attention. The Modernisation of Tertiary Services (MTS) Report used a speciality specific approach to good effect and merits operationalisation and implementation[30]. However the latter was based partly on once off surveys and informational improvements are required to take this type of planning forward.

The approach used to costing has been based on costing of model staff establishments and other inputs. This has useful advantages such as the ability to develop resource-based plans to support particular outputs and for comparability across countries. However other linked research would be useful. Continued development and costing of service packages for specific levels of care would further strengthen understanding of the cost and funding implications of specific service types.[48] Further research to explore the nature of average versus marginal cost curves of particular service types would be useful as would research into the huge variability in unit costs between institutions of a similar broad type (e.g. regional hospitals).

The model that has been presented is for South Africa as a whole. Deepening the analysis to specific provinces and districts would help to address the variability across geographic areas, but would also require modification for specific local issues such as problems of low density areas and the historical legacy of existing facility distribution. Recent versions of the Department of Health's Integrated Health Planning Framework have pursued this approach providing greater regional specificity but at the same time greatly increasing the size and complexity of the model. The planning model also does not include the detailed programming (see planning cycle Chapter 2) required for implementation.

CHAPTER 11: CONCLUSION AND RECOMMENDATIONS

This chapter summarises the main conclusions arising from the research and makes recommendations for the future. This thesis set out to examine the availability and requirement for funding for public health services in South Africa, a lower middle income country with a high burden of disease from HIV/AIDS. Hoffmeyer and McCarthy refer to these as the supply and demand sides of health care expenditure.[1]

The role of health planning as an approach to determine spending requirements was examined in a detailed literature review (Chapter 2). Only a relatively small number of published quantitative health sector planning framework models were found in the international health planning literature. These include work by Denton[2], Segall[3], Navarro[4] and Wanless[5]. However these planning models were largely developed in the context of developed economies with sophisticated health information systems, which are not available in South Africa. The author has used a health service planning approach and has developed and applied a quantitative sector planning model to determine spending requirements.

PUBLIC SECTOR HEALTH SERVICE FUNDING

The author analysed funding trends for public sector health services in South Africa over the period from 1995/96 to 2008/09 with a particular focus on locating health sector funding within the context of government's broader fiscal and expenditure choices (Chapters 3 and 4). In addition to providing some of the latest available information on public sector health care funding in the country, the thesis provides new insights into the background under-pinning health sector funding levels. A rapid analysis by the author suggests flow of funds through financing intermediates of around R125.8 billion in 2005/06, or 8.1% of GDP. An estimated 42.7% of funds flow through public sector intermediaries, 56.5% through private sector intermediaries and 0.8% through Non-Governmental Organisations or donors.

The South African public sector health service in the decade from 1995/96 to 2005/06 experienced three distinct phases of funding which were found to correspond closely to three phases of fiscal policy in South Africa. The period from 1995/96 to 1996/97 was marked by large wage increases and structural and organizational restructuring in the immediate post-apartheid period. The period from 1997/98 to 1999/2000 was characterized by an internally imposed structural adjustment programme, which significantly constrained health budgets and was associated with the downsizing of approximately 20 000 health personnel. The period from 2000/01 to the present has been characterized by rising health budgets. After a reduction of health expenditure of R4.1 billion between 1996/97 and 1999/2000, health expenditure recovered by R12.3 billion from 1999/00 to 2005/06 in real terms. However the latter period has occurred in the context of a large HIV/AIDS epidemic with implications for mortality, health care utilisation and costs.

Funding for health services as a proportion of GDP is sometimes considered unusually high in South Africa compared to countries of similar income, exceeding 8% of GDP.[6] However given that in South Africa the majority comprises private financing, the author used World Health Organisation data to compare levels of public sector health service funding with a basket of other middle income countries. South Africa is shown to be located close to the average of middle income countries in the study group. Public sector health care spending expressed as a proportion of GDP was found to be 3%-3.3% of GDP depending on whether a narrow or wider definition of health spending is used. This measure was found to be close to the average for countries of this income group. The same was found for health spending expressed as a proportion of total government expenditure or in absolute terms whether expressed in $US terms or adjusted for purchasing power parity. However it is plausible that given South Africa's high level of need in terms of its disease burden, particularly due to HIV/AIDS, that public sector funding levels should appropriately be above the average.

In this thesis an innovative funding module has been developed as a tool to predict forward funding levels for public health services. The module is based on the combined effects of economic growth and selected fiscal and expenditure policy indicators. The analysis suggests that South Africa is currently in a relatively stable and strong fiscal position with a growing economy, low levels of debt and is increasing spending on priority programmes, which bodes well for health care funding. The module predicts that the funding level of public sector health services will increase by R14.5 billion in real terms from 2004/05 to 2010/11 (range: R11.1-R19.7 billion.) This is equivalent to real growth of 4%-6.4% per annum with an estimate of 4.9% in the main option and will raise public sector health care funding to R57.9 billion by 2010/11 (2005/06 prices).

Furthermore, an analysis of inequity in inter-provincial funding was conducted which sheds new light on trends in inter-provincial equity. An analysis of the financing basis of the inequities provides new insights into the way that inequity arises from the design of the existing inter-governmental funding streams.

Health care expenditure

Although expenditure in the national and provincial departments is projected to grow by R20.7 billion from 1995/96 to 2008/09 (3.8% annually), the positive effects of this have been eroded by several major cost drivers and the sector faces major challenges. An analysis of public sector health expenditure trends has been undertaken and is presented in the thesis (Chapter 6).

