Preliminary Estimate of NHI Costing in 2009 Rand Terms

McLeod-Grobler-Van der Berg Model Methodology and Assumptions

A briefing paper prepared for National Treasury

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1. Introduction

1.1 Introduction

During 2009 a number of costings of National Health Insurance (NHI) were prepared and in some cases released or reported on in the media. The models include:

- The COSATU costing by Calikoglu and Bond;
- The UCT Health Economics Unit costing by McIntyre, Ataguba and Cleary;
- The costing by McLeod, using price curves from Grobler, with pricing by Van der Berg;
- The costings and evaluations by ECONEX;
- The costing and evaluation by Van den Heever;
- The Actuarial Society of SA / Deloitte / Discovery model.

This document summarises the methodology and assumptions used in the preliminary costing and pricing model by McLeod, Grobler and Van der Berg. The results of the model and evaluation by Van der Berg and McLeod were reported in Business Day and reproduced on Health E-News[1].

The document begins with an outline of the methodology and an understanding of the difference between costing and pricing. The assumptions used in the preliminary costing of NHI are discussed, followed by the assumptions used to determine the price that might need to be paid by taxpayers. The sensitivity of the estimates to the key assumptions is shown and limitations of this preliminary work discussed. Most of this material (except for section 4) has been in the public domain, having appeared in IMSA Policy Briefs[a] prepared by Heather McLeod during 2009. In order to foster greater understanding of the costing and pricing, as well as the limitations of the estimates, the relevant technical material is collated in this summary document[b].

1.2 Costing and Pricing of Healthcare

This material was in section 1 of IMSA Policy Brief 6: Costing and Long-term Modelling of NHI[2].

The terms "cost" and price" are often used loosely and mean different things to different professions. It is important always to be clear on which term is meant. Actuaries like to differentiate between the terms "cost" and "price" as follows and as illustrated below:

- The total **cost** is the total amount needed across all eligible beneficiaries to provide access to a defined package of benefits in a particular delivery setting.
- The **price** is the amount incurred by contributors to the system and may be set according to other criteria, like equity and affordability. For example, the price may be expressed as a contribution table or as a percentage of income, subject to certain maximums.

[a] Innovative Medicines South Africa (IMSA) hosts a web-site with material on NHI technical issues: http://www.innovativemedicines.co.za/national_health_insurance_library.html

[b] In quoting previously published work it is usual to place the material in quotes. In this instance the material was prepared by the same author and the use of double quotes may have become confusing. The relevant policy brief and sections are indicated and the material reproduced from the relevant policy brief.

- The price charged by providers to funders in the health system will be referred to as the **reimbursement rate** and it may be determined in a variety of ways, from fee-for-service to per visit or capitation (pre-paid, typically on a monthly basis).

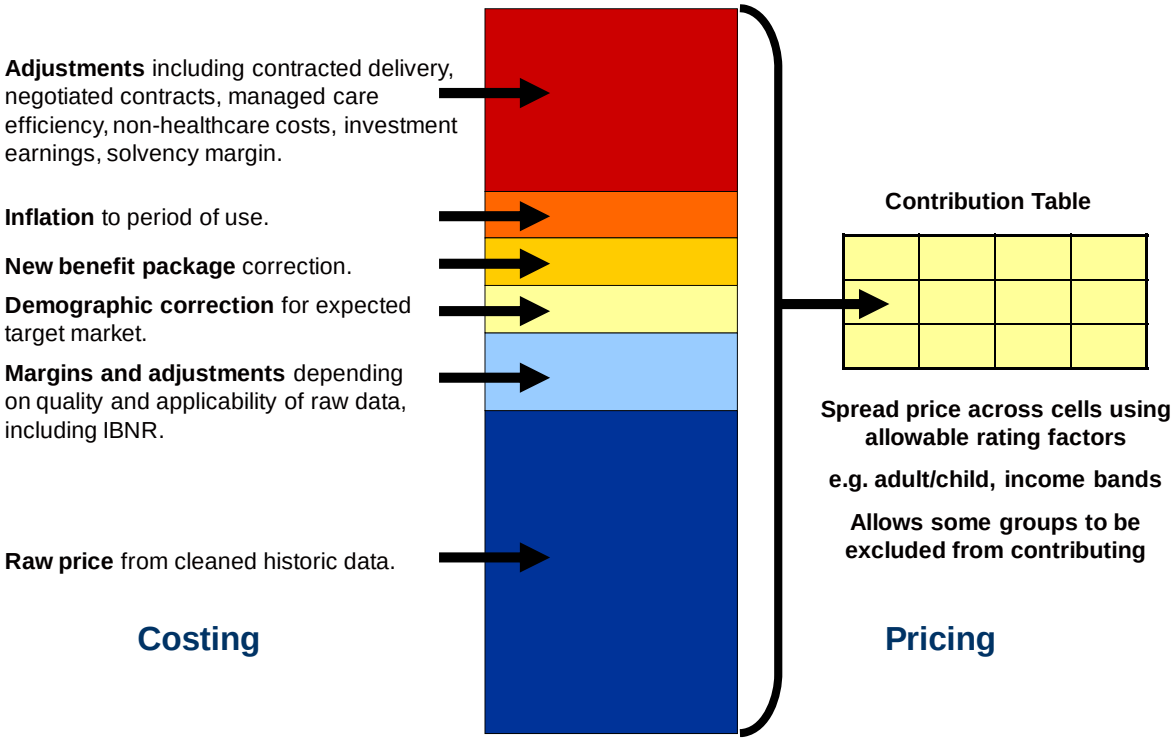

Figure 1: Generic Costing and Pricing of Healthcare

The generic costing and pricing model above is applicable to medical scheme and bargaining council schemes, to provider capitation (or other reimbursement methodologies), to determining the Risk Equalisation Fund tables and to mandatory health insurance.

For National Health Insurance, the need is to determine a table of amounts or a formula relative to some definition of income, payable by defined contributors and incorporating income cross-subsidies and an equitable Government subsidy. The total amount needed would be determined from historic data, population projections, other inputs and assumptions. The total amount would be set to cover a defined package of benefits for the entire population (or a phased target population), with an expected dispensation of efficiency in healthcare delivery. There would be loadings for administration and managed care costs but probably no loading for solvency as money in would equal money out.

The elements of costing and pricing and some of the issues to be considered are summarized below. The sequence usually starts with a defined package of benefits, then works up from the bottom of the costing part of Figure 1 and then across to determine the price to be charged to contributors.

Benefit package: the package of minimum benefits needs to be defined at the outset as the detail will influence the choice of data and the design of the costing study. There may be iterations to determine alternative benefit packages when affordability is assessed in the final step. The form of

rationing[c] expected in the package has a large influence on the study design and needs to be articulated at the outset.

Raw price: a suitable source of data is identified and data extracted and tested for reasonability (this is often the longest phase of costing as further data extracts may be needed when anomalies are identified). As healthcare has a strong seasonal pattern, data must cover at least one complete calendar year and up to three years of data is ideal (any longer and trends are unlikely to be valid as benefits may have changed). If data is gathered from multiple sources, a lot of effort needs to be put into ensuring that data definitions are identical and that the results can be validly combined.

While it is true that total cost is a function of utilisation and the unit price (reimbursement rate to practitioners), it is often better to work with the total amount per beneficiary per month (pbpm). Utilisation has a strong pattern by age and gender but many researchers are not aware that average cost also has patterns by age and gender. The average cost patterns may be quite "lumpy" by comparison to utilisation and are thus difficult to use for modelling. An analogous situation occurs with admission rates and average length-of-stay (ALOS) in hospital data where ALOS is very lumpy and it is advisable to combine them and work with total bed days.

$$\text{Average Cost} = \frac{\text{Total cost}}{\text{Number of admissions/visits}}$$

$$\text{Utilisation} = \frac{\text{Number of admissions/visits}}{\text{Exposure}}$$

$$\text{Raw Price} = \frac{\text{Total cost}}{\text{Exposure}}$$

The box on the left shows the key pricing relationships. **Exposure** is usually calculated as "beneficiary months" which is the number of months that each beneficiary is exposed to making a potential visit or claim in the data. For example, if a person was in the risk pool for the whole year that would be 12 months of exposure but someone joining at the beginning of the last quarter of the year would have only 3 months of exposure.

Margins and adjustments: the raw data may need to be adjusted, depending on the quality and applicability of the data extract. One of the most common adjustments is to estimate the "incurred but not reported" claims (IBNR) if the data has been extracted very soon after the calendar year end. Medical scheme claims, for example, may be submitted up to four months after the event and there

[c] Healthcare financing is a rationing problem and rationing will occur somewhere in the system. We generally consider four parties that could do the rationing and each uses different tools, as shown in examples below:

- **Government**: by means of budget constraints; by long queues (at clinics or for getting certain elective surgery); by availability (limited ICU beds or surgical beds); and by denial (no dialysis after a certain age and no resuscitation of very low-birth-weight babies).
- **Health funders** (like medical schemes or NHI): by means of limits, co-payments, deductibles and thresholds or by means of volume (like one pair of spectacles every two years).
- **Patients and their families**: by means of affordability (choice to have private insurance, level of savings account or degree of out-of-pocket spending) or conscious choice (choice to refuse care in terminal illness).
- **Doctors**: by prognosis typically but also by affordability in some cases (differential treatment or prescribing based on patient income).

In principle, we should try to move rationing to doctors firstly, together with their patients, rather than having accountants and bureaucrats make healthcare rationing decisions.

may be disputes about the amount payable. By delaying the extraction of data for five or six months after year end, the claims are usually fully "run-off" and no estimate needs to be made. Other adjustments may be due to sharp changes in the quality of coding or data submission during a period and sometimes a decision is taken to use only the patterns from the latter part of the time period. These adjustments require intimate knowledge of the data and considerable judgement is needed to ensure that the adjusted data is valid for the purpose of the study. Removing what some people call "outliers" (very large claims) is never advisable in healthcare data as the very nature of the data is some very expensive extreme events. Having a few of these in the data is in fact normal and the larger the data set the more predictable are these large cases.

The size of the data set extracted needs to take into account the minimum risk pool sizes[3] in the box on the right. These are very much minimum sizes and the larger the risk pool the more stable the results will be. The most recent work on costing Prescribed Minimum Benefits in medical schemes[4] was done with 49.8 million beneficiary months of data or effectively 4.2 million lives worth of data for the calendar year.

Minimum size of risk pool to take risk and thus give reasonably stable results:	
Primary care only:	1,000 lives
GPs and Specialists:	30,000 lives
Hospital care only:	100,000 lives
All benefits:	25,000 lives

Demographic correction: it is rare to be able to obtain raw data for precisely the group that needs to be costed. It is much more likely that data from several sources will be used and then adapted for use on the expected target market. Major errors can be made if the demographic structure of the data is not taken into account and the number blindly applied to a population with a different demographic structure. As age and gender are the primary risk factors in cost, it makes sense to always do the costing work by at least age and gender. In some cases, using province is also useful as there are major differences in hospitalisation rates between the provinces. HIV strongly influences need for healthcare and Policy Brief 4[3] showed how this differs by province.

New benefit package correction: often the benefit package that is to be mandatory is being changed as part of the study. Taking data collected when a benefit is voluntary and converting it to the expected utilisation reimbursement rate and thus raw price when it is mandatory is a difficult exercise and requires experience and judgment. Typically, usage will be higher once a benefit is included in a minimum package but the extent of the change is difficult to forecast. It is simpler to take generous benefits and determine what the raw price should be if limits, deductibles or co-payments are applied, although all of these will still alter provider and beneficiary behaviour from that observed in historic data.

Inflation to period of use: the diagram overleaf describes the problem of using historic data to predict cost in the future. If data is extracted in Q3 2009, then the true inflation from mid-2008 to mid-2009 will already be known. An estimate of inflation will need to be made from mid-2009 to the middle of the period of use, mid-2010[d]. Inflation is usually calculated and estimated separately for

[d] For the model produced in 2009 Rand terms, inflation was only added from mid-2008 to mid-2009. If the fund had been in existence, an estimate for the next year, 2010, would have typically been required.

different components of the benefits, like hospitals, medicines and visits. It is crucial to isolate any changes in the demographics of the risk pool from the price effects in calculating the historic inflation.

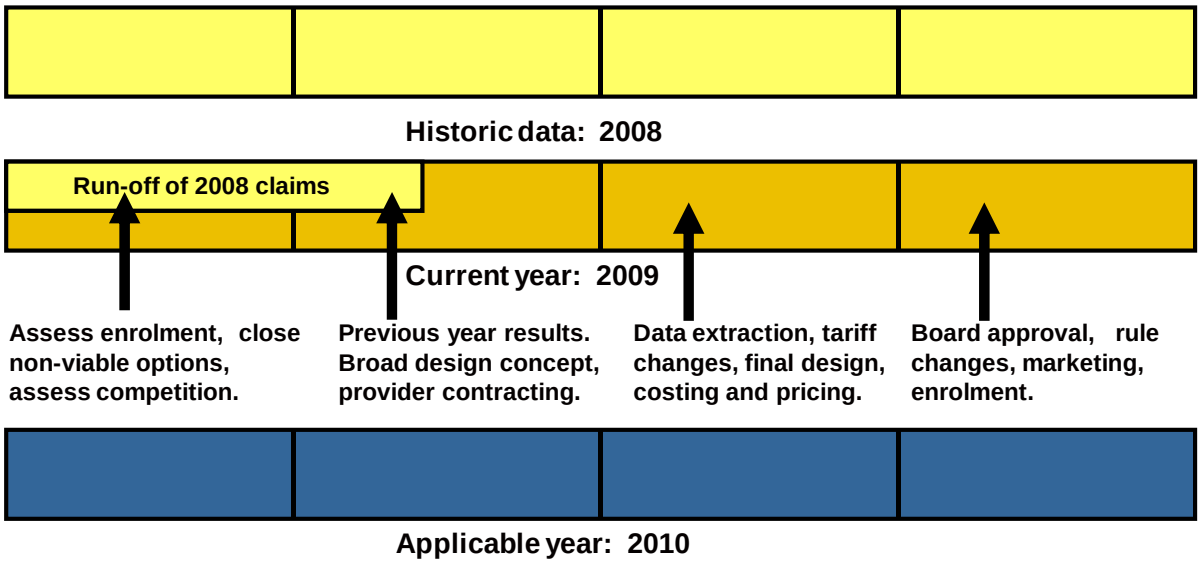

Figure 2: Benefit, Contribution and Data Cycle in Medical Schemes

Adjustments: the price of any negotiated healthcare delivery contracts and contracts for administration and managed care need to be explicitly taken into account. These contracts need to have been finalized before the costing is completed in order to be certain as to what needs to be charged. There are some spectacular examples of insolvency where a fund promised certain contributions to members first, before concluding contracts with providers, only to find that no providers would contract at the rate used in the calculations. This is a particular danger for NHI in that contribution levels have been promised to be lower than for existing medical schemes yet no negotiations with providers have yet been entered into.

Other adjustments in the total cost may be for anticipated investment earnings and there may be loadings for a liquidity buffer or solvency margin. Healthcare expenditure has a very particular seasonal shape by month of the year. Summer months and months with many holidays (the April or May Easter holidays) have much lower claims while the winter months have higher claims. This means that a buffer of unspent funds will build up in the first quarter of the year, there may be over-spending in the middle of the year and the final quarter of the calendar year is typically light. Unsuspecting trustees or managers can over-react and enhance benefits based on Q1 results only to find themselves under financial pressure in the following two quarters.

