The South African burden of disease:

Implications for resource allocation under the proposed NHI

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Abstract

The health sector in South Africa is characterised by a comparatively high burden of disease. This has implications for resource allocation decisions, especially in the face of the proposed National Health Insurance system. Using Disability-Adjusted Life Years (DALYs) and cause of death data as measurements, the paper analyses the South African burden of disease. It is shown that South Africa has a unique quadruple burden of disease which is also more severe than many other countries', both developed and developing. The paper then considers the implication of this finding for human and physical resource allocation in the South African health system. Specifically, the paper aims to contribute to the current debate around the planning and implementation of the proposed National Health Insurance scheme in South Africa.

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1 Introduction

A country's burden of disease refers to the assessment of mortality, morbidity, injuries, disabilities and other risk factors specific to that country. Determining the burden of disease is important for comparing a country's health status with that of the region, continent or other countries in the rest of the world. Also for the proposed NHI it is necessary to evaluate South Africa's burden of disease since it will impact on resource allocation, demand forecasts, specific programme needs and the like. A heavier burden of disease will demand prudent financial planning, well-planned health interventions and proper structuring of the entire system to cater for specific needs unique to this country.

The burden of disease can be measured in different ways; with quality-adjusted life-years (QALYs) and disability-adjusted life-years (DALYs) being the most comprehensive and widely used measures. We will focus on DALYs here, because it was used (and developed) in the seminal Global Burden of Disease (GBD) study[2] and it is also the unit used by the World Health Organization (WHO) to measure and compare the burden of disease across countries. The DALY is an incidence-based measure quantifying the health gap between a population's actual health status and a specified norm. "It measures the future stream of healthy years of life lost due to each incident case of disease or injury" by adding together "years of life lost (YLLs) due to premature mortality, and years of life lived with disability (YLDs) weighted according to the severity of the disability."[3] In this way, it is possible to calculate DALYs for specific diseases, and for the country as a whole.[4]

[2] Murray, C.J. & Lopez, A.D., 1996. "The Global Burden of Disease: a Comprehensive Assessment of Mortality and Disability from Diseases, Injuries and Risk Factors in 1990 and Projected to 2020." Vol.1, Global Burden of Diseases and Injury Series. Boston: Harvard School of Public Health.

[3] Bradshaw, D., Groenewald, P., Laubscher, R., Nannan, N., Nojilana, B., Norman, R., Pieterse, D. & Schneider, M., 2003. "Initial Burden of Disease Estimates for South Africa, 2000." Cape Town: South African Medical Research Council.

[4] The DALY figures used in the rest of this paper are all age-standardised and time discounted. For specific details on how this is done, see the SA NBD study (footnote 3).

2 Measuring DALYs in South Africa

With the lack of reliable data in South Africa, it was initially thought that only substantial improvements to birth and death registration statistics would make the calculation of DALYs possible.[5] However, as the need for such an estimate became crucial in terms of targeting health interventions and specifically measuring the burden of HIV/AIDS on South Africa, the gaps and inconsistencies in the underlying data simply had to be overcome. A first attempt at estimating DALYs for South Africa was published in 2003. The "Initial Burden of Disease Estimates for South Africa"[6] calculated DALYs for the year 2000. This landmark document revealed interesting facts about South Africa's burden of disease, with the main findings being confirmed by a second study revising the first estimates.[7]

The initial estimates were revised for a Comparative Risk Factor Assessment[8] (CRA) specifically. The CRA measures the contribution of selected risk factors to the overall burden of disease and was done according to the standardised and systematic approach set out by the WHO. Both the results of the CRA and revised burden of disease estimates are presented below.

[5] Bradshaw, D., 1996. "Is the DALY measurable in South Africa?" South African Medical Journal, Vol.86, No.11: 1483

[6] See footnote 3.

[7] Norman, R., Bradshaw, D., Schneider, M., Pieterse, D. & Groenewald, P., 2006. "Revised Burden of Disease Estimates for the Comparative Risk Factor Assessment, South Africa 2000." Methodological Note. Cape Town: South African Medical Research Council.

[8] Norman, R., Bradshaw, D., Schneider, M., Joubert, J., Groenewald, P., Lewin, S., Steyn, K., Vos, T., Laubscher, R., Nannan, N., Nojilana, B., Pieterse, D. & the South African Comparative Risk Assessment Collaborating Group, 2007. "A Comparative Risk Assessment for South Africa in 2000: Towards Promoting Health and Preventing Disease." South African Medical Journal, Vol.97, No.7: 637