Population growth amounting to an increase of 8.3 million uninsured persons occurred over the period from 1995/96 to 2008/09 (1.7% annually) and per capita expenditure has only surpassed levels last reached in 1996/97 by 2005/06 (Chapter 4). The average unit cost of labour increased by 36.7% from 1995/96 to 2005/06 (Chapter 6). This has contributed to the total number of employees in the public downsizing by 20 000 in the late 1990s and only recently in 2006/07 recovering to past peaks. However personnel to population ratios are still significantly below past levels. HIV/AIDS has emerged as a major epidemic in the region and has been estimated in this thesis to cost public health services at least R6.3 billion in 2005/06. The severe burden of disease especially from HIV/AIDS has seen average lifespan declining to 51 year, almost twenty years below most comparable middle income countries.

DEVELOPMENT OF PLANNING MODEL AND APPLICATION TO ASSESS HEALTH CARE SPENDING REQUIREMENTS

In this context the research focused on the development and application of a planning framework model. This has been designed with interlinking modular components to simulate the public health sector in South Africa. The model draws on previous planning and costing tools that have been developed for South African public sector health services, including early versions of the Department of Health's Integrated Health Planning Framework in whose early design the author played a significant role. The model has been applied to examine cost implications of various public sector health service options for 2010/11.

The model shows that the sector faces numerous and substantial cost pressures going forward. Some of the largest of these are the costs of rolling out antiretroviral treatment, further increasing salary costs and improving hospital services. A set of scenarios illustrating a number of critical policy choices the South African health sector faces with a range of very different macro outcomes were explored.

In the most negative "no change" scenario additional funding of R11 billion in real terms by 2010/11 is fully spent on poorly controlled input costs, increasing hospitalization due to HIV/AIDS and population growth. This scenario sees little improvement in services or increase in service outputs.

Various scenarios were developed which explored the implications of increasing demand (rising primary health care, emergency medical service and hospital utilisation and AIDS treatment), improving services (funding and staffing health services at the normative levels developed in the thesis) and rising cost of inputs. These were found within the context of the funding envelopes predicted by the funding module (Chapter 4) to be affordable individually, but not collectively. Their combined effect was a "bust" scenario with over-expenditure of 27% (R15.7 billion) by 2010/11 despite budgetary growth of R14.5 billion.

In the "efficiency gains" scenario various reforms are introduced to improve technical efficiency in the sector including reducing length of stay, increased day surgery, treatment at appropriate lower level of care and developing substitute care pathways for hospital admissions such as home based and step-down care. However the modelling suggests that the efficiency gains will not be enough to fully offset the additional cost pressures identified. The "achievable" scenario allows for somewhat more moderate growth in demand, better control of unit costs and a more favourable budget option. It incorporates some of the best features of the other scenarios showing that with the right combination of budget improvements, efficiency gains and control of labour costs, that significant improvements in services and outputs can be achieved.

The tool is developed in a South African context but makes a contribution to both local and international health planning literature. These include the development of a sophisticated planning tool with modular components that has applications for resource allocation and budgeting; physical planning and human resource planning. It contains an updated primary health care and hospital costing and staffing model set to current wage levels. This thesis provides a planning framework in which planning targets across the sector are consistently linked to costs so that the cost options of different policy choices are apparent. The methodological tool and findings from its use may inform decisions on funding health services as well as in allocative and budgetary decisions within the sector. A set of scenarios have been developed which illustrate a number of critical policy choices the South African health sector faces with a range of very different macro outcomes.

Quantitative targets for human resource requirements for the South African health sector for 2010/11 have been derived and analysis of gaps against baseline staffing numbers by occupational group undertaken. These are based on detailed human resource modelling in the context of a broader framework model of service levels and funding. These provide a useful contribution to the National Human Resources Plan which did not provide quantitative targets of this type.

RECOMMENDATIONS

The following recommendations are made:

FUNDING

1. Strong real funding growth is required in the health sector annually until at least 2010 and possibly 2015. The sector should probably aim for increasing public funding for health in the main budget from the current 3% to 3.5%-4% of GDP.
2. The health sector needs to prepare thorough and detailed motivations for funding increases over a sustained period linked to detailed plans, lobby and negotiate strongly for these and be able to demonstrate progressive benefits gained from funding improvements.

PLANNING AND MANAGEMENT

3. Capacity for quantitative health service planning needs to be built at various levels of the health system. Planning models such as presented in this thesis, the Department of Health's Integrated Health Planning Framework or in related provincial plans can provide a very useful framework for health services development. Capacity for detailed programming is also essential at provincial (and district) levels.
4. The Department of Health needs to develop a comprehensive set of quantitative norms and standards for many parts of the health service. It will be difficult for managers across the country to substantially improve services if they do not have clear guidelines, standards, specifications and examples of the improved services they should strive for.
5. The difference between the successful scenarios which encompass substantial service improvements and increases in demand as opposed to the "no change" scenario will rely significantly on the ability of managers to effect change.
6. The process of performance monitoring needs to be significantly strengthened in the sector in order to monitor and incentivise desired outcomes.