The single most critical assumption to be made in NHI costing and pricing will be the level of efficiency that might be achieved. There is a perception that the private sector is inefficient and that somehow the public sector can use the same funds more efficiently. This central assumption is typically offered without evidence and it is unwise to anticipate any improvement in efficiency (resulting in a lowering of costs) unless there is hard evidence on the table.

Spread total cost as a price to be charged using allowable rating factors: medical schemes may use income but not age as a factor in setting prices to be charged. Separate adult and child rates are permitted in the voluntary environment to encourage families to enrol children. Under NHI, the group of people who will become contributors will need to be tightly defined, as will the definition of how contributions are to be calculated and the definition of income. It is always possible in setting the prices to be charged to socially-engineer the table to provide relief for vulnerable groups. In medical schemes, elderly pensioners or lower income workers are typically favoured in restricted schemes. It is not usually feasible to do so in open schemes because of the potential anti-selection if only some open schemes follow this route. This is where Government needs to play a role in regulating acceptable cross-subsidies that all open schemes must implement. Under NHI the definition of who is to contribute and who will be exempt from contributing (including definitions related to citizenship, employment, age and income) is critical before any price can be determined.

1.3 Outline of Methodology for Costing and Pricing Model

The core problem is that there is a need to cost for a benefit package and mode of delivery which is not yet in existence in South Africa. This implies using data from other sources and estimating adjustments to the data to make it relevant to what is currently known about the proposed National Health Insurance scheme[5]. In particular, the lack of an adequate costing of quality delivery of healthcare in the public sector is a severe constraint. Attempts have been made on four previous occasions to get cost curves by age and gender for the public sector but this have not been successful to date. Costings in capitated settings have also been attempted but the most reliable data remains that of private sector medical schemes.

The age and gender profile of medical schemes is very different to that of the public sector and the general population (as shown in section 2.3). Any use of average utilisation or cost from the current private or public sector, or subsets thereof (such as a specific province), will not be applicable when applied to the whole population. However if age-gender curves of price are used, these can reasonably applied to the age-gender profile of the target or total population.

It is known from the early studies on risk equalisation that the age-gender curves for the cost of healthcare per person in other countries have a very similar shape to that from the private sector data. The private sector age-gender curves are thus used as a starting point for the costing and combined with the age-gender profile of the total population. The cost curves are developed for a variety of packages of healthcare. The most critical assumption will be the price reduction for delivery in a public sector setting and there is poor data on what this assumption should be. This will therefore be one of the assumptions used in testing the sensitivity of the results.

The total cost is then related to tax revenue to estimate the effect of raising the amount using various possible forms of taxes. The intention here is not to show the incidence of such taxes, but rather to understand their magnitude within the context of the South African economy and its fiscal resources. This assists in placing these costs in context.

2. Population for Costing

The estimation of the population is obtained on an age and gender basis, using age bands[e] that will give a meaningful shape to the price curves. The choice of data was argued in section 1 of IMSA Policy Brief 1: The Population for Universal Coverage[6].

The ASSA2003 model[7] is by far the most consistent and useful projection available. Despite not yet being adjusted for the findings of the StatsSA Community Survey 2007, the projected population is closer to the revised StatsSA 2008 figures than those produced by StatsSA up to 2007. An update of ASSA2003 is under construction and is due to be released in mid-March 2010. The ASSA2003 projection is of course available into the future which is essential for costing the implications of any NHI structure. The version being used[f] allows for separate projections for each province.

The ASSA provincial model produces (amongst other results) the expected total population, the population structure by age and gender and expected total births. All of these can be used directly in models of National Health Insurance. The model also provides a projection of the numbers who are HIV+, the numbers of AIDS sick and the numbers expected to need anti-retroviral treatment. Projections of orphans are also directly available for social grant planning by the provinces.

It was strongly recommended (in Policy Brief 1) that all costing work on National Health Insurance be done using the ASSA2003 provincial model and that the costings be updated when a revision to the model is released.

The ASSA2003 provincial tables by age and gender from 1985 to 2025, in an age format needed for costing can be downloaded from the IMSA web-site[g]. A summary of the table is given in Annexure 1.

2.1 Aging of the Population

This material was in sections 4 and 5 of IMSA Policy Brief 1: The Population for Universal Coverage[6].

The graph below illustrates the expected population of South Africa at five year intervals to 2025, compared to the age and gender structure in 2009. The graph shows the reduction in the number of children, the increase in those in the working years, the increase in those near retirement age and particularly the increase of older women.

[e] Some of the StatsSA data is in five year age bands, beginning with 0-5 and ending at age 80+. As shown in section 2, there is a significant difference between the costs of the Under 1s and those from 1-4. At the oldest ages the cost of healthcare begins to decrease and a distinction is made between 80-84 and 85+. These age bands are used by the Council for Medical Schemes for the collection of data from medical schemes, were used for the technical work on the Risk Equalisation Fund and are also typically used by the WHO. Technically, the definition used is "age last birthday on 1 January" so that people stay in one age category for the whole calendar year.

[f] The historical development of the ASSA suite of models is covered in section 2 of Policy Brief 4: The Impact of HIV on a Future NHI.

[g] IMSA NHI web-site: http://www.innovativemedicines.co.za/national_health_insurance_library.html

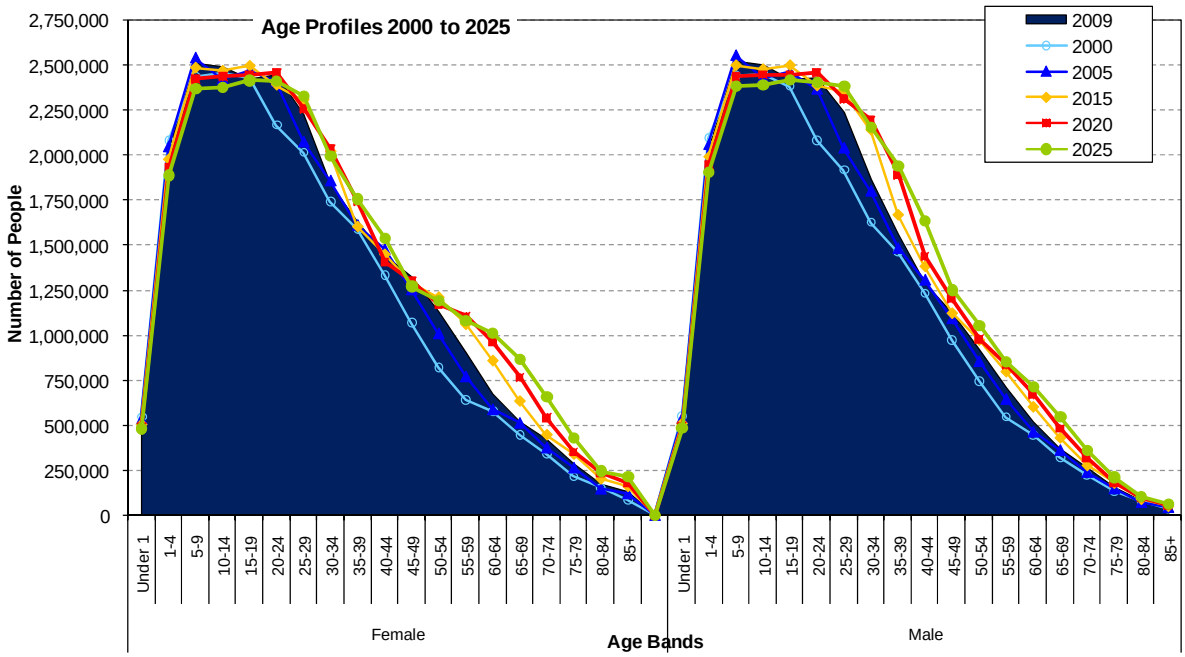

Figure 3: Age Profiles for South Africa from 2000 to 2025 using ASSA2003

This illustrates the importance of projections by both age and gender, as the gender mix in each age band in not static over time. Some diseases are more prevalent in females than males and this will affect the future need for specialists in those fields and for particular categories of medicines. The shift is rapid over the horizon of our planning process. In absolute terms, the increases in some age bands are very meaningful e.g. Females age 65-69 grow from some 521,000 in 2009 to 865,000 by 2025, or a 66% increase. This has important implications for future medicine and hospital usage.

The table below uses the Managed Care version of the Preferred Table 2009[h] to isolate the effect of the aging demographics on the cost of healthcare for the country as a whole.

Table 1: Impact on Price of Healthcare of Age and Gender Differences to 2025

Value in 2009 Rand terms	South Africa 2000	South Africa 2005	South Africa 2009	South Africa 2015	South Africa 2020	South Africa 2025
DTP Hospital	175.56	178.50	181.51	186.96	191.99	197.55
CDL Medicine	38.88	40.50	41.94	44.39	46.64	48.94
Visits and Related Costs	40.51	41.48	42.33	43.76	45.05	46.35
Total Prescribed Minimum Benefits	**254.95**	**260.47**	**265.78**	**275.11**	**283.68**	**292.84**
Change from 2009 due to age and gender	-4.1%	-2.0%	0.0%	3.5%	6.7%	10.2%

[h] Developed using identical methodology to the REF Contribution Table [Base 2005, Use 2007] which was published by the Council for Medical Schemes. The Preferred tables have been produced using the REF Study 2005 data as a starting point and the same consistent methodology. This Preferred series thus gives a consistent historic series which can be used for research, pricing, risk analysis and managed care pricing. The tables are produced by Heather McLeod and updated annually.

The change in age and gender profiles alone would have increased the price of healthcare by 4.1% from 2000 to now in 2009. The price of healthcare would be expected to increase by 10.2% by 2025, given the age and gender differences alone. This table has used the same price of healthcare going back in time and forward in time. However to be more realistic, a price table should be developed for each year taking into account the growing HIV epidemic. The effect would be to make both the historic and future increases larger than quoted.

The provinces will also each have a different experience of aging. The Western Cape and Gauteng are expected to have the greatest growth in older people relative to children. Thus the impact of increased chronic disease (excluding HIV) will be highest in these provinces.

2.2 Implications of Aging for NHI

Studies of healthcare costs to do pricing for a future NHI would usually be done using historic data. If the historic data is not analysed by age and gender, then applying it to today would already be too low as the population has changed shape this decade. Applying the historic cost to the future, without considering age and gender, will likewise produce an estimate that is too low. Studies are also typically done on a small part of the population. If these results are not produced by age and gender, then the cost of healthcare may be very different when the whole population is enrolled. Policy Brief 1 showed how important it is to work by at least age and gender in any costings and when working with the population.

The policy brief has also demonstrated the future age and gender profiles that have been projected through to 2025. It is important to look further forward than just a typically five year planning horizon to see some of the longer term demographic changes that might be expected. The implication of the aging of the population is that there will be greater future demand for both chronic medicine and for hospitalisation, as both these are strongly related to age. There are distinctive curves for females and males, as commonly found in other countries, and work needs to be done by both age and gender.

2.3 Anti-selection in Voluntary Medical Schemes

This material on expanding coverage beyond medical schemes to the whole population was in sections 5, 6 and 7 of IMSA Policy Brief 2: Expanding Health Insurance Coverage[8].

There is substantial evidence of anti-selection[i] by members of medical schemes in the voluntary environment. The graph below compares the age and gender profile of medical schemes with the shape of the total population and the families that could be covered at various phases of mandatory health insurance.

[i] Anti-selection in insurance arises from the insured knowing more about their condition than the insurer (or medical scheme in this case). An extreme example from short-term insurance is someone telephonically arranging cover for fire damage while a fire is approaching the house. In healthcare, anti-selection can occur if a diagnosis is suspected or expected and thus there is an almost certain need for healthcare at the time the person joins a medical scheme.

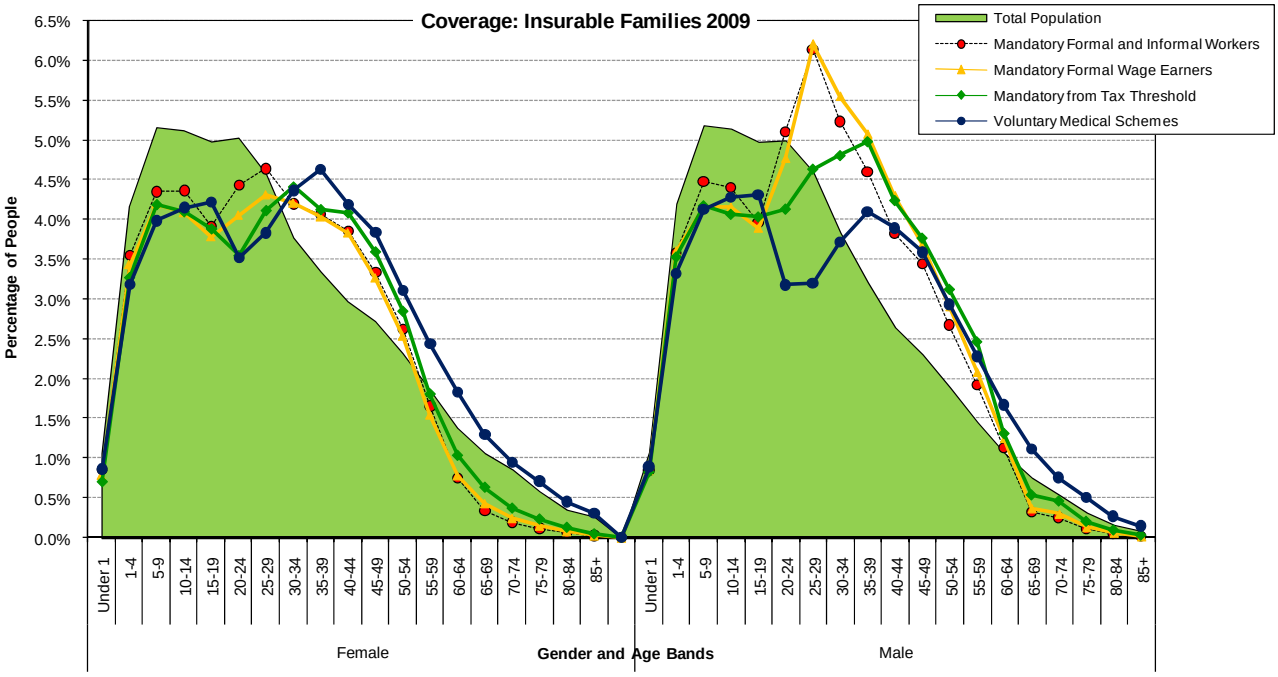

Figure 4: Standardized Age Profiles for Phased Implementation of Mandatory Insurance

Medical schemes have a "twin-peak" age profile, showing that young working age people have remained outside the voluntary health insurance system while older working age and retired people have joined medical schemes in significant numbers. The effect of remaining outside the system is very marked for young working men. The introduction of the Government Employees Medical Scheme (GEMS) since 2006 has increased the numbers of working women covered as the State employs significant numbers of women as teachers and nurses.

The graph shows that the age profile will alter substantially as the reforms to create a mandatory system of National Health Insurance are implemented. The impact differs substantially by gender with many more young working men becoming eligible for health insurance if there is mandatory cover from the tax threshold. There are also a significant number of young men earning below R2,000 pm in 2005 Rand terms who do not currently have health insurance cover.