PRIMARY HEALTH CARE (PHC)

7. Funding for PHC should be progressively increased towards R397 per capita along with visit rates to 3 per person per capita or higher by 2010 (and 3.5 by 2015). Given existing inequities, particular emphasis should be placed on provinces which are well below this target at present.
8. An extensive network of at least 409 community health centres should be developed as a

higher tier of primary care services and should offer a comprehensive set of services including radiology, pathology, dental, psychology and social work, physiotherapy and occupational therapy, psychiatric, maternity and HIV/AIDS treatment. Improvement of primary health care services is a critical aspect to prevent bypassing and unnecessary use of hospital services.

9. Community based and public health services should be strengthened and expanded.

HIV/AIDS

10. Rollout of antiretroviral treatment should be accelerated in order to provide appropriate modern management and reduce escalating mortality rates and pressure on hospital beds. Over 1 million persons should have commenced treatment by 2010/11.
11. Alternate care pathways for a proportion of AIDS patients such as home based and stepdown care need to be developed and clear guidelines for appropriate patient pathways developed.
12. HIV is the largest single cost driver in the model and a range of initiatives should be accelerated to improve prevention. Also, because it is the largest cost driver, the HIV/AIDS module would need to be updated and refined regularly using new information on uptake, adherence and movement from 1st to 2nd line treatment.

Emergency medical services (EMS)

13. Resourcing of ambulance services should be improved towards the cost norms developed in the model, which are also compatible with the Department of Health's ambulance model.
14. Improvement of EMS information systems is required.
15. Further research is required on what appear to be inefficiencies in the existing ambulance system and appropriate steps taken to address these.

Hospitals

16. Hospitals need to be resourced more adequately with appropriate levels of staffing, medical equipment and other inputs. The cost norms arising from this thesis and the Modernisation of Tertiary Services project are very similar and may help to provide guidance on an appropriate levels of resourcing. Regional hospitals should be a particular priority.
17. Outpatient departments need to be protected from an overwhelming primary care workload and specialist outpatient departments strengthened and better resourced, linked also to increasing day surgery, hi-tech procedures and improved support for PHC services at community health centres.

18. A range of efficiency measures needs to be strengthened in hospitals. These include:
    - Measures to decrease length of stay such as increased improved processes of admission and discharge planning, day surgery and use of step-down care.
    - Greater use of performance based budgeting systems to better match resources to workloads.
    - Improve occupancy levels in district hospitals including rationalization in some cases .
19. The cost outcomes of the Modernisation of Tertiary Services (MTS) report have been largely confirmed through this thesis. The MTS report provides a compelling strategic plan for developing regional and tertiary hospital services and needs to be operationalised and implemented.

Human resource planning

20. Significant deficits in numbers of personnel have been identified in a range of areas. Additional posts need to be funded, created and filled in these areas. A powerful recruitment strategy and programme needs to be implemented.
21. A quantitative human resource supply plan needs to be developed especially for areas where supply needs to be expanded. Practical aspects of expansion of programmes in the Higher Education sector and Nursing Colleges need to be negotiated, planned and funded.

Escalating costs of inputs

22. Increasing wages needs to be carefully targeted to align with human resource goals, improve performance and skills.
23. Attention must be given to better understanding costs of critical sector inputs and how to control these.
24. Care must be taken to avoid the pitfalls of the "no change" scenario in which unfocussed input cost gains crowd out a number of other critical priorities.

Information systems and research

25. The quality of existing information is poor in many instances and needs to be improved. This relates especially to emergency medical services and hospitals. Sector information systems need to provide regular management information about a range of key performance, output and efficiency indicators in order to monitor the change process.
26. A number of new pieces of information need to be collected including measures of patient

flow between components of the health system e.g. referrals to hospital, measures of cross-boundary patient flows, information on utilisation by age, speciality and diagnosis.

FUTURE RESEARCH

A number of research and development areas could strengthen sectoral planning and budgeting and take further the work undertaken in this thesis. These include:

- Development of tools to better link need (burden of disease, aging) and demand within and between populations.
- Further research on statistical and empirical relationships between key planning variables such as primary care, outpatient and admission rates.
- Further development of costed service packages for each service type
- More in depth costing and technical efficiency studies for specific service types including benchmarking between institutions and determination of the nature of average versus marginal cost curves.
- Operational research to take forward planning for specific service types such as to more specifically guide the Modernisation of Tertiary Services process.
- Adaptation of the planning tools developed in this thesis model to particular provinces or districts

This thesis has provided an unusual and innovative approach to modelling the spending requirements of the public sector health care service in South Africa. A quantitative planning model has been developed and applied to develop a range of scenarios which indicate some of the critical choices that health leaders and managers face in the country. Alongside this, an analysis of long term funding trends has been undertaken and a funding supply model developed to predict forward funding levels. It is hoped that this analysis contributes both contextually in South Africa and to broader academic knowledge and understanding of health sector planning and funding.

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APPENDIX 1: DOWNSIZING OF THE WESTERN CAPE DEPARTMENT OF HEALTH – CAUSES AND LESSONS

SUMMARY

This appendix presents a summarised version of a case-study of substantial downsizing of health services in one province in the late 1990s. The case study suggests that the downsizing was largely due to disjointed fiscal, expenditure and wage policies determined at the national level. A national policy of fiscal constraint (structural adjustment) was applied shortly after negotiating large wage adjustments centrally and simultaneously with implementation of a new resource allocation formula entailing redistribution to achieve equity.