Figure 5 shows clear evidence of anti-selection in the voluntary environment by women in the child-bearing years. The minimum benefit package includes almost all maternity care and thus it has become a common phenomenon for women to join a medical scheme to have their children and to leave if the children are healthy.

McLeod & Grobler[9] found that the total number of children expected to be born in South Africa in 2005 was 22.8 per 1,000 women. In an extensive study covering 63% of the medical scheme beneficiaries in 2005 the number of children was found to be 26.4 per 1,000 women in medical schemes. This fertility in medical schemes has been found to be on the low side compared to actual experience since 2005, suggesting that anti-selection by pregnant women has been widespread.

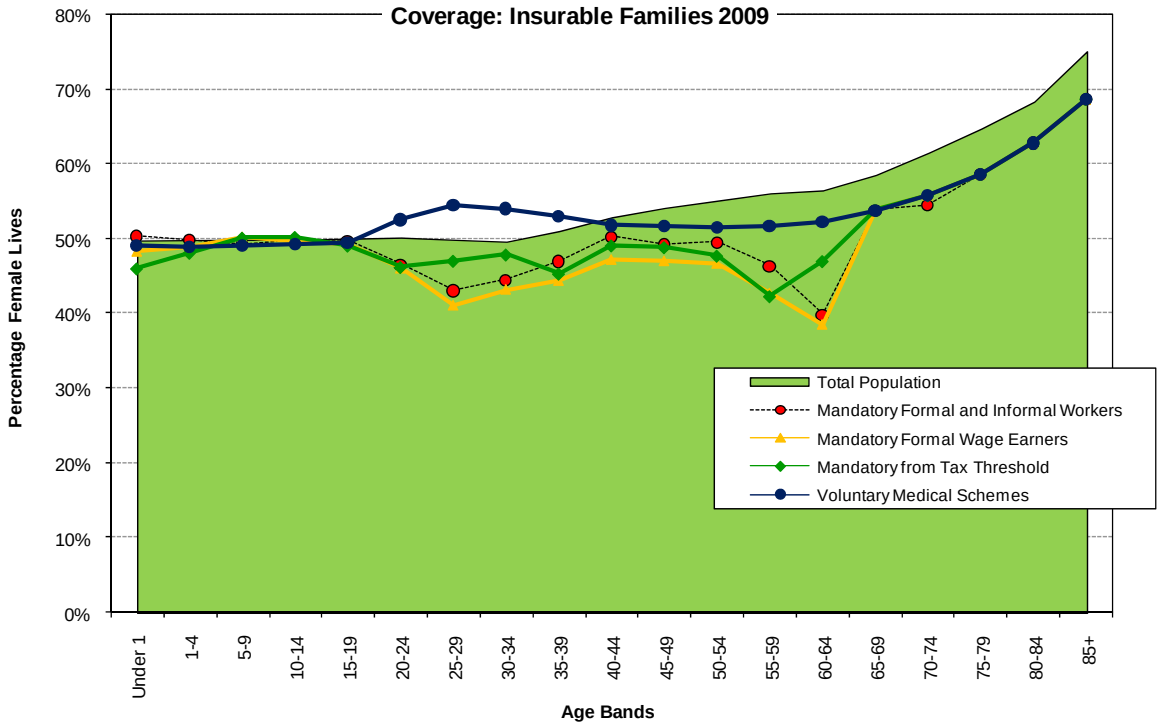

Figure 5: Proportion of Female Lives during Phased Implementation of Mandatory Insurance

The extent of anti-selection by those with chronic disease can only be speculated but the patterns of disease by age show unusual bulges in the young adult years for some severe diseases like multiple sclerosis, suggesting that families with someone with an expensive disease would try to join a medical scheme.

The Medical Schemes Act of 1998, effective from January 2000, instituted waiting periods[j] in medical schemes to provide some measure of protection against anti-selection but these do not seem to have been effective for disease requiring expensive treatment. There is anecdotal evidence that older people with chronic renal failure needing dialysis are encouraged to join medical schemes in order to get dialysis in the private sector, as limited resources in the public sector have meant severe rationing by age with dialysis not typically provided over age 60. Dialysis in the public sector is offered to bridge the known 12 month waiting period that the medical scheme will apply. The impact on a medical scheme is substantial: the industry community-rate[k] for all medical scheme members was estimated using an age-gender profile from mid-2008 to be R310.50 [10]. A healthy 60-year old male is expected to cost R583.28 per month but one with chronic renal failure needing dialysis is expected to cost R19,291.96 per month. The net effect is that the community rate for all members of medical schemes must increase to cover the costs of this anti-selection.

[j] The rules are complex but in essence someone who transfers from another medical scheme and joins a new one has no waiting periods for minimum benefits. Someone who has not been on a medical scheme recently is required to wait for a period of three months before receiving minimum benefits and there may be a 12 month exclusion for any pre-existing condition.

[k] The industry community rate is the amount needed per person from all beneficiaries in all medical schemes in order to cover the total cost of Prescribed Minimum Benefits. It is as if all medical schemes are one single risk pool with one price to be paid, regardless of age, gender or state of health.

2.4 Impact of Mandatory Insurance on the Price of Minimum Benefits

In Figure 4 it was demonstrated that mandatory health insurance would substantially change the age and gender profile of current medical schemes, adding more children and more young working age people. Table 2 uses those age and gender profiles to illustrate the expected impact of the changes on the price of minimum benefits.

Table 2: Impact of Phased Implementation of National Health Insurance on the Price of Minimum Benefits for 2009

National Health Insurance Phase	Phase 0	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5
	Voluntary Medical Schemes	Mandatory from Tax Threshold	Mandatory from LIMS Threshold	Mandatory Formal Wage Earners	Mandatory Formal and Informal Workers	Total Population Covered
Additional people covered		4,503,463	2,382,993	4,040,079	6,205,067	23,906,777
People Covered by Health Insurance	7,816,834	12,320,297	14,703,290	18,743,369	24,948,436	48,855,213
Percentage of Population with Health Insu	16.0%	25.2%	30.1%	38.4%	51.1%	100.0%
Minimum Benefits in 2009 Rand terms						
DTP Hospital	206.19	189.15	184.90	178.27	173.07	181.51
CDL Medicine	53.52	46.92	45.08	41.85	39.43	41.94
Visits and Related Costs	49.48	45.83	44.84	43.03	41.64	42.33
Total Prescribed Minimum Benefits	**309.19**	**281.90**	**274.82**	**263.15**	**254.14**	**265.78**
Change from Voluntary Medical Schemes due to age and gender		**91.2%**	**88.9%**	**85.1%**	**82.2%**	**86.0%**

The table shows that moving from the current voluntary environment to mandatory cover for the insurable families of all those earning above the tax threshold, the price of minimum benefits would fall to R281.90 per beneficiary per month (pbpm) or to 91.2% of the value expected in 2009[I]. If membership was mandatory from the LIMS threshold, then this would add younger working age members and children and the price would fall further to R274.82 pbpm. The price per head continues to fall with each added group until all those earning an income are covered, together with their insurable families. At this point, 51.1% of the population would be covered for health insurance and everyone earning any income would be a contributor (even if there were almost complete subsidies for the lowest income workers).

To add the remaining population to achieve universal coverage would effectively add many more children but also a substantial number of elderly people. This would raise the price of healthcare

[I] The community rate published in the Preferred REF Contribution Tables for 2009 uses the most recently available age profile at that time, which was from mid-2008. In this comparison the age profile for 2009 has been estimated, taking into account growth reported in the quarterly reports from CMS. It is expected that growth is occurring in the children and working age years and not in those over age 65, hence the estimate that the community rate may have been R309.19 in Table 2 compared to R310.50 in the published tables.

from 82.2% to 86.0% of the current medical scheme community rate. This illustration has simplified the effects to consider only the impact of age and gender on the price of healthcare.[m]

McLeod & Grobler[9] estimated the effect that the anti-selection by pregnant women and the ant-selection by those with serious chronic disease may have on the price of healthcare using 2007 data. While these estimates are more speculative, they argue that the price of minimum benefits for mandatory cover for all workers and their families might be 77.3% of the price in a voluntary environment, thus adding a further roughly 5% to the reduction in price. They conclude that "Another way to look at this phenomenon is that prices of minimum benefits in the voluntary environment are some 17% to 23% more expensive than they could be under this phasing of mandatory cover."

The age and gender differences between existing medical schemes and the various phases of mandatory insurance are substantial. The price impact was demonstrated and generally, the more lives added under mandatory coverage, the lower the average price of healthcare for all. The age and gender effects alone mean that the price of minimum benefits in medical schemes is some 18% higher than it would be under mandatory insurance covering all income earners. There may well be additional price reductions under mandatory insurance due to the effect of anti-selection in the voluntary environment but the impacts are more difficult to estimate.

This reinforces the conclusions in Policy Brief 1 that it is critical to perform calculations for National Health Insurance by at least age and gender and preferably also by the burden of disease.

3. Price Curves for Costing

The classic shape of the price of healthcare by age is described in section 2 of IMSA Policy Brief 1: The Population for Universal Coverage[6].

3.1 The Price of Healthcare by Age and Gender

Figure 6 shows the very strong pattern by age and gender in the cost of healthcare. The costs are aggregated for a full calendar year for each age and gender group and this is the price that needs to be charged to cover the cost of healthcare benefits for that age and gender group.

The package of benefits used for illustration is the Prescribed Minimum Benefits (PMBs)[n] required in all medical schemes.

[m] There are many other factors that could have an impact on the actual price of minimum benefits. Estimates of the differences in disease burden between the currently covered population and those who would be added can be made but there is seldom strong evidence to use in the calculations. Factors that require considerable judgement in the pricing include the issue of greater demand from moral hazard due to easier access and the impact of removing limits or co-payments on benefits included in the minimum package.

[n] The Prescribed Minimum Benefit package is a list of some 270 diagnosis-treatment pairs (DTPs) primarily offered in hospital (introduced January 2000); all emergency medical conditions (defined January 2003);

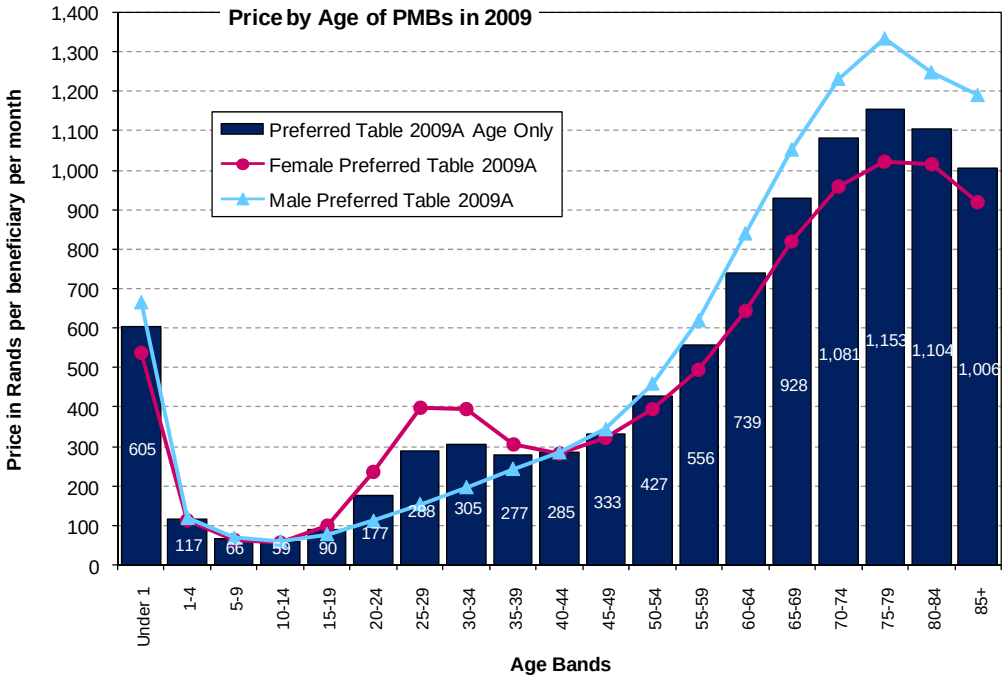

Figure 6: Price by Age and Gender of Prescribed Minimum Benefits in 2009

Children under the age of 1 year are much more expensive than slightly older children. Not all Under 1s are expensive but there are a few very high cost babies, usually those born prematurely. Male babies are more expensive than female babies as they tend to be sicker and there may be costs of circumcision soon after birth. Children of school-going age are the lowest cost beneficiaries but as they leave school, costs escalate rapidly. Costs in the early adult years are influenced by maternity costs, vehicle accidents, substance-abuse and the consequences of violence. Female costs are much higher than male due to the "maternity bump" in the child-bearing years. At age 40 male and female costs are about equal and after age 40 the impact of lifestyle choices in early adulthood begin to show in the high costs for chronic disease. Male costs are higher than female from about age 40 onwards for the rest of life.

Legislation may modify how healthcare is charged, for example the community-rating provisions of the Medical Schemes Act require that each option (package of benefits) charges a flat community rate, not differentiated by age or gender or state of health. If a province receives an amount specified as per person, then this is effectively a community rate being paid to the province. The same concept lies behind the capitation fee used when paying groups of doctors.

The graph below shows the price by age and gender split into component parts: hospital costs (the diagnosis-treatment pairs or DTPs); the medicine for the chronic diseases in the Chronic Disease List (CDL) and the visits to GPs, specialists and related diagnostic and monitoring tests required by minimum benefits.

diagnosis, treatment and medicine according to therapeutic algorithms for 25 defined chronic conditions on the Chronic Disease List (CDLs) (introduced January 2004).

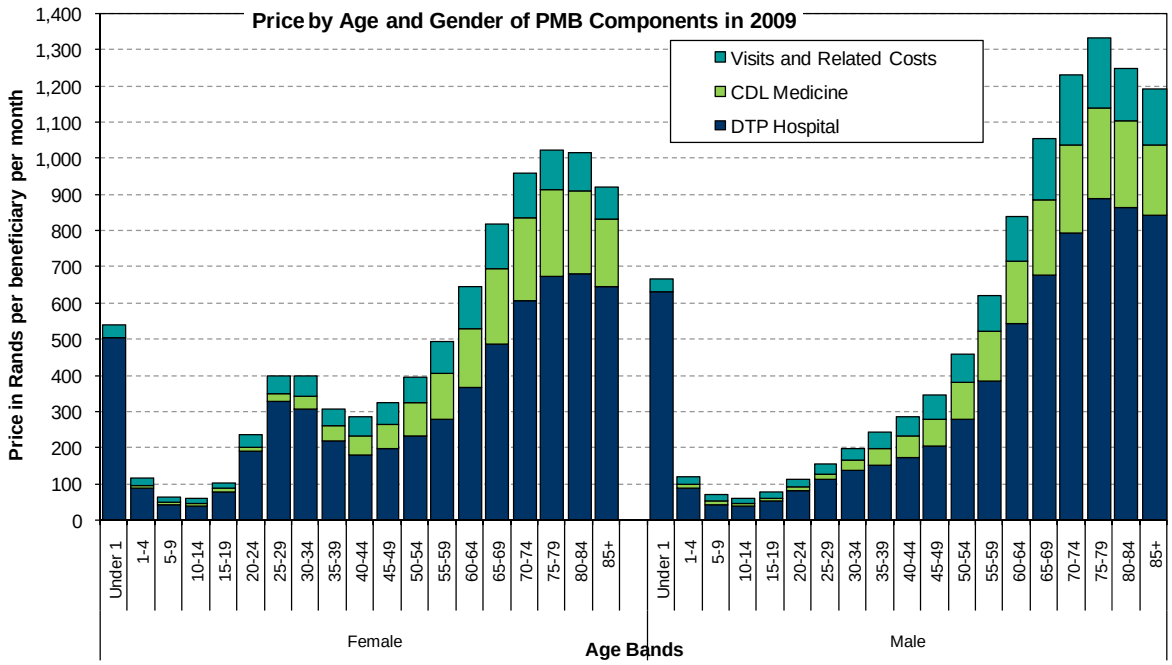

Figure 7: Price by Age and Gender of PMB Components in 2009

There are as yet no publicly available costings of public sector healthcare by age and gender. In the sections that follow, the price by age and gender for PMBs is used as a proxy measure to enable the demographic factors to be illustrated. How reliable is using the PMBs as a proxy for health costs?