The Department of Health in the Western Cape Province downsized by 9282 health and support personnel (27.9%) and 3601 hospital beds (24.4%) over 5 years from April 1995 to April 2000. Inpatient days in hospital declined by 502 000 (13.6%) despite increasing population growth (8%) and escalating HIV/AIDS prevalence.

A study was undertaken in order to analyse the financial basis for the downsizing and suggest policy implications. The methodology consisted of analysing relevant departmental, provincial and national financing and expenditure trends from 1995/96 to 2002/03.

The study found that despite the policy of national fiscal constraints (GEAR) total transfers to the nine provinces remained fairly constant in real terms. There was a real reduction in Western Cape provincial funding of 13.2% (R1.675 billion) from 1995/96 to 1999/00, with a reduction in its share of provincial transfers from 11.8% to 10%. However the Department of Health's share of the Western Cape's provincial budget increased over the period from 25.6% to 29.3% mainly associated with a substantial upward revision in national health conditional grants allocated to the provinces. The net effect of these financing changes has been that Health's allocation in real terms is similar in 2000/2001 to what it was in 1995/96. This suggests that financing changes were not the major cause of the substantial downsizing.

Expenditure analysis revealed a 39.7% real rise in the average cost of health and support personnel over the period. Given the proportion of personnel expenditure to the total, this increase is equivalent to a 26.2% real rise in total departmental expenditure. Wage growth has largely been driven by centrally negotiated salary decisions beyond provincial control.

Disjointed fiscal and wage policy has in this case seriously affected health services. Where-as inter-provincial inequity was perhaps the major policy concern that needed to be addressed, simultaneous application of policies of fiscal constraint, redistribution and substantial real wage growth has resulted in substantial downsizing without making major inroads into inequities. The extent of the downsizing appears not to have been foreseen. If Heath's share of the provincial budget and the conditional grants had not been increased substantially the effects on health services could have been catastrophic with a reduction in the service by 42% in less than 5 years.

Simultaneous application of fiscal policies (which individually appear quite reasonable) affecting the budget (fiscal constraints to reduce the national deficit, redistribution) in the absence of adequate coordination with policies and negotiations that affect expenditure (e.g. wage bargaining) may have serious effects on basic social services. This study emphasises an important lesson for fiscal policy makers in South Africa as well as other developing and lower middle income countries.

INTRODUCTION

The Western Cape Provincial Department of Health went through a period of rapid and massive downsizing over a 5 period with the closure of approximately 3500 hospital beds and the downsizing of the staff establishment over 9000 health workers. It is perhaps tautologous to state that downsizing of health services of this magnitude represented a substantial problem and was cause for significant concern by the public and health workers. Although equity redress was at the time widely perceived to be a significant cause, personnel numbers did not paradoxically increase significantly in other provinces

The motivation for this research was that a proper understanding of the financial basis for the downsizing will help to correctly target interventions in resolving this problem of precipitous downsizing in one province, without significant corresponding growth elsewhere. This will be of importance not only to this province but more broadly to other provinces as well as to other similar settings internationally. This appendix presents a summarised version of a longer report and publication by the author.

METHODOLOGY

1. Financing trends of the Department were analysed.

1.1. Health Departmental and provincial budget data were obtained from audited financial statements by Auditor General and official (White Book) budgets (Provincial Government Western Cape

1996,1997,1998,1999, 1999(2), Province of Good Hope 1994). Data was used from final appropriations accounts and audited financial statements since these reflected the final budgets for each financial year. The figures from the latter two sources were identical but differed substantially from the White Book budgets since budgets changed over the course of each financial year.

1.2. Trends in the provincial allocation to the health department were analysed from the combined appropriations accounts of all the provincial departments.

1.3. National budget and expenditure trends were obtained from data from national budget reviews of national Department of Finance (Department of Finance 2000).

1.4. Analysed trends in own revenue and briefly reviewed potential for alternative sources of financing (McIntyre 1994, 1996, 1997, 1997(2)) and progress made around revenue retention (Western Cape Provincial Government 1998, Department of Health 1998).

1.5. The national Department of Finance's formula based financing approach was briefly reviewed (Department of Finance 2000)

1.6. Adjustments for inflation were made using data from the Consumer Price Index of Statistics South Africa. All real prices are given in 2000 prices. The CPI for metro areas was used as opposed to the index for all areas since close to 70% of the provincial population live in the metro and the higher metro inflator is likely to reflect medical inflation better.

2. Expenditure trend analysis

2.1. Expenditure data by subprogram, region and standard item (to the 4th level) were obtained from financial information system (Financial Management System - FMS) and compiled reports of the Department. Standard item trends were adjusted to exclude selected exceptional items.

2.2. Average salaries were determined by dividing total personnel expenditure by filled posts on a monthly basis over the period.

2.3. Limited analysis of medicine and laboratory costs was undertaken.

3. Personnel numbers were obtained from monthly reports drawn from personnel information system (PERSAL)

4. Hospital bed numbers and trends were obtained from Departmental annual reports and the database of the Directorate Information Management.

RESULTS

Key results are for the 1995/96 to 2000/01 years, since this represents the period of downsizing studied and are expressed in 2000 prices.

2.1. EXTENT OF DOWNSIZING

The department has downsized 9282 health and support personnel (27.9%), closed over 3601 hospital beds (24,4%) and effectively closed 8 hospitals, either completely, or for inpatient services (Blecher; 1999). This is shown in table 1. Inpatient days declined by 502 000 from 1995/96 to 1999/00 (13.6%). Despite these service reductions the uninsured population has grown by 218 396 (8%) over the period (Statistics South Africa 1996,1998 and 2000) (medical scheme coverage data from national household survey - personal communication Statistics South Africa).

Table 1 Downsizing of the Department of Health, Western Cape Province

Date	Filled posts	Actual beds	Inpatient days per year
1-May-95	33295	14744	
1-Apr-96	32557	14380	3,826,007
1-Apr-97	29564	12954	3,699,294
1-Apr-98	26988	11908	3,345,062
1-Apr-99	24661	11240	3,193,831
1-Apr-00	24013	11143	3,197,049
Decrease 95 to 2000	9282	3601	502,245
% Change 95 to 2000	-27.9%	-24.4%	-13.6%

2.2. FINANCING TRENDS

Financing trends of the Department of Health in the Western Cape Province in nominal and real terms are shown in Table 2 and figure 1. The net effect of a range of financing changes at various levels of government (described below) has been a small R20.9 million real decrease (0.6%) in funding to the Health Department from 1995/96 to 1999/00 or a somewhat larger R313 m reduction (8.9%) since 96/97. Figure 1 is particularly interesting showing:

- Budget levels in 1995/96 and 2000/01 fairly comparable in real terms i.e. budget might be considered fairly stable

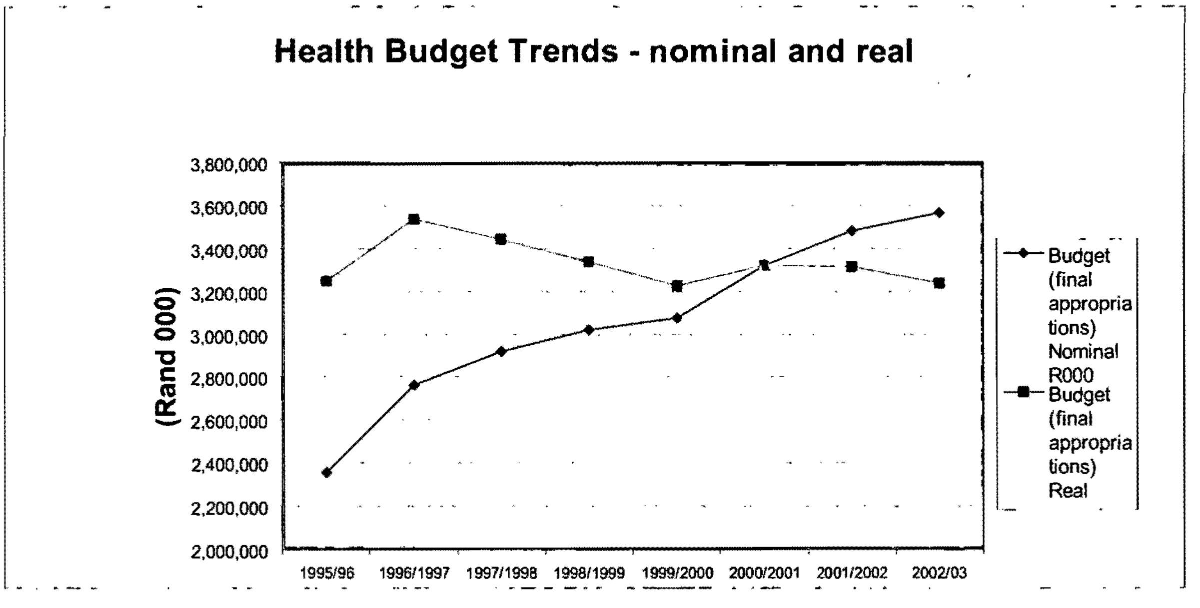
- A significant funding increase between 1995/96 and 1996/97, following which during the next three years the department's funding declined back towards the baseline.

Table 2. Health Budgets (appropriations account) trends - nominal and real

	Budget (final appropriation) Nominal R000	Budget (final appropriation) Real R000	Cumulative real change since 1996/97	% real change since 1996/97	Cumulative real decrease since 1995/96	% real change since 1995/96
1995/96	2,359,160	3,247,502				
1996/1997	2,761,900	3,539,938			292,436	9.0%
1997/1998	2,917,791	3,444,670	-95,268	-2.7%	197,168	6.1%
1998/1999	3,019,998	3,336,419	-203,519	-5.7%	88,917	2.7%
1999/2000	3,072,888	3,226,532	-313,406	-8.9%	-20,969	-0.6%
2000/2001	3,322,532	3,322,532	-217,406	-6.1%	-75,030	-2.3%

* Real figures are in prices of year 2000/01

1. Budget trends of Western Cape Department of Health



EXPENDITURE AND COST DRIVERS

While financing changes have had a relatively limited effect on real expenditure, cost drivers on the expenditure side have had a marked effect. Figures 2 and 3 demonstrate substantial rise in average salary (including all benefits) per employee as the major cause of the downsizing. This has risen by 83.1% in nominal terms or 39.7% in real terms between 1995/96 and 1999/00. The effect in 1996/97 is particularly marked with personnel expenditure increasing by R360 million (31.1%) despite the reduction of 1699 posts. This increase in personnel funding in 96/97 explains the large budgetary increase in that year shown in figure 1. Figure 2 show standard items adjusted to exclude exceptional items and expressed in real 2000 prices.