The shape by age and gender shown in Figure 6 is consistent with that seen in many other countries.

- The major difference is that in South Africa there is a higher cost of maternity due to the very high Caesarean rates in the private sector[10] as well as the anti-selection by pregnant women (discussed in section 2.3).
- The PMBs cover only about 50% of a comprehensive healthcare package[9].
- The cost of delivery in the public sector may be lower than in the private sector but there are no authoritative studies on the extent to which costs differ. A rough rule of thumb was thought[11] to be that the public sector might be 70% of the private sector cost.
- The HIV epidemic is greater in the public sector population than the medical scheme population used to develop the PMB pricing.

While the PMB price is not very reliable for estimating public sector costs, the general shapes by age and gender are likely to be broadly similar. The thoroughly-researched PMB shape[4] is thus used, updated using the same methodology to 2009[12,13], to estimate the effect there might be in South Africa as a whole due to changes in the age and gender structure of the population (as shown in Table 1).

3.2 Estimates of Component Cost Curves in South Africa

Cost curves by age and gender for various "slices" of healthcare benefits have been developed in order to be able to estimate the impact of different benefit packages. The following components were developed for Prescribed Minimum Benefits (PMBs):

- PMBs In-hospital excluding maternity;
- PMBs for maternity in hospital;
- PMBs for chronic medicine; and
- PMBs for related visits and tests.

The PMB curves were developed from a very large data set and study conducted using 2005 data from the four largest administrators, the "REF Study 2005"[4]. These administrators provided services to some 4.249 million lives which represented 63.4% of the medical scheme beneficiaries in 2005. Monthly data for a full calendar year was used, giving 49.847 million member months of data or the equivalent of 4.154 million member years of data. The study design ensured that data on PMBs was collected consistently across all four administrators and the data was extensively checked before use.

Definitions of PMBs and algorithms were those in force at the time of the REF 2005 Study. The curves developed initially to apply to 2007 have been inflated to 2009 using the official inflation rates for PMB components published by the Council for Medical Schemes each year.

Table 3: Actual and Expected Inflation Rates used to adjust PMB Curves from REF Study 2005

Year	Inflation measure		DTP Hospital	CDL Medicine	REL Visits and Tests
2007	Inflation 2005-2006	Actual	9.32%	5.58%	9.62%
	Inflation 2006-2007	Expected	7.50%	8.16%	4.90%
2008	Inflation 2005-2006	Actual	9.32%	5.58%	9.62%
	Inflation 2006-2007	Actual	7.26%	6.43%	5.40%
	Inflation 2007-2008	Expected	8.74%	5.91%	7.04%
2009	Inflation 2005-2006	Actual	9.32%	5.58%	9.62%
	Inflation 2006-2007	Actual	7.26%	6.43%	5.40%
	Inflation 2007-2008	Actual	7.25%	4.69%	5.90%
	Inflation 2008-2009	Expected	12.00%	9.00%	11.00%

These inflation rates are determined annually by the Risk Equalisation Technical Advisory Panel and Council for Medical Schemes. The work uses data from the largest administrators in a defined format, together with advice from their pricing actuaries.

One concern that arose in late 2009 was that evidence began to emerge that actual PMBs may exceed these estimated PMBs. The issue was discussed at a research meeting in November 2009 and data is to be provided by four of the largest administrators and consultants. Early evidence suggest that PMBs may be being under-estimated by some R90 per beneficiary per month. This is not uniform across the price curves, but concentrated at the oldest ages.

There may be several explanations for the difference between PMBs in 2005, inflated to 2008, and the data emerging on actual 2008 expenditure. Members and healthcare providers have become more conscious of PMBs and entitlement to PMBs in recent years and this may be having an effect on what is coded as a PMB when it reaches the administrators. The requirement to pay PMBs at full cost, following decisions by the Council for Medical Schemes, may also be having an effect. New technology and drugs for the elderly may also have an impact. The research work is underway and results should be discussed in about March 2010.

The above-PMB curves were developed from data from a single administrator, Medscheme, for calendar year 2008. The data was drawn from 33 options across 17 medical schemes, of which 13 were restricted membership schemes and four were open schemes. The set contained 20.555 million beneficiary months of data, giving an average exposure of 1.713 million beneficiaries. The following elements above-PMBs were collated from more detailed benefit categories:

- Primary Care excluding Specialists;
- Primary Care including Specialists;
- In-Hospital above PMBs; and
- Non-PMB Out-of-Hospital Non-Primary Care.

The 2008 price curves above-PMBs were adjusted for inflation using the relevant inflation rates from Table 3. The "Non-PMB Out-of-Hospital Non-Primary Care" component assumes a medicine component of 30% and the balance from visits and tests. All of the component age-gender price curves are illustrated below in 2009 terms.

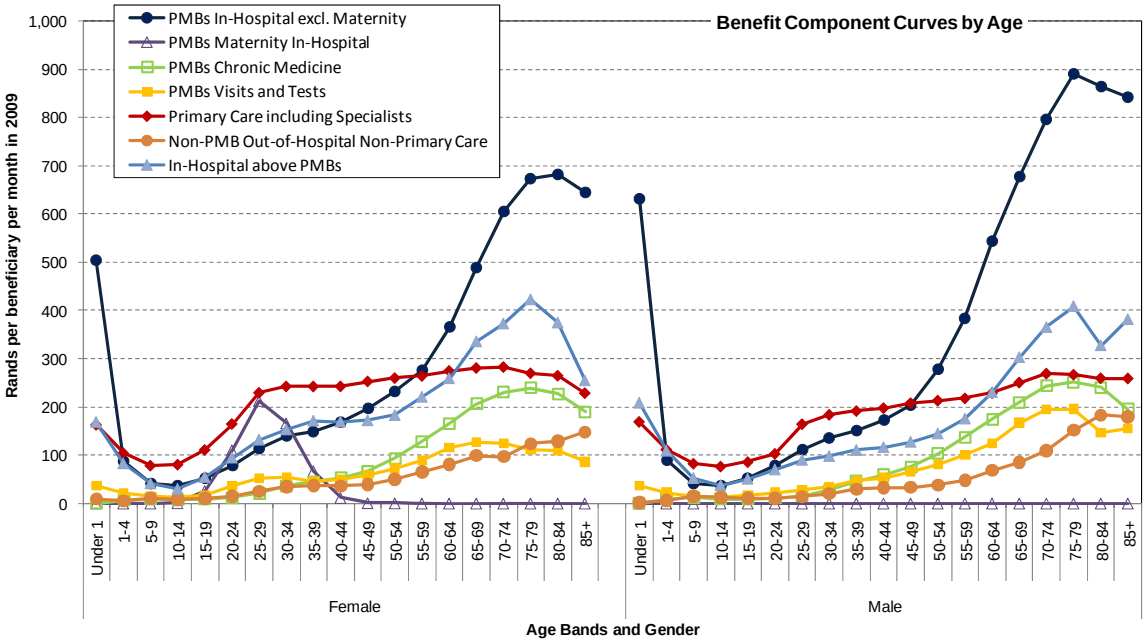

Figure 8: Estimates of Component Cost Curves by Age and Gender for Medical Schemes in 2009

3.3 Benefit Package Cost Curves for Model

The component cost curves were then combined to create initial estimates of a number of different minimum benefit packages as follows:

- **Medical Scheme Prescribed Minimum Benefits (PMBs)**: consists of PMBs In-hospital excluding maternity; PMBs for maternity in hospital; PMBs for chronic medicine; and PMBs for related visits and tests, in terms of the published therapeutic algorithms.
- **Basic Benefits: PMBs+ Primary Care**: consists of the PMBs as above, with primary care including specialist costs. This is effectively the recommended definition for minimum benefits made by the International Review Panel in 2004[14].
- **High Cost Benefits: PMBs+ all In-Hospital**: consists of the PMBs as above; primary care including specialists; and all benefits provided in-hospital. This is effectively the suggestion for minimum benefits and revised options structures by the Council for Medical Schemes in Circular 8 of 2006[15].
- **Core Benefits: PMBs+ Primary Care+ In-Hospital**: consists of the PMBs as above; Primary care including specialists; and all benefits provided in-hospital. This is a construct of minimum benefits that is reasonably comprehensive and is what the public might regard as a minimum set of healthcare benefits.
- **Fully Comprehensive: all healthcare benefits**: consists of the PMBs as above; Primary care including specialists; all benefits provided in-hospital; and a final "slice" of benefits that includes non-PMB out-of-Hospital non-primary care costs. This is equivalent to fully comprehensive packages at the top end of the medical scheme market at present.
- **LIMS Minimum Benefits**: consists only of the PMBs for maternity in hospital; PMBs for chronic medicine; PMBs for related visits and tests; and primary care including specialists. This is equivalent to the recommendation for the Low Income Medical Scheme (LIMS) options that was made in 2006.[16] It was intended that the PMBs in-hospital excluding maternity would be covered in public sector hospitals and not from the LIMS options. The LIMS Minimum Benefits are shown in two forms: the cost curve before delivery efficiency and an adjusted version calibrated to the observed cost of low-cost options that make use of capitated primary care and a GP gatekeeper model for referrals to specialists.

The graph below illustrates the price curves by age and gender that have been developed for 2009 showing the impact of different benefit designs. Critically, these are not yet adjusted for any of these packages becoming mandatory and costs of administration and managed care have not been loaded. The impact of the extent of the HIV epidemic needs further work to be more carefully incorporated as the effect changes over time. The level of efficiency in delivery is at the current level in the private sector, for purposes of illustration. The level of efficiency of delivery in the public sector and under a future NHI is a difficult issue which is dealt with at length in section 4.

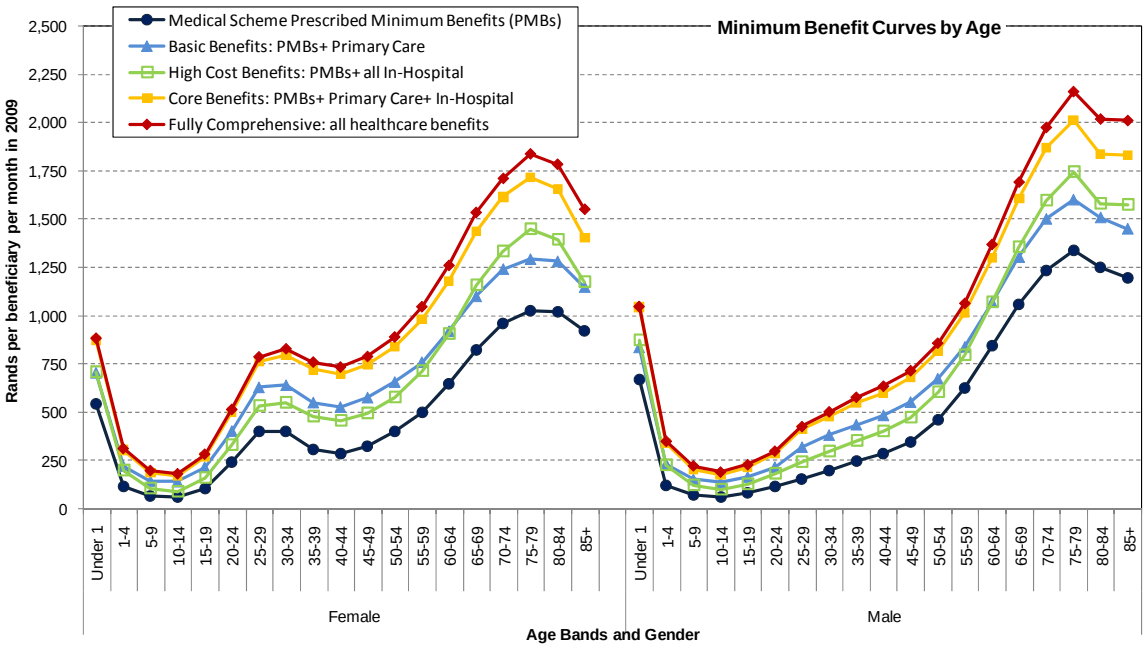

Figure 9: Initial Estimates of Cost Curves by Age and Gender for Medical Schemes in 2009

A critical issue in using these cost curves into the future is to what extent they might be stable. We know from experience that these general shapes by age and gender are persistent, not only over different schemes but also over time in the same funder (changing benefits are more important than time) and across countries (with some differences). Subsequent sections in IMSA Policy Brief 6[2] explore some of the philosophical assumptions that underlie whether the curves are in fact stable into the future. (See also section 7.3 in this document).

The graph below from work by Randy Ellis in Boston illustrates the shape of the male and female cost curves in the insured population in the USA, using a data set of 14.9 million lives.

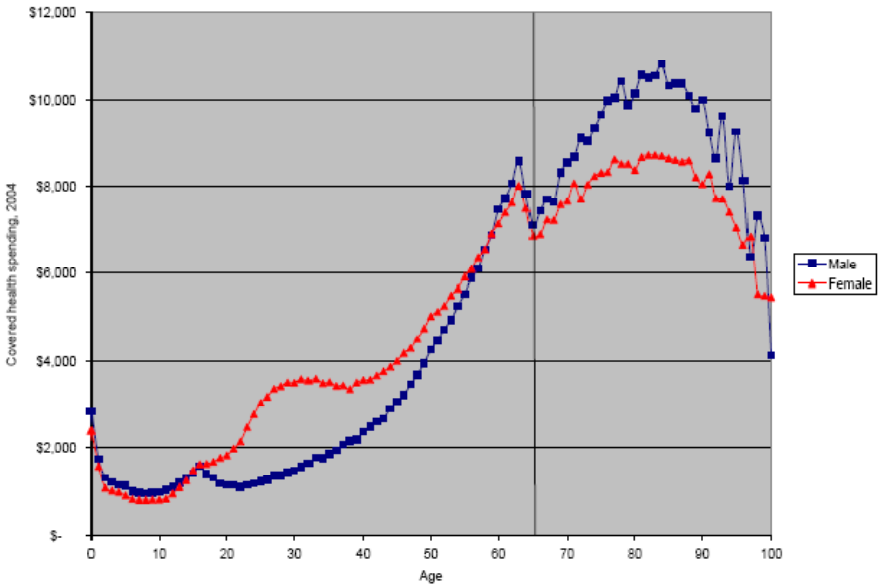

Figure 10: US privately-insured health care spending, by age and by gender, 2004
Source: Ellis[17].