Figure 2. Standard item trends adjusted real prices

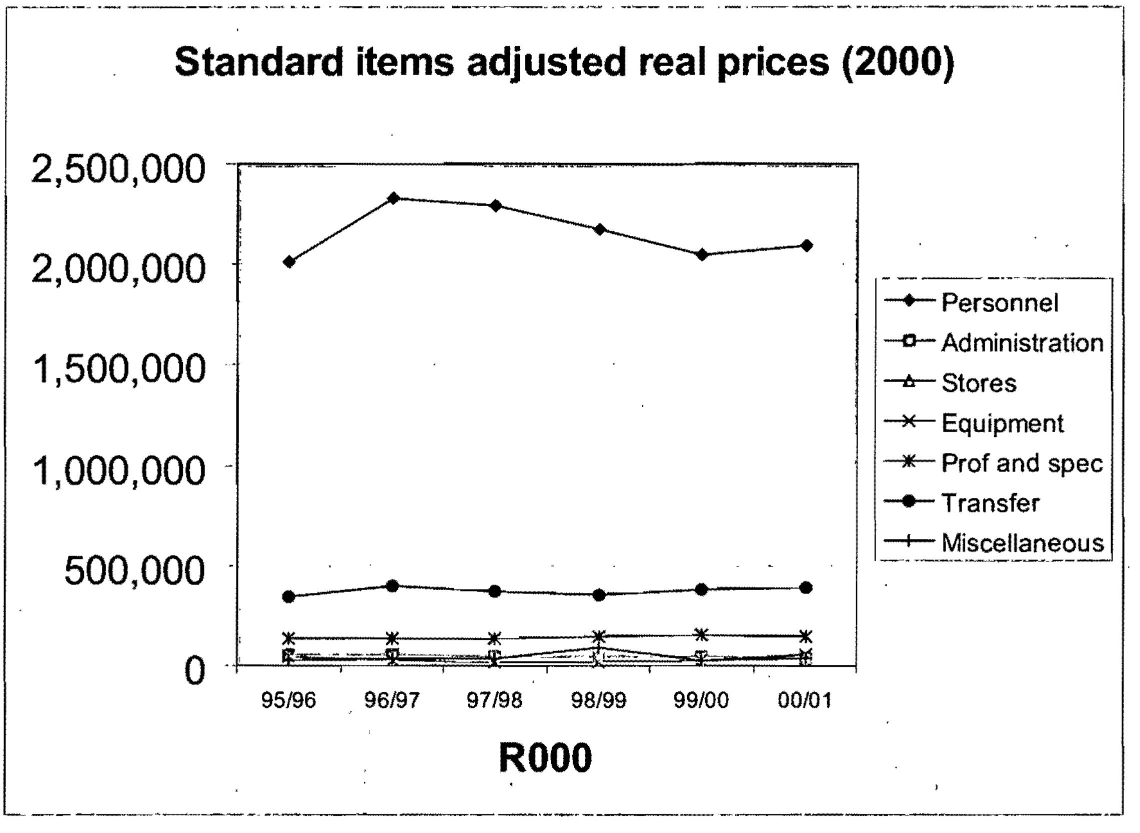
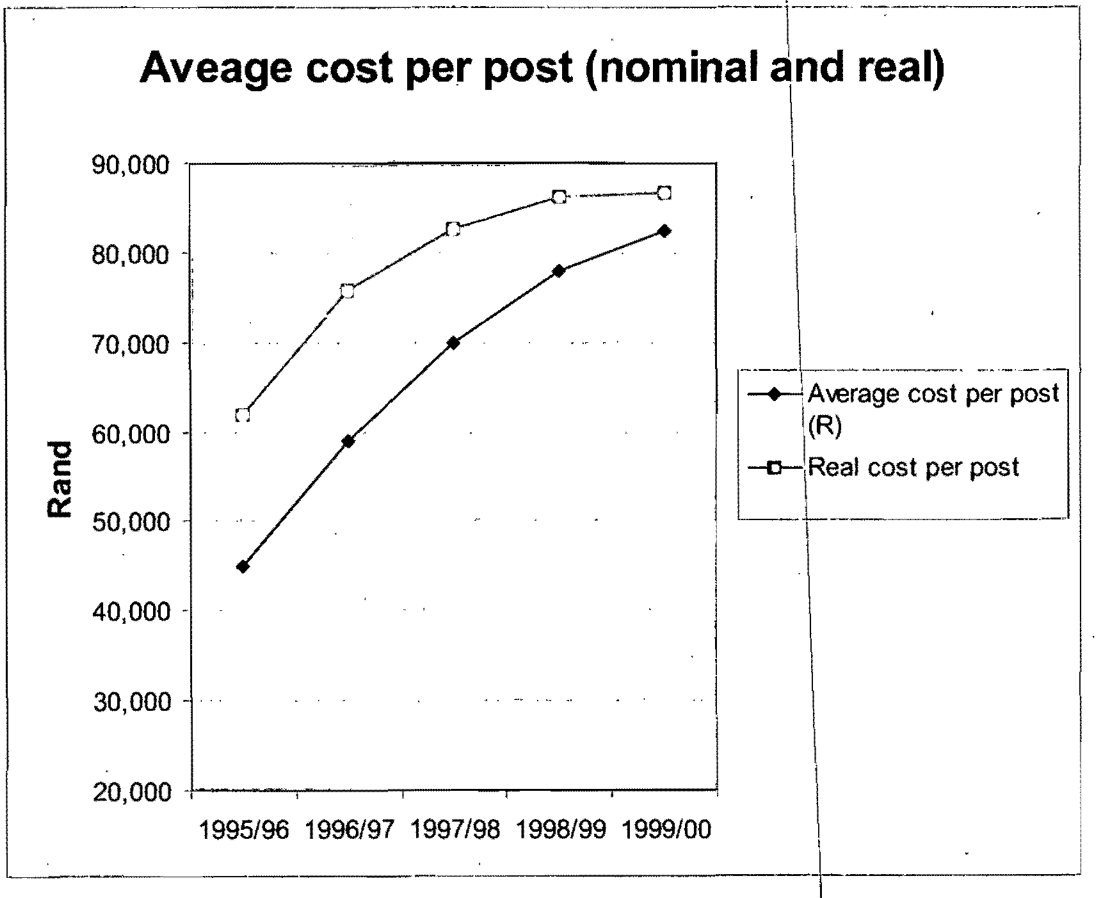