The Ellis graph reflects total health spending and includes covered inpatient plus outpatient plus pharmacy covered spending. The sample is merged MEDSTAT commercially insured (under age 65) and MEDSTAT Medicare (over age 65) samples. The author notes that the discontinuity at age 65 reflects both a sample discontinuity as well as benefit and utilization changes. Note the much lower Under 1 costs relative to South Africa. The general shape and the differences by gender are similar to the curves derived in South Africa.

Ideally, we would want to study the age-gender curves in the public sector in South Africa but despite several attempts over a nine year period it has not yet been feasible to estimate these curves. It is of course very difficult to use data from an under-resourced public service to predict cost in a future better-resourced system. This brings us back to attempting to use the excellent private sector data and adjust it to the total cost likely in a well-resourced public system.

In all likelihood the public sector curves have a similar shape to those shown in Figure 9 but with at least the following differences: lower costs for Under 1s (fewer ICU admissions and very low birth-weight babies are not resuscitated in the public sector); lower maternity costs (far fewer Caesarean sections and more realistic birth rates); and higher HIV admissions and costs in the HIV years (a first attempt at this has been tried). The cost of chronic disease from age 40 onwards may also be affected by different patterns of disease and treatment regimens.

While we know that the mix of chronic diseases amongst the poor is different to that of the higher income groups in medical schemes, the total burden of disease (excluding HIV) might possibly be of about the same magnitude. This is a research question that needs further work and the results will have important implications for the use of private sector data to project public sector costs.

4. Delivery Efficiency for Costing

This element of the costing is the most difficult to estimate. It has been widely held[14,18-21] that the private sector is relatively inefficient and that the predominantly fee-for-service reimbursement system is at the root of the problem. There is thus often an assumption that a future system with changed purchasing behaviour (more strategic purchasing and less passive purchasing) and changed reimbursement (more capitation[o] and use of DRGs[p, 22]) can deliver healthcare more efficiently than the private sector at present. In other words, models often make allowance for the cost of delivery to be cheaper in the public sector or NHI than the current medical scheme environment.

However hard evidence for the extent of any saving is much more mixed and the issue is not at all straightforward. This section sets out some of the evidence for this critical assumption in costing and comments on some of the studies, their relevance to local conditions and newer evidence.

[o] Capitation is a fixed amount per person enrolled, typically per month, rather than a fee paid per patient visit. Doctors take on the risk of managing expenditure within the monthly capitation amount received.

[p] Diagnosis Related Groups – a payment method for hospitals which groups similar diagnostic categories into clinically meaningful diagnostic clusters that have similar resource use. It simplifies payment to hospitals and hospitals take on the risk of managing expenditure within the amounts received.

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4.1 NHS in the UK compared to South African Hospitals

In early work on minimum benefits in South Africa, Söderlund & Peprah[23] used data from the National Health Service (NHS) in the UK, blended with data from the mine hospital system in South Africa and a small amount of medical scheme data. They "combined individual data sources to yield a hybrid utilisation and cost dataset which selectively uses elements from each of the sources. The hybrid dataset was designed to represent the best possible estimates for the South African target population".

The authors found "potential for enormous variation in the elective surgery rates ... . Admission rates for this category in the South African Medical schemes sector are almost double those of NHS hospitals, and approximately four times those of mine hospitals".

4.2 NHS in the UK compared to Managed Care in the USA

It is of interest to see from later studies that the NHS is not considered as efficient as some other systems. A paper in 2003 compared the utilisation of hospital beds by those over age 65 in the NHS in England, Kaiser Permanente in California, and the Medicare programme in the United States and California[24]. The authors found that "Bed day use in the NHS for the 11 leading causes is three and a half times that of Kaiser's standardised rate, almost twice that of the Medicare California's standardised rate, and more than 50% higher than the standardised rate in Medicare in the United States. Kaiser achieves these results through a combination of low admission rates and relatively short stays."The authors concluded that "the NHS can learn from Kaiser's integrated approach, the focus on chronic diseases and their effective management, the emphasis placed on self care, the role of intermediate care, and the leadership provided by doctors in developing and supporting this model of care."

It is now known that there are large differences in definition between hospital admissions in the USA and South Africa[25] (see section 4.4). The NHS- Kaiser-Medicare study also found that the differences in coding, types of facility and ways of recording information influenced the results, saying "the NHS data presented here do not distinguish between the time that patients spend in an acute hospital and the time they spend in a community hospital or similar facility. This is a limitation of the reporting of activity data in the hospital episodes statistics system and means that the NHS figures overestimate the use of acute beds in comparison with Kaiser and Medicare". It is not simple to compare admission rates and length-of-stay across different countries or different provider systems.

4.3 Levels of Managed Care Efficiency in the USA

The Formula Consultative Task Team in 2003/4 considered the issue of delivery efficiency when initially developing a formula for risk equalisation between medical schemes[26]. Information at that time was provided by Rob Parke and Mark Litow of Milliman USA, an actuarial and clinical consulting

firm. Milliman USA made use of a concept of levels of efficiency when pricing healthcare in the USA. They used three levels of efficiency in managed care and these were interpreted for South Africa in discussions with Rob Parke in 2001:

- **Loosely-managed**: the standard level of managed care interventions in general use by SA schemes i.e. includes pre-authorisation, case management, drug-utilisation review but almost no risk-sharing with providers. This use of the tools of managed care with little risk-sharing is described by Doherty & McLeod[27].
- **Moderately-managed**: an intermediate level of managed care that involves some risk-sharing. Examples would be per diem or per case rates on hospitalisation. In 2001 it was unlikely that many whole schemes would have reached this level. For the last seven years, many schemes at Medscheme have been on per diem rates and fixed fees for about 80% of total hospital costs.
- **Well-managed**: a full implementation of managed care with extensive risk-sharing with providers or complete risk-taking by providers as in staff model Health Maintenance Organisations. The best examples in SA (in 2001) were the mine healthcare systems like Igolide and Impala Platinum.

While it had been hoped to do a PMB costing in one of the Well-managed settings in South Africa, this has not yet been possible and should still be a high-priority research project in South Africa.

The graph below illustrates the three levels of efficiency using data supplied by Milliman USA for their market. Note the similar shapes for the different efficiency levels in the graph.

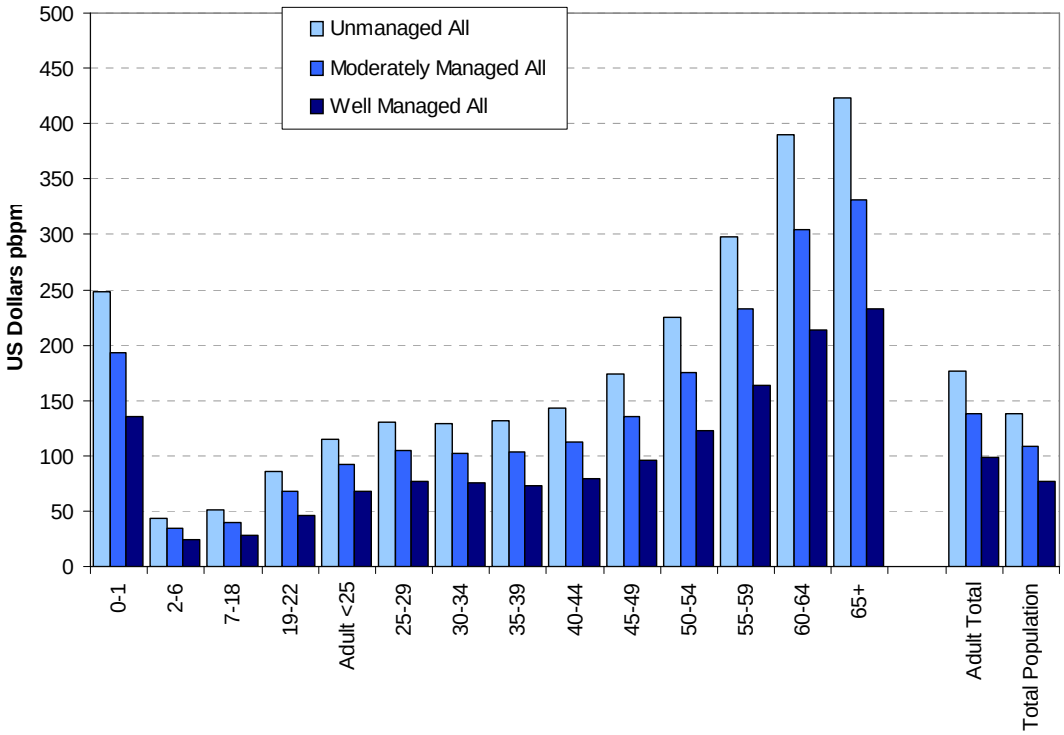

Figure 11: Effect of Efficiency on USA Hospital Costs (Inpatient + Outpatient)
Source: Milliman USA

The table below illustrates the expected effect for three measures of utilization, using data from the USA for commercial (under age 65) health plans and the very large USA national fund, Medicare, which provides healthcare to those over age 65.

Table 4: Impact of Managed Care Level on Admissions and Bed Days Needed in the USA
Source: Milliman USA [28]

Population	Efficicency Level	Admissions per 1,000	Average Length-of-Stay	Bed Days per 1,000	Utilization relative to Loosely Managed
Commercial (i.e. under age 65)	Loosely Managed	77.200	3.982	307.400	100%
	Moderately Managed	62.765	3.488	218.950	71%
	Well Managed	8.330	2.700	130.500	42%
Medicare (i.e. over age 65)	Loosely Managed	292.600	6.673	1952.600	100%
	Moderately Managed	220.800	5.873	1296.650	66%
	Well Managed	149.000	4.300	640.700	33%

In the work on the Risk Equalisation Fund pricing, there have been strong arguments to suggest that this theoretical efficiency could not be expected in South Africa[4,14]. After seven years of experience of Moderately-managed care it has been difficult to show that there is any material gain compared to Loosely-managed care. The order of magnitude of changes suggested in the USA data are definitely not what experience has shown in South Africa.

There are considerable issues delaying the full introduction of risk-sharing under managed care with little coordination between the Competition Commission, the Council for Medical Schemes, the Health Professions Council and the National Department of Health. There are also significant differences in the structures in which medicine is practiced and the relative numbers of healthcare providers between the two countries.

4.4 Comparison of Bed Utilisation in the USA and South Africa

The difficulties with comparing utilisation figures across different countries was examined in a recent paper comparing bed utilisation in South Africa and the USA[25]. At face value, the Council for Medical Scheme published an admission rate for the private sector in South Africa of **301.7** days per 1,000 population, whereas USA figures are quoted as **132.2** days per 1,000, or a gap of 169.5 days per 1,000 lives.

Van Eck & Besesar showed that a series of adjustments were needed to both the SA data and the USA data in order to do a fair comparison. These included:

- Adjustment to SA admission rates to remove ambulatory, emergency unit admissions and admissions to non-acute care facilities to bring the definition of facility in line with that in the USA [reduced SA figure from 301.7 to 224.4 per 1,000].

- The in-patient definition in the USA is for admission over 24-hours duration. The SA admission rates had included stays shorter than 24 hours and were thus adjusted [reduced SA figure to 136.5 per 1,000].
- A normal birth in the USA counts as two admissions whereas in SA, normal newborns are not counted separately. The USA admission figures were thus decreased to the SA definition [reduced USA figure from 132.2 to 121.6 per 1,000].
- The USA has a much older age profile than South Africa and hospital admissions have a strong pattern by age. The USA figures were adjusted to the SA private sector age profile [further reduced USA figure to 98.3 admissions per 1,000]
- The USA has a much lower maternity rate in the peak years of age 25-29. As other evidence has shown, there seems to be anti-selection in South Africa with more women joining medical schemes in order to give birth in private facilities (see section 2.3) [USA figures adjusted to SA maternity rate results in USA admissions increasing to 101.2 days per 1,000 lives].
- There are large numbers of people in the USA who are uninsured and there is a strong pattern by age. Admissions by uninsured are lower than for the insured and so the reported USA figures for the whole country are increased to allow for higher utilisation if all people were insured [USA figure increases to 114.8 days per 1,000].

This results in a comparison of adjusted SA figures of **136.5** days per 1,000 with adjusted USA figures of **114.8** days per 1,000 or a gap of 21.7 days per 1,000. The authors argue that the remaining difference may be due to the differing burden of disease in the two countries (HIV/AIDS prevalence in particular) and differences in the insurance environment. For example, in the USA many states allow insurers to decline cover for "medically uninsurable" individuals or increase premiums whereas medical schemes in South Africa operate under community-rating and open enrolment[q].

A similar exercise adjusting published length-of-stay (LOS) figures increases the observed South African LOS from 3.16 days to 5.14 days while the average USA LOS is 5.6 days.

4.5 Impact of Different Forms of Managed Care

Randy Ellis of Boston University reported on research in the USA on the effect of different forms of managed care design on cost curves by age[17]. Initially it seems that there are significant differences in the cost curves for under age 65s between five types of health plans. While the whole data set is 13.0 million lives, Ellis says: "Each of the lines is drawn with at least 100,000 enrollees, so the patterns are highly stable across age groups. The figure suggests that enrollees in each of the five plan types are relatively similar up until age 40, at which time there is a divergence of HMO and point-of-service (POS) with capitation plans from the rest. By age 40 there is about a 20 percent discrepancy between the HMO and POS with capitation plan from the other three plan types. Is this difference due to selection of healthier people conditional on age, to taste differences, or due to supply side moral hazard response to incentives?"

[q] Community-rating requires that everyone in an option is charged the same standard rate while open enrolment requires that open medical schemes accept anyone who applies.