Table 3 and figure 3 show trends in average cost per post

Table 3. Changes in posts, personnel expenditure and average cost per post

	Average filled Posts	Personnel expenditure	Average cost per post (R)	Change since 95/96	Real cost per post	% change in real cost
1995/96	32,860	1,480,448	45,053		62,018	
1996/97	31,161	1,840,705	59,071	31.1%	75,711	22.1%
1997/98	28,241	1,975,630	69,956	55.3%	82,588	33.2%
1998/99	25,676	2,003,255	78,021	73.2%	86,195	39.0%
1999/00	23,682	1,953,673	82,497	83.1%	86,622	39.7%

Figure 3. Trends in average cost per post



DISCUSSION

The Department of Health in the Western Cape Province downsized substantially by 9282 health workers (27.9%) and 3601 hospital beds (24.4%). There have been several contributory factors to this decline of approximately one quarter of the department.

The study revealed some highly unexpected findings, especially that the major cause of the downsizing does not appear to have been substantial budget reductions but has rather been predominantly due to uncontrolled cost drivers on the expenditure side. Uncontrolled labour costs, mainly a factor of central policy decisions, within the context of fiscal constraint and inter-provincial redistribution has been the critical causative factor.

Financing

National fiscal constraints within the context of the GEAR policy do not appear to have contributed significantly to the downsizing, given that there has been fairly small (1.9%) real expenditure growth in the fiscus after deducting debt costs. Clearly an expansionary fiscal policy based on substantial national reconstruction would in the short term have been more favourable to health service delivery if government intended to simultaneously implement the various policy choices described here. This paper does not argue the case for expansionary fiscal policy, but rather emphasises that in a climate of fiscal constraint, budgets and policy decisions that affect expenditure such as wage policies need to be carefully aligned. Simultaneous application of substantial real wage increases along with redistribution can have serious implications for services in a climate of fiscal constraint.

Trends in the vertical split suggest that provinces are receiving a slightly reduced share, and this together with the slight decrease in total national spending have contributed to a 3.7% real reduction in total provincial transfers.

A key factor contributing to the downsizing has been the reducing share of the provincial pool going to the Western Cape. Significant inter-provincial redistribution resulted in an 18.4% real decline in Western Cape's total provincial budget (excluding own revenue) from 1996/97 to 1999/2000. However for reasons which will be described below and despite this substantial financing pressure, the Western Cape Treasury increased the share of its budget to Health from 25.6% to 29.3%. This relative protection of health funding caused the Health budget to decrease less (8.9%) than the overall provincial budget (18.4%) from 1996/97 to 1999/2000. Substantially underlying the increase in Health's share was the substantial upward revision in the Health conditional grants allocated to the Province under a new funding dispensation. The upward revisions of these grants occurred at a time of significant downsizing in the academic hospitals in the Western Cape and substantial national pressure to avoid collapse in academic hospital services.

Expenditure and cost drivers

The study shows a 39.7% real (83.1% nominal) increase in average costs per employee from 95/96 to 99/00. In 1996 a large wage agreement was negotiated between government and trade unions in the Central Bargaining Chamber of the public sector, in which salary negotiations for the entire public service are conducted. One of the key aspects of the 1996 wage agreement included implementation of a policy of "rank promotion", in which large numbers of personnel were allowed to automatically progress to a higher salary rank without applying for jobs in these higher ranks. At the same time a system of voluntary severance packages was introduced which allowed experienced health workers to exit with large pay-outs. There are many factors impacting on personnel expenditure which are negotiated in the Central Bargaining Chamber and are beyond provincial control including salary increases, benefits such housing subsidies and medical cover, over-time payment system and equalisation of benefits.

In this case the implementation of large negotiated wage increases was followed by early large increases in personnel expenditure and then several years of substantial losses of health workers until personnel expenditure returned to within the constrained budget envelope. Thus real wage growth appears to have played a major role in the progressive personnel losses over the period as the Department attempted to contain personnel expenditure as the real budget level returned to its baseline. It is apparent that processes of wage negotiations in the Central Bargaining Chamber need to be much more closely aligned to broader fiscal and expenditure policies of government.

There has also been a slight crowding out by transfer payments equivalent to 1.6% of total expenditure).