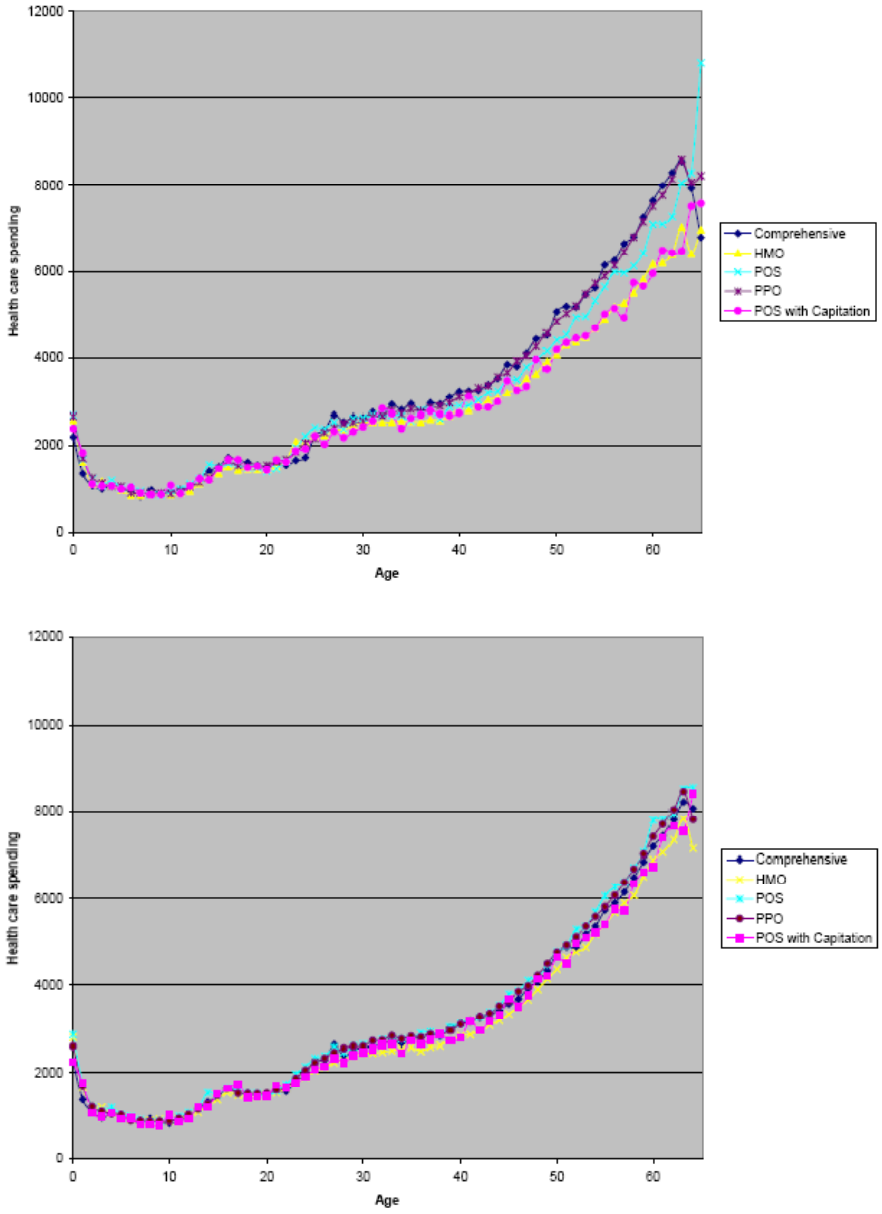

Figure 12 a and b: US privately-insured health care spending, by age and health plan type, 2004.
Figure a is unadjusted and Figure b is risk-adjusted. Source: Ellis[17].

Ellis says that the second graph above "provides one answer to this question. Instead of plotting actual spending by age and plan type, the figure shows the risk adjusted spending by age and plan type. Risk adjustment in this example was done using the DCG/HCC concurrent risk adjustment model. The five lines are much closer together, differing by less than 5% across plan types. There is still a difference at age 40, but it is much smaller. This modest difference once spending is risk adjusted suggests that most of the 20 percent observed difference is due to selection differences, not taste, or moral hazard. The implied cost savings from the HMO and POS with capitated from the most common plan type of preferred provider organizations (PPOs) is less than 5%, with a modest gradient upward with age."

4.6 Why are Managed Care Plans Less Expensive?

Another paper that gets behind the observed differences in price between managed care plans and other plans is a 2004 paper by Polsky & Nicholson[29]. The paper quantifies the reasons why managed care plans appear to be less expensive, considering the roles of risk selection, utilization and reimbursement levels.

The authors say: "Today, various plan types exist; some with strict controls on enrollee use of medical services (i.e., Health Maintenance Organizations (HMOs)[r]), and others with fewer restrictions such as indemnity[s] plans and preferred provider organizations (PPOs)[t]. The mean [annual] premium for a family policy in 2001 was US$6,500 for an HMO, US$7,700 for an indemnity plan, and US$7,200 for a PPO plan. Despite the strict controls on medical service use, HMOs have been able to capture a 45 percent share of the large-employer market by charging considerably lower premiums than indemnity plans and PPOs."

"We will consider utilization, reimbursement, and risk selection as possible explanations for the lower premiums. First, we consider the utilization effect, which would occur if lower premiums reflect the success of HMO plan managers at restricting access to medical care they believe is worth less to enrollees than it costs HMOs. Second, we consider the reimbursement effect, which would occur if the lower premiums are due to the ability of HMOs to pay physicians and hospitals less than non-HMOs by promising to channel more patients to medical care providers who agree to accept discounted payments. Third, we consider the risk selection effect, which would occur if lower premiums reflect the ability of HMOs to enrol a disproportionate share of people who have a relatively low demand for medical care."

"Which stakeholders have been influenced the most by managed care penetration depends largely on which of these explanations tend to dominate. If HMO plans are less expensive because they are designed and managed differently, there are efficiency gains due to the more efficient use of health care resources and consumer welfare gains due to greater product selection. If HMOs are less expensive because they pay hospitals and physicians less than non-HMO plans, this transfers money from medical care providers to consumers or health insurers. And finally, if HMO plans are relatively inexpensive because HMOs attract low-risk enrollees who have low expected costs, policy makers, high-risk enrollees, and employers should be concerned because HMOs may be distorting services to create disincentives for high risk enrollees and because this differentiation could lead to market disequilibrium (quoting Chernew and Frick, 1999)".

[r] Relative to PPOs, HMOs generally have a more restricted network of physicians and hospitals, evaluate the medical necessity of medical care more rigorously (e.g., require approval before a patient can be referred to a specialist), and are more likely to provide physicians and hospitals with financial incentives to encourage judicious use of resources (e.g., by paying physicians a fixed amount per enrollee per year, regardless of how much medical care the enrollee requires).

[s] Enrollees in indemnity plans are generally able to choose any physician and hospital but must pay a co-insurance rate for the medical care they receive.

[t] PPOs offer enrollees reduced payments at the point of care if they choose to be treated by physicians and hospitals who have agreed to accept discounted payments from the health insurer.

"Among people who had a choice of health plan type, ... Expenditures per enrollee are US$188, or 9.3 percent, lower for HMOs relative to non-HMOs. Decomposing this -US$188 difference into its component parts, it is estimated that US$46 is due to different utilization of medical services due to differences in plan design and management (the utilization effect), US$22 is due to differences in observed enrollee characteristics, US$13 is due to differences in unobserved enrollee characteristics [both risk selection], and -US$269 is due to relatively low HMO provider reimbursement levels."

"The large reimbursement effect combined with the small estimated utilization and selection effects indicates that HMO plan expenses are lower than non-HMO plan expenses due to superior negotiating power, rather than superior utilization management or favourable risk selection. We find no evidence of risk selection between HMOs and non-HMOs in a large national sample."

"The finding that HMO and non-HMO enrollees of similar characteristics receive the same amount of medical services differs from the results of early studies. These studies generally conclude that HMO enrollees spend fewer days in the hospital, but receive more physician visits and more preventive care than their fee-for-service counterparts (summarized by Miller and Luft, 1994), which would probably result in lower utilization for HMOs. A more recent study by Tu et al. (1999) is consistent with our findings of no utilization differences. They conclude ... that HMO enrollees receive more primary and preventive care than non-HMO enrollees, while many of the more costly services are used in equal amounts in both plan types."

"Likewise, Altman, Cutler, and Zeckhauser (2000) and Cutler, McClellan, and Newhouse (2000) find little difference in the amount of medical resources used to treat HMO and indemnity patients. The conclusion that differences in provider reimbursement rates account for most of the expenditure difference between HMOs and non-HMOs is consistent with the results of Cutler, McClellan, and Newhouse (2000) and Altman, Cutler, and Zeckhauser (2000). These studies conclude that patients with eight different medical conditions generally received the same type and amount of medical care whether they were enrolled in an HMO or indemnity plan. Massachusetts HMOs, however, paid physicians and hospitals about 40 percent less than indemnity plans conditional on the type of treatment rendered."

The authors thus conclude: "the US$188 difference between HMO and non-HMO medical expenditures per enrollee can be explained by the relatively low provider reimbursement rates paid by HMO plans." [emphasis added]

4.7 Cost for Hospital Admissions in the Public Sector in South Africa

In 2001 attempts were made using South African data to get an understanding of the difference in cost between medical schemes and the public sector. The work on in-hospital benefits was attempted as part of the work on PMB pricing for 2001[30]. The authors wrote: "Attempts to obtain information from the public sector departments have not proved as successful as envisaged. The figure quoted several times in efforts to obtain data was that the UPFS was set up to cost 25% less than comparative private sector rates. The number of 30% is also regularly quoted. Neither has been substantiated in any meaningful way."

"The Consortium has been able to obtain two studies, which could assist in this comparison. The first relates to a single case study performed by Dr Gilbert in which she analysed anticipated costs of an appendicectomy in district vs. academic facilities according to the UPFS." Data was extracted from Medscheme for comparison and it was found that "Average costs ... were ... 43.8% higher than the public sector. Initial reaction is that the private sector costs are exorbitant but if comparable analysis is done on average length-of-stay then a somewhat different picture emerges. Considering only the admissions ... for 4 days and less, the average cost per stay ... decreases to 34.08% higher than the public sector. The average cost is thus driven up by the cases with complications."

"The second [study] relates to work done by the Provincial Administration of the Western Cape Health Department by Kim Lowenherz, where a comparison was made of costs for some procedures and diseases entities between the Public and Private sector." "The comparison by PAWC of BHF and UPFS tariffs for the same condition provides no evidence of any pattern that can be used for the estimate of public sector delivery costs."

The authors concluded: "A great deal of work needs to be done to definitively determine the relationship between the UPFS costs in the public sector and the costs in the private sector." "In the absence of solid evidence," [emphasis added] "the Consortium recommends the use of 70% of the full PMB price for delivery of both the PMB Inpatient package and the PMB Outpatient package in the public sector environment."

More recent work at Medscheme shows that the difference in cost per admission after adjusting for risk and case mix is about 20%. However the average LOS in State is significantly longer, perhaps because there is no case management infrastructure in place and medical schemes do not manage this aggressively in the public sector. It is important to remember that that 14% of any difference between private and public hospital costs sector is due to the public sector not paying VAT. This leaves at best a **6%** difference after adjusting for risk, reason for admission and severity.

The level of urgency should also be considered in future work: while there may be potential savings on elective hospitalisations, the same may not be true of non-elective or emergency admissions.

4.8 Cost for Medicines in the Public Sector in South Africa

An estimate for the medicine component of PMBs in the public sector was considered as part of the PMB pricing done in 2001[31]. "The Department of Health developed the Essential Drugs List (EDL) for public sector implementation in 1996, with possible future extension to the private sector. Stakeholders were consulted to develop an EDL with the objectives of safety, efficacy and quality at the lowest possible cost, while providing coverage for 90-95% of the common and important conditions in the country. The development of the EDL was seen as an important part of the National Drug Policy [of that time]." ...

"The 1995 Report of the Committee of Inquiry into a National Health Insurance System reported that even a partial switch to EDL medicines would reduce overall projected private health expenditure by 5% and the potential savings were estimated at some R 1.2 billion per annum. The Committee recognised the potential for resistance on the part of providers, and therefore favoured a scenario in

which prescription costs would be halved, rather than the best-case scenario in which an 80% reduction could be achieved if all drug prescriptions were switched to EDL medicines. Private sector access to the list was originally given a target date of April 1997, but has not occurred." ...

"A comprehensive study of private sector prescribing patterns compared to the Essential Drugs List protocols was performed by Professor Alan Rothberg and Dr Laubi Walters in 1994." [32] "The research produces an estimate of the potential saving for medical schemes if the EDL is implemented fully. ..." The table shows that if the EDL medicines currently prescribed by GPs in the database were purchased through the State, an 18.3% saving would be achieved on the total GP medicines expenditure. An additional 15.7% would be saved if GPs switched the 'other forms of EDL' items to EDL items, and another 38.0% if the supplementary formulary items and some out-of formulary items could be switched to EDL medicines. Switching of all items, with the exception of an accepted 10% out-of-formulary items, would therefore achieve a saving of some 72% on total GP medicine expenditure".

"The analysis indicates that the draft EDL covers only approximately one-fifth of items currently prescribed within a large, disciplined HMO in which the GP is promoted as the 'gatekeeper'. .... the extent of such savings clearly depends on two major factors: the ability and willingness of prescribers to switch patients from non-EDL to EDL products, and the base from which the savings are calculated. Savings would also depend on the success of pricing proposals as detailed in the National Drug Policy document. (A further factor is whether) the scope of primary care is sufficient to ensure that patients currently under GP care are not unnecessarily forced up the referral pathway to secondary-level providers and medicines."

"Maximal savings would be achieved through switching of all except the accepted approximately 10% of out-of-formulary products to EDL medicines. According to the calculations, this could result in savings of more than 70% on GP prescriptions in a cost-controlled environment, and even greater savings in an environment in which there is currently less use of generic medicines. On the basis of the preceding discussion it would appear that the Committee of Inquiry's estimate of a 50% reduction in private sector costs is achievable for primary health care medicines. However, this cannot be extrapolated to the total private sector medicines budget without repeating the exercise for secondary level and specialist-prescribed medicines." .... "On the advice of Professor Rothberg, the Consortium recommends using an estimate of a 50% saving in the cost of the CDL package when delivered in the public sector. As policy unfolds in this area, so this estimate can be further refined."

However in subsequent research the extent to which state tender prices are being subsidised by the prices charged in the private sector has become evident. The impact on medicine prices in the public sector of this cross-subsidy being reduced or eliminated has not been taken into account in any of the analysis above. The above estimates should thus not be used without estimating the effect on medicine prices of the loss of the cross-subsidy from the private sector and the impact of VAT. It is also critical to revisit medicine policy in South Africa and consider the estimates in the light of policy as it has evolved to 2010.

4.9 Assumption for Delivery Efficiency in South Africa

Subsequently, three further projects were attempted at UCT in order to get a better understanding of delivery costs in other settings. The attempts at using public sector data directly have not yet yielded usable results. A promising project in a capitated primary care setting has some useful information but more work is needed in order to be able to make recommendations from the analysis. This research area is one that deserves greater attention by all healthcare financing researchers.

The core of the problem still remains: there is inadequate information to develop cost curves by age and gender for delivery of quality healthcare in the public sector. Faced with the excellent data from private sector medical schemes, what adjustment needs to be made to the private sector costs curves to estimate the public sector cost curves? The answer is, as actuaries and economists, we simply do not know.

One issue that concerns economists is that the cost "saving" in the public sector is not really an "apples vs. apples" comparison. There may potentially be great differences in the quality of care in the two sectors. The private sector nurse-bed ratio of 1.20 (28,000 beds vs. 33,600 nurses, by Medi-Clinic estimates) is exactly the same as that in the public sector (87,000 beds vs. 104,000 nurses, according to Medi-Clinic and Econex estimates), but the latter counts all the nurses in the public sector, while it should subtract those in clinics. This is just one dimension of quality difference. Yes, the public sector is likely to do things considerably cheaper, but this is not a homogenous product.

The major reason managed care plans appear to be lower cost, according to Polsky & Nicholson[29] (see section 4.6) is that they are able, in the USA, to drive down reimbursement rates. The critical difference between South Africa and the USA is the relative lack of human resources. New information on the shortages of doctors and nurses emerged in the last few years from the Development Bank of South Africa Roadmap process[33] and from Econex[34]. Ownership of hospitals in the USA is typically widespread and community-based. There are also lower cost settings available for care, including day hospitals and step-down facilities. These factors have had a major impact on the ability of health plans in the USA to negotiate price in return for volumes as managed care has evolved since the mid 1970s. It is thus argued that in the South African environment the price differences for the introduction of managed care are not achievable given the relative shortage of resources.

Future work in this area should perhaps be focussed on the components of total cost, including reimbursement rates and methods, utilisation, admission rates, lengths-of-stay, levels of care and levels of severity. Ideally, there will be research on the results of demonstration projects in South Africa, looking at the improvement in the cost of delivery in a variety of settings.

In the absence of clear evidence of how to adjust the private sector data for the cost of delivery in the public sector, the model allows for a "family" of cost curves to be developed to illustrate the sensitivity of the total cost to this critical assumption.

5. Preliminary Costing Results and Sensitivity

Servaas van der Berg and Heather McLeod, with technical assistance from Pieter Grobler of Medscheme, produced a set of estimates of the cost of various packages at different levels of delivery efficiency. These are provided in the table below.

Table 5: Preliminary Costing of NHI for a Range of Packages and a Range of Efficiency Levels

Cost in Rbn (2009 terms) of Benefit Package Offered by NHI					
Efficiency assumption	Medical Scheme Prescribed Minimum Benefits (PMBs)	Basic Benefits: PMBs+ Primary Care	High Cost Benefits: PMBs+ all In-Hospital	Core Benefits: PMBs+ Primary Care+ In-Hospital	Fully Comprehensive: all healthcare benefits
Medical schemes efficiency: 100% of cost	156	251	224	319	**334**
Moderate improvement: 80% of cost	125	201	179	255	**267**
Presumed public sector cost: 70% of cost	**109**	**176**	**157**	**223**	**234**
Staff model efficiency: 50% of cost	78	126	112	160	**167**

Van der Berg and McLeod showed that fully comprehensive cover might cost as much as **R334 billion** in 2009[1]. This assumes current medical scheme delivery. The same package would be **R234 billion** if there was a 30% reduction in delivery cost compared to the private sector. The authors said: "Even if one accepts the optimistic view that public sector provision could be up to 30% cheaper (though this ignores service quality) and applies that 30% reduction across the board, the funding required to fund the NHI at BBP benefit[u] levels is a full **R176 billion**".

The costings prepared by Van der Berg and McLeod should be regarded as preliminary costings as administration and managed care costs have not been included. The effect of HIV/AIDS in the public sector population is also not fully taken into account and there are a range of technical issues that need to be addressed, as discussed in section 7.

The McLeod-Grobler-Van der Berg costing for various packages and at various levels of delivery efficiency is shown graphically below. The second graph below shows the effect of demographic change (age and gender only) on the estimates. Critically, the analysis does not include medical inflation or changes in medical technology. The figures are illustrated in 2009 Rand terms, indexed to 100 in 1994. It is shown that a package of benefits costed in 1994 would cost **between 145.7% and 152.3% of that value by 2025**. The benefit package definition is shown to be critical as different packages have different shapes by age and gender.

[u] The Basic Benefit package consists of PMBs plus primary care only.

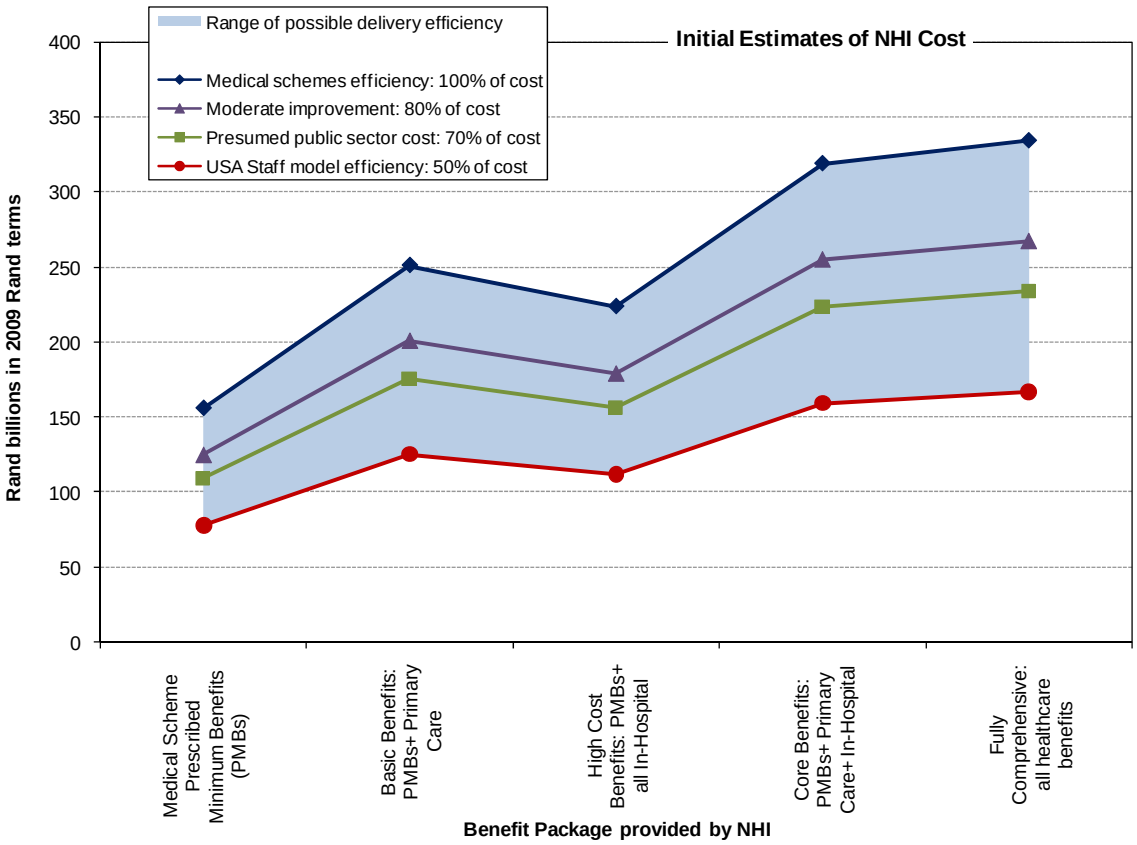

Figure 13: Preliminary NHI Costings for Various Packages of Minimum Benefits Assuming Different Levels of delivery Efficiency

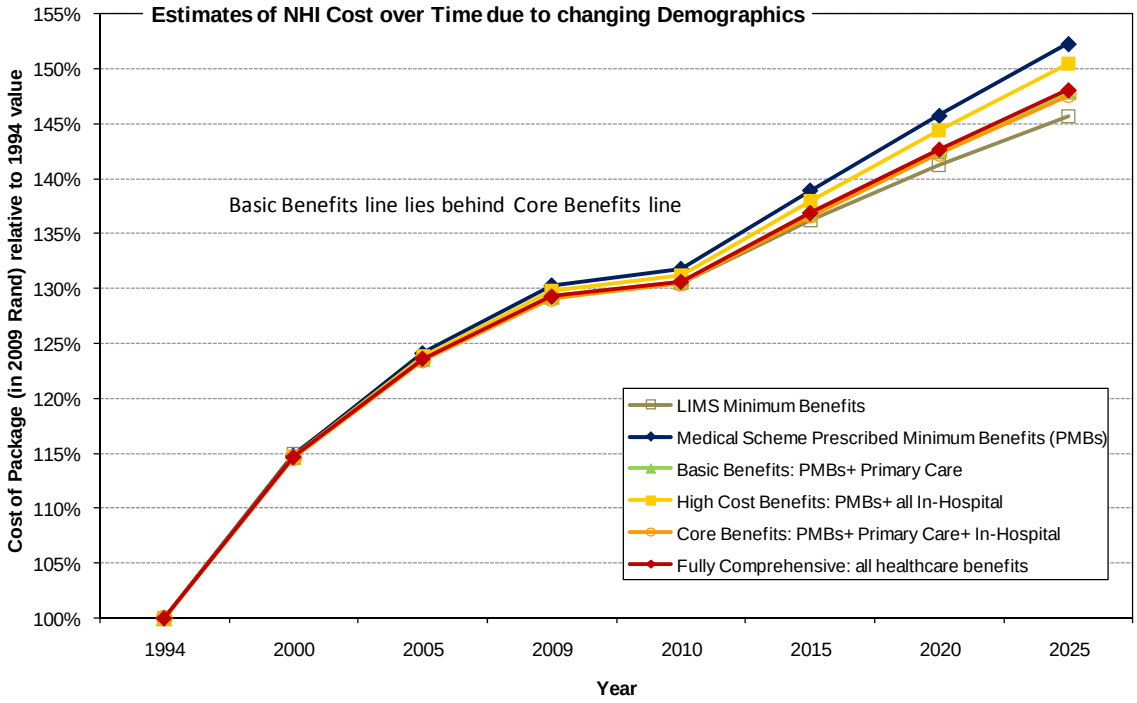

Figure 14: Impact of Demographic Changes over Time on Preliminary Estimate of NHI Cost

6. Preliminary Pricing of NHI

As illustrated in Figure 1, once the costing is complete, it is then necessary to determine who will pay and what the shape of that contribution table will be.

Research on this aspect of mandatory contributory social security has been done for the retirement reform project undertaken by National Treasury and the Department of Social Development. The One Year Model constructed and reported on in that process[35] allows for examination of different descriptions of the social security contribution. However this is an early model using the General Household Survey from StatsSA and better information would be available directly from South Africa Revenue Services.

6.1 Tax Base for Pricing

It is not clear what combination of taxes would potentially be used under a NHI. A payroll tax is mentioned in some documentation, but would not necessarily raise enough revenue and a combination of taxes appears more likely. To understand the orders of magnitude involved, the costs can be expressed relative to existing tax revenue of different types, as discussed below. These revenues were taken from the Budget Review 2009, [36] but the actual tax intake in the 2009/2010 tax year is now expected to be considerably lower than these budgeted figures, given the state of the economy. Thus these estimates under-estimate the full tax burden that the NHI may impose, given the costings.

6.2 Preliminary Pricing Results for NHI

Van der Berg and McLeod showed that[1] the estimate of NHI cost of R176 billion for a package of PMBs plus primary care, delivered at 30% below private sector costs, is "a massive amount compared to budgeted income tax revenue of R206 billion and public health expenditure of R84 billion".

"A payroll tax of over 17% would be needed to fund such a conservatively estimated revenue need. (To exempt poorer workers would require higher rates or subsidies from general tax revenue). Alternatively, to fund the NHI through an income tax would require tax rates to increase by 85% across the board – the top marginal tax rate of 40% would have to rise to 74%." The incidence of a flat payroll tax is likely to be far less progressive than an income tax, even if lower-earning workers were to be exempted.

"Our estimate of the tax costs is similar to that of a 2005 Ministerial Task Team, who declared an NHI "*unaffordable at the existing level of economic development*", even with fiscal substitution (i.e. reducing other public health spending). Laying claim to present medical scheme contributions for the NHI (around R76 billion) is not a solution for getting financial resources for the public system, as

scheme members will want to continue receiving the benefits currently covered. The NHI proposal can only be taken seriously once a proper analysis of its costs, fiscal consequences and affordability has been undertaken. The current proposal is beyond what the country can afford."

7. Limitations, Caveats and Further Work Needed

This section sets out the limitations of the current model, firstly from a technical perspective in terms of the work that remains to be done and secondly from a broader philosophical perspective.

7.1 Technical Issues with the Price Curves

The price curves described in section 0 and combined into packages in section 3.3 were prepared for use in 2009 and effectively apply to mid-2009. The following important considerations still need to be taken into account:

- The costs do not include any administration costs.
- The costs do not include what would need to be significant managed care costs to achieve the efficiency levels used for sensitivity. The greater the efficiency (lower healthcare cost) the greater the expenditure needed on managing the care delivered.
- None of the above-PMB curves have been adjusted for increased utilisation if these elements become part of a minimum package.
- There is new evidence that the price curves for PMBs in practice are producing higher values by about R90 pbpm in two large administrators. This needs further investigation.
- The cost of treating HIV/ AIDS in the public sector population (with higher HIV prevalence) is not fully taken into account.
- The values are thus relatively conservative. Total costs derived using these values should be described as a "preliminary costing".
- The fiscal year for National Treasury is not a calendar year and the price would need to be adjusted to the mid-point of the fiscal year.
- A major assumption which has to be made is the cost of delivery of quality healthcare in the public sector. There is no good data available on this at present and so our model uses private sector data and then postulates several levels of reduction in costs. This is in order to show the range of results possible – this assumption is critical to the amounts determined and needs to be backed up by further research.
- Medical Scheme options generally have benefit limits and thus do not cover all care. No allowance has been made for this and the estimates are thus conservative.

Further technical work that is needed for a rigorous costing of NHI includes the following (however this is not an exhaustive list):

- Split the HIV effect from the PMBs and then re-working the effect to take account of the higher HIV incidence in the NHI population.
- Adapt the maternity costs to take account of lower Caesarean section rates in the public sector. Note that the curves above have already been reduced from private sector practice through the assumptions made for REF.
- Adapt the Under 1 price to take account of different patterns of ICU use in the public sector and the rationing that very low-birth-weight babies are not resuscitated in the public sector.
- Test the assumption that although the mix of disease is different across socio-economic groups, the overall burden of chronic disease is about the same.
- Deal with the effect of anti-selection of high-cost diseases in existing PMBs.
- Deal with the impact of some elements being mandatory and others being voluntary and the effect on utilisation.
- Estimate the effects of all elements becoming mandatory in future.
- Investigate the reasons for the curve increase in practice for PMBs from the REF Study 2005 to the data used for some of these elements which is 2008.
- Adapt inflation to actual values for 2008-2009 once these are known with certainty from the 2010 REF pricing process.
- Produce 2010 version of figures using estimate inflation of components from 2010 REF pricing process.
- Adjust for the impact of current benefit design which makes actual expenditure lower than it could be under NHI. This could have a significant effect.

7.2 Technical Issues with the Population

In Policy Brief 1[6] it was strongly recommended that all costing work on National Health Insurance be done using the ASSA2003 provincial model and that the costings be updated when a revision to the model is released (perhaps by the end of 2009). The expected aging of the population of the South African population is significant over the period shown (to 2025) and thus NHI costings need to be done not only for the current period but also into the future. The degree of uncertainty in demographic projections needs to be borne in mind in this work.

It seems likely that a revised version of the ASSA model, ASSA2008, will be released by mid-March 2010. All the costing work needs to be redone using the new population projections.

This material was in section 3 of IMSA Policy Brief 6: Costing and Long-term Modelling of NHI[2]. The concern is the inherent uncertainty in long-term demographic projections.

The ASSA model[7] uses the cohort component projection method and the results are calibrated to available data as it emerges. The key elements for this approach are given below with some comments about the differences between provinces:

- The existing population by age, gender and ethnicity from a "good" Census or adjusted where the Census is weak. The model is calibrated to the Census points from 1991, 1996 and 2001, taking into account the limitations of each. The next Census is planned for 2011.
- Fertility rates to project births: the Western Cape and Gauteng have lower expected total fertility rates than other provinces. This has obvious implications for obstetrics and neo-natal facilities.
- Mortality rates to project deaths: these are set by ethnic group. The Western Cape has a very different ethnic structure to other provinces with predominantly so-called Coloured lives while KwaZulu-Natal has the largest Indian population.
- HIV incidence and prevalence: The HIV incidence (new infections) for the Western Cape is projected to peak at a much lower level than for the country as a whole. The peak is also later than for most of the provinces. The HIV epidemic is the highest and most advanced in KwaZulu-Natal.
- The effect of HIV on both mortality and fertility; and
- Net immigration (result of immigration in and emigration out).