IMPLICATIONS FOR FISCAL POLICY

It is evident from the data that had Provincial Treasury not relatively protected Health and the national conditional grants substantially increased, that the downsizing would have been even greater. Indeed with no relative protection Health might have downsized a further 4461 posts (13.8% budget reduction equivalent to that of the province overall) bringing the total downsizing to 13743 posts or 41.3% of the total. This occurred in a period of less than 5 years.

At the time of transition the Western Cape Province needed to downsize to address inter-provincial equity. Equity redress clearly provided an economic and political rationale for downsizing. However the incoherent mix of policies applied has led to health services in that province downsizing very substantially, but mainly to fund wage and benefit increases. Substantial inequity remains. If these inequities were to be eliminated and had the Provincial Treasury not relatively protected health services and augmented conditional grants, the total potential reduction in the Western Cape department would have been immense.

These findings suggest an incoherence of fiscal policy: Several policies have been applied simultaneously. These include fiscal constraint within the context of GEAR, inter-provincial equity redress, shifting of funds within Health to Primary Health Care and significant improvements in wages and benefits of health workers. While each of these policies is laudable reasonable individually, their collective application had the potential to cause service collapse with a potential 41.3% personnel reduction in under 5 years. The most significant problem was agreement to major wage and benefit increases at the same time as a significant redistribution and national fiscal constraint. There is no evidence that the national government envisaged a downsizing of this magnitude or meaningfully considered the potential implication of the simultaneous application of these policies. Political decisions are often of primary importance in allocation decision making. It is likely that at that time strong political forces within the health sector placed great importance on pursuing equity and redress.

The effects of this collective policy stance in poorer provinces is likely to reflect the bulk of redistributory gains going to improved salaries and staff benefits rather than on expanded improved services and addressing the apartheid backlogs.

It is probably unwise to make significant deductions from this study to levels of public sector employment and unemployment more broadly. However it is interesting to note that while government claims unemployment is amongst its top priorities, that it's own policies of "rightsizing" and wage policies have, in this sector example, led to personnel losses (9282) of similar magnitude (27.9%) (but in the opposite direction) to real wage growth.

IMPLICATIONS FOR HEALTH SERVICES IN OTHER SETTINGS

If the policy inconsistencies discussed have had the effect of downsizing and substantial personnel reductions in the Western Cape Province, then it is likely that the effects of redistribution to other provinces are unlikely to be vastly improved services, but mainly to be reflected in higher salaries.

The findings of this research are likely to hold lessons for public sector budgeting practices in other developing and middle income countries, particularly in the context of structural adjustment programmes. Several countries have undergone difficult structural adjustment programmes, which have had negative consequences for social sectors such as health service delivery. This study strongly suggests that in the context of scarce financial resources, such as with structural adjustment, it is critically important that wage policies and other policies that impact on cost be handled carefully with attention to potential unexpected cumulative effects. The same applies to expenditure policies, such as where rapid redistribution between provinces and across levels of care is taking place.

CONCLUSIONS AND RECOMMENDATIONS

A limited number of macro-economic fiscal policy decisions have had a huge impact on health services. A key problem of policy incoherence has been demonstrated. Simultaneous implementation of a range of fiscal policies with implications for the budget (e.g. redistribution, fiscal constraints) and expenditure sides (e.g. real wage growth) has had serious effects on basic social services.

Where-as the Western Cape needed to rationalise and downsize to address the key policy priority of interprovincial equity, it has now downsized mainly because of wage growth and substantial inequities remain. Implications for the sector nationally are likely to include that the major benefits of redistribution and funding increases have largely been expended on wage increases and this is likely to have limited the service expansion intended in the Reconstruction and Development Program.

Recommendations include:

i) In determining macro fiscal policy careful consideration must be given to the cumulative effect of multiple policies influencing budgetary allocations, expenditure and cost. Coherence of fiscal, wage and expenditure policy needs to receive particular attention in times of scarcity including periods of fiscal constraint, when optimising resource allocation decisions becomes crucial and policy disjunctures are more likely to lead to service problems.

ii) Wage and benefit costs are a crucial determinant of expenditure and thus cannot be negotiated as independently from the budget process as is presently the case.

iii) Provincial governments need to have a significant say in negotiations in the Central Bargaining Chamber since they bear the costs of most of the decisions reached.

iv) In the Health sector control of factor costs is essential to allow adequate funding for redistribution and shift to primary health care without causing collapse of hospital services.

v) Future policy decisions affecting the Western Cape's funding need to recognise that it has already downsized by over 9000 health workers (27.9%).

The findings of this study has implications for sound fiscal policy decisions in other developing and lower middle income countries.

APPENDIX 2: SELECTED ADDITIONAL TECHNICAL DETAILS OF MODEL

Utilisation rates among persons with HIV/AIDS

	Not on HAART		**On HAART**	
	Inpatient day	Admission rate	Inpatient day	Admission rate
CD4>350	1.9	317	0.14	23.3
200-350	3	500	0.39	65.0
<200	7.7	1283	0.26	43.3
<200AIDS	17.7	2950	1.8	300.0
	Outpatient visit		Outpatient visit	
CD4>350	4.1		4.6	
200-350	5.1		3.9	
<200	5.6		3.9	
<200AIDS	7.7		5.6	

Source: Personal Communication S Cleary, University of Cape Town