Prof Dorrington, in teaching population projection, states that "As a general rule, nationally, the greatest uncertainty arises from fertility, followed (over the longer term) by mortality, and then migration. As a general rule, the smaller the unit (province, district, city, town) the more significant (and the less certain) is migration."

He argues that "migration is most difficult to project: often impossible to record and difficult to estimate in future". International migration is usually low but not in South Africa. Internally, work-seekers move to provinces with better employment opportunities but the families are sometimes left in the province of origin. This may lead to a reversal at later ages as retired people return to the province of origin. In projecting the future population, demographers usually assume the current level of migration for the short term or a slow trend towards zero over time. Immigration is also sometimes used to balance a model to surveys of the population.

7.3 Philosophical Issues in Long-term Modelling

This material was in sections 4, 5, 6 and 7 of IMSA Policy Brief 6: Costing and Long-term Modelling of NHI[2]. The interested reader is referred to that document for the full discussion on the three topics:

- Demographic, Epidemiological and Health Transitions
- The Quadruple Burden of Diseases in South Africa
- Theories of Future Changes in Mortality and Morbidity.

[These are] complex topic[s] for which little evidence has been gathered in South Africa. Researchers are advised to be aware of these possibilities in performing very long term projections of need. The impact of changes in medical practice and technology is an important influence which will impact any long-term projections. Over medium-term planning periods, the effects are not likely to be as important.

The key issue remains for planning in South Africa – that the number of elderly people is expected to increase rapidly and that chronic disease and cancer prevalence and need for hospital facilities are strongly related to age. While the extent may be difficult to quantify precisely, there is no doubt that there will be an increasing burden on the health system in future.

Add to this the well-documented and modelled HIV/AIDS epidemic and related epidemics of sexually-transmitted infections and tuberculosis, and the immense challenges for a sustainable National Health Insurance system become apparent.

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Annexure 1: Population by Age and Gender

South Africa		PROJECTION using ASSA2003 Model with Provincial assumptions and modified output							
Calendar Year starting 1 J		1994	2000	2005	2009	2010	2015	2020	2025
Gender	Age Band								
Female	Under 1	532,484	545,163	533,351	520,659	517,638	504,212	492,119	480,779
	1 to 4	1,989,432	2,083,143	2,048,843	2,036,330	2,027,343	1,976,803	1,932,545	1,890,000
	5 to 9	2,440,821	2,433,397	2,543,170	2,518,414	2,515,486	2,486,350	2,425,912	2,373,174
	10 to 14	2,357,203	2,457,507	2,427,309	2,499,215	2,512,982	2,469,219	2,440,519	2,380,153
	15 to 19	2,095,268	2,427,750	2,473,344	2,430,887	2,423,327	2,496,531	2,446,398	2,416,893
	20 to 24	1,933,412	2,167,904	2,411,698	2,454,088	2,442,769	2,391,417	2,462,568	2,412,311
	25 to 29	1,720,741	2,015,922	2,075,623	2,235,034	2,280,801	2,308,442	2,260,816	2,329,013
	30 to 34	1,560,761	1,743,046	1,859,467	1,843,254	1,845,815	2,020,860	2,038,140	1,996,419
	35 to 39	1,304,127	1,590,855	1,612,653	1,634,548	1,640,513	1,602,988	1,744,489	1,757,221
	40 to 44	1,046,815	1,333,801	1,478,594	1,449,440	1,437,978	1,448,723	1,409,647	1,538,830
	45 to 49	806,409	1,067,088	1,254,053	1,329,033	1,334,144	1,288,348	1,301,991	1,272,361
	50 to 54	670,843	820,285	1,010,234	1,133,744	1,156,134	1,210,285	1,174,443	1,191,585
	55 to 59	612,291	638,668	771,115	908,321	939,488	1,060,365	1,107,575	1,081,535
	60 to 64	497,174	577,534	587,656	675,385	708,636	858,425	965,019	1,011,373
	65 to 69	386,303	446,902	512,501	521,356	524,318	633,795	767,731	865,270
	70 to 74	273,909	340,160	375,255	422,287	433,539	446,911	543,154	659,896
	75 to 79	215,381	212,798	263,471	286,691	291,591	338,752	351,515	429,292
	80 to 84	109,864	150,623	146,588	173,843	181,697	201,301	234,647	244,936
	85+	23,445	83,124	120,640	131,472	134,224	160,091	182,939	212,406
Total Females		**20,576,684**	**23,135,669**	**24,505,567**	**25,203,999**	**25,348,424**	**25,903,817**	**26,282,166**	**26,543,446**
Male	Under 1	537,103	549,896	538,087	525,436	522,425	508,995	496,859	485,486
	1 to 4	1,999,028	2,096,578	2,061,268	2,049,712	2,040,943	1,991,250	1,947,420	1,905,175
	5 to 9	2,441,545	2,442,005	2,556,500	2,530,194	2,527,545	2,499,793	2,440,559	2,388,595
	10 to 14	2,321,209	2,453,069	2,432,777	2,509,589	2,522,619	2,477,535	2,450,279	2,391,238
	15 to 19	2,022,498	2,382,735	2,463,252	2,428,865	2,422,661	2,499,521	2,448,033	2,419,927
	20 to 24	1,833,050	2,083,438	2,369,560	2,437,407	2,430,565	2,386,868	2,460,873	2,409,247
	25 to 29	1,617,574	1,918,216	2,042,071	2,245,801	2,299,389	2,356,409	2,314,553	2,386,878
	30 to 34	1,477,069	1,626,745	1,802,721	1,871,360	1,891,775	2,140,642	2,196,031	2,158,020
	35 to 39	1,244,110	1,461,200	1,483,715	1,567,599	1,595,578	1,668,300	1,892,024	1,941,753
	40 to 44	995,741	1,232,292	1,308,292	1,291,105	1,291,401	1,382,251	1,439,497	1,635,514
	45 to 49	768,518	970,670	1,093,936	1,125,933	1,127,604	1,121,665	1,202,869	1,252,425
	50 to 54	600,581	742,624	854,769	923,417	937,648	972,566	980,050	1,054,579
	55 to 59	503,081	544,636	645,354	711,119	724,415	797,173	837,381	852,689
	60 to 64	386,575	445,938	462,815	520,268	538,108	601,452	670,369	712,136
	65 to 69	289,833	320,603	361,873	369,084	371,669	429,392	483,097	545,927
	70 to 74	196,935	224,372	239,665	264,095	269,677	275,968	318,719	360,734
	75 to 79	140,225	128,616	148,170	156,100	158,052	177,900	182,468	210,989
	80 to 84	63,922	77,855	72,014	80,492	82,882	88,673	100,274	103,820
	85+	10,850	34,782	43,809	43,637	43,797	48,729	53,092	59,910
Total Males		**19,449,446**	**21,736,270**	**22,980,648**	**23,651,213**	**23,798,754**	**24,425,083**	**24,914,447**	**25,275,044**
Total Population		**40,026,130**	**44,871,939**	**47,486,216**	**48,855,213**	**49,147,177**	**50,328,900**	**51,196,613**	**51,818,489**

Selected years only. Full table and all provinces available from IMSA NHI web-site:
http://www.innovativemedicines.co.za/national_health_insurance_library.html

Annexure 2: Benefit Component Curves by Age and Gender

Year		2009	2009	2009	2009	2009	2009	2009	2009
Gender	**Age Bands**	**PMBs In-Hospital excl. Maternity**	**PMBs Maternity In-Hospital**	**PMBs Chronic Medicine**	**PMBs Visits and Tests**	**Primary Care excluding Specialists**	**Primary Care including Specialists**	**Non-PMB Out-of-Hospital Non-Primary Care**	**In-Hospital above PMBs**
Female	**Under 1**	504.69	0.00	0.00	35.84	119.44	163.01	8.89	168.51
	1-4	87.54	0.00	6.20	21.76	94.42	104.82	4.98	82.66
	5-9	39.97	0.00	8.85	14.63	73.92	78.79	10.08	41.31
	10-14	37.21	0.60	7.20	13.22	77.67	80.80	7.87	30.03
	15-19	51.76	25.99	7.99	17.13	107.04	111.28	10.16	54.36
	20-24	78.86	110.29	11.69	36.18	156.57	164.79	14.56	94.45
	25-29	114.26	212.83	20.45	51.62	216.55	229.12	24.48	131.58
	30-34	140.39	166.10	36.48	54.13	228.87	242.35	34.03	152.89
	35-39	149.15	67.26	45.09	45.69	229.27	242.15	36.82	170.97
	40-44	169.12	11.63	52.79	50.36	229.97	242.41	35.73	169.19
	45-49	195.96	0.71	67.25	58.63	240.61	252.62	39.19	171.91
	50-54	230.83	0.31	92.64	72.41	247.75	259.55	49.56	182.53
	55-59	276.66	0.00	128.22	89.88	251.24	263.92	65.58	220.50
	60-64	364.91	0.00	165.23	114.91	258.02	274.43	81.03	259.02
	65-69	487.96	0.00	205.95	126.21	260.64	280.29	98.84	335.28
	70-74	605.71	0.00	230.36	124.01	259.10	282.17	96.86	372.28
	75-79	674.12	0.00	238.64	111.32	247.77	269.54	123.29	422.37
	80-84	682.49	0.00	226.52	108.67	246.10	264.37	128.55	374.29
	85+	645.25	0.00	189.29	86.21	216.27	228.38	147.53	254.48
Male	**Under 1**	630.56	0.00	0.00	35.84	124.71	169.13	2.00	208.14
	1-4	88.55	0.00	8.15	22.17	100.59	111.86	5.81	108.80
	5-9	41.23	0.00	11.63	15.08	77.20	82.85	14.99	52.26
	10-14	37.60	0.00	8.46	13.16	73.29	76.96	11.85	37.55
	15-19	51.86	0.00	8.66	16.94	82.76	85.99	9.66	50.68
	20-24	78.50	0.00	10.72	22.15	99.17	103.11	10.21	69.85
	25-29	111.28	0.00	14.67	27.95	158.99	164.29	13.55	90.04
	30-34	135.83	0.00	27.63	33.44	177.53	183.70	20.01	98.00
	35-39	150.37	0.00	45.99	47.10	184.30	191.33	28.92	110.44
	40-44	173.09	0.00	59.40	52.92	190.32	197.48	32.51	116.31
	45-49	203.57	0.00	76.03	64.64	199.34	207.69	33.00	127.28
	50-54	277.59	0.00	102.38	79.91	204.58	213.00	37.75	144.47
	55-59	383.95	0.00	137.27	99.73	207.20	217.67	48.16	175.50
	60-64	542.48	0.00	174.14	124.48	216.27	228.65	68.32	230.19
	65-69	678.06	0.00	209.38	166.87	233.11	250.14	85.42	302.54
	70-74	795.05	0.00	243.86	194.92	249.06	268.69	109.04	364.92
	75-79	890.13	0.00	250.54	195.44	246.83	266.47	151.48	408.42
	80-84	864.72	0.00	239.69	146.10	235.91	259.28	182.82	327.26
	85+	841.99	0.00	195.60	155.01	243.13	258.67	179.69	381.34

Important: these are preliminary estimates of the curves. Critically, they do not contain administration and managed care fees; the higher HIV/AIDS prevalence in the public sector has not been taken into account; no adjustment has been made for the effect of greater utilisation if packages other than PMBs become the minimum benefit package. For a full discussion of further technical work needed, see section 7.

Annexure 3: Benefit Package Curves by Age and Gender

Year		2009	2009	2009	2009	2009	2009
Gender	Age Bands	LIMS Minimum Benefits	Medical Scheme Prescribed Minimum Benefits (PMBs)	Basic Benefits: PMBs+ Primary Care	High Cost Benefits: PMBs+ all In-Hospital	Core Benefits: PMBs+ Primary Care+ In-Hospital	Fully Comprehensive: all healthcare benefits
Female	Under 1	152.95	540.53	703.54	709.04	872.06	880.95
	1-4	102.13	115.50	220.32	198.16	302.98	307.96
	5-9	78.66	63.45	142.24	104.76	183.54	193.63
	10-14	78.32	58.23	139.03	88.26	169.06	176.92
	15-19	124.91	102.87	214.15	157.23	268.51	278.67
	20-24	248.41	237.02	401.81	331.47	496.26	510.81
	25-29	395.38	399.16	628.28	530.74	759.86	784.34
	30-34	383.87	397.10	639.45	549.99	792.34	826.37
	35-39	307.82	307.19	549.34	478.16	720.30	757.13
	40-44	274.75	283.90	526.31	453.09	695.50	731.23
	45-49	291.68	322.55	575.17	494.46	747.08	786.27
	50-54	326.83	396.19	655.74	578.72	838.27	887.84
	55-59	370.76	494.76	758.68	715.26	979.17	1,044.75
	60-64	426.56	645.05	919.48	904.07	1,178.50	1,259.53
	65-69	471.09	820.12	1,100.41	1,155.40	1,435.70	1,534.53
	70-74	489.62	960.08	1,242.25	1,332.36	1,614.53	1,711.40
	75-79	476.51	1,024.08	1,293.62	1,446.45	1,715.99	1,839.27
	80-84	461.18	1,017.68	1,282.05	1,391.97	1,656.34	1,784.89
	85+	387.58	920.75	1,149.13	1,175.23	1,403.61	1,551.14
Male	Under 1	157.66	666.40	835.53	874.54	1,043.67	1,045.67
	1-4	109.37	118.87	230.73	227.67	339.53	345.34
	5-9	84.27	67.94	150.79	120.20	203.04	218.03
	10-14	75.83	59.22	136.18	96.77	173.73	185.58
	15-19	85.84	77.46	163.45	128.14	214.13	223.79
	20-24	104.60	111.37	214.48	181.22	284.34	294.55
	25-29	159.15	153.90	318.19	243.94	408.23	421.78
	30-34	188.28	196.90	380.60	294.90	478.60	498.61
	35-39	218.77	243.46	434.79	353.90	545.23	574.15
	40-44	238.30	285.41	482.89	401.72	599.20	631.71
	45-49	267.95	344.24	551.93	471.52	679.21	712.21
	50-54	304.05	459.88	672.88	604.35	817.34	855.09
	55-59	349.73	620.95	838.62	796.45	1,014.13	1,062.29
	60-64	405.57	841.10	1,069.75	1,071.29	1,299.94	1,368.27
	65-69	481.81	1,054.31	1,304.45	1,356.85	1,607.00	1,692.42
	70-74	544.18	1,233.83	1,502.52	1,598.75	1,867.45	1,976.49
	75-79	548.01	1,336.11	1,602.58	1,744.53	2,011.00	2,162.48
	80-84	496.18	1,250.51	1,509.79	1,577.77	1,837.06	2,019.87
	85+	468.65	1,192.60	1,451.27	1,573.94	1,832.61	2,012.29

Important: these are preliminary estimates of the curves. Critically, they do not contain administration and managed care fees; the higher HIV/AIDS prevalence in the public sector has not been taken into account; no adjustment has been made for the effect of greater utilisation if packages other than PMBs become the minimum benefit package. For a full discussion of further technical work needed, see section 7.