3 Quadruple Burden of Disease

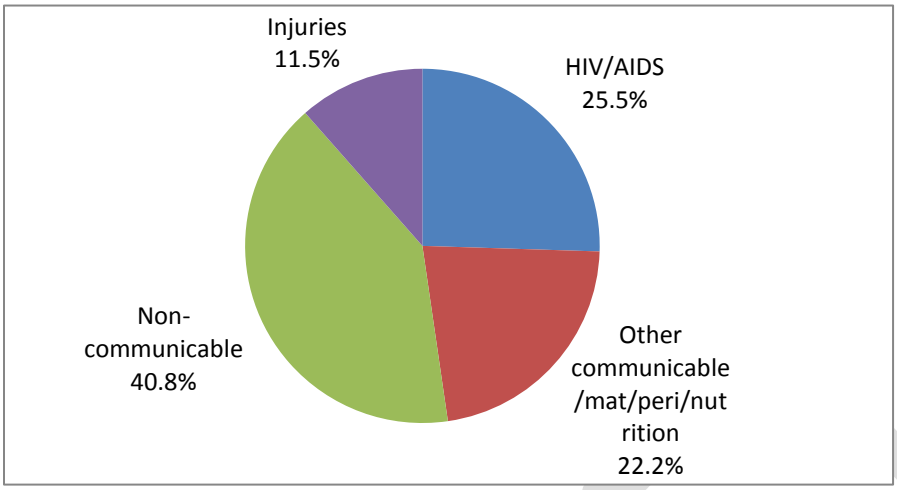
In order to determine the extent and severity of a country's burden of disease, the initial GBD study divided the various causes of death into three broad categories. Group I includes all pre-transitional causes, i.e. communicable diseases, maternal and perinatal conditions, as well as nutritional deficiencies. These causes of death are usually highly correlated with underdevelopment and poverty. Group II includes all non-communicable diseases, while Group III represents the injuries. HIV/AIDS is of course a communicable disease and falls in Group I, but for the South African National Burden of Disease (SA NBD) study[9] it was decided to assess the burden of this disease separately (as a fourth group) because of its unusually large burden on this society.

Each country's *type* of disease burden is then determined in accordance to the relative percentage of deaths or DALYs falling in each group. For instance, a country where most people die from diseases in Group I and II, and relatively more so than from injuries in Group III, is said to have a "double" burden of disease. The evidence below from the SA NBD study and the CRA indicates a quadruple burden of disease for South Africa. This is quite a unique situation since the disease profile of more developed countries usually changes from one of "infectious diseases, high child mortality and malnutrition to a predominance of degenerative, chronic diseases. However, developing countries often experience a double burden, resulting from the simultaneous occurrence of these disease spectrums. In the case of South Africa, there is the added burden of injuries and HIV/AIDS."[10]

The mortality profile for both males and females in 2000, according to the revised burden of disease estimates, is shown in Figure 1. These estimates are based on the ASSA2002 model which estimated the population at 43,968,779 people with a total number of 521,082 deaths in 2000. The causes of death statistics are split between Groups I to III and HIV/AIDS as discussed above.

[9] See footnotes 3 and 7.
[10] See footnote 7; p.1

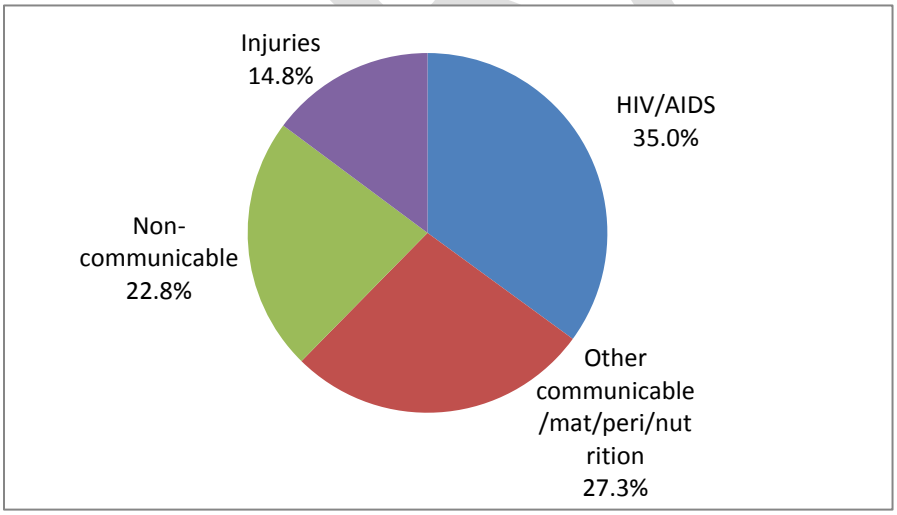
Figure 1: Estimated Deaths by Broad Group for South Africa, 2000



Source: Norman et. al. *2006: 10*

The first step in calculating total and disease-specific DALYs for South Africa was to calculate the associated YLLs for each cause and disease group. Figure 2 below shows the revised estimates of YLLs for South Africa in 2000. While the large impact of HIV/AIDS is disturbingly obvious, poverty-related diseases would account for more than 60% of YLLs in South Africa, if HIV/AIDS is not separated from Group I.

Figure 2: Estimated Years of Life Lost (YLLs) by Broad Group for South Africa, 2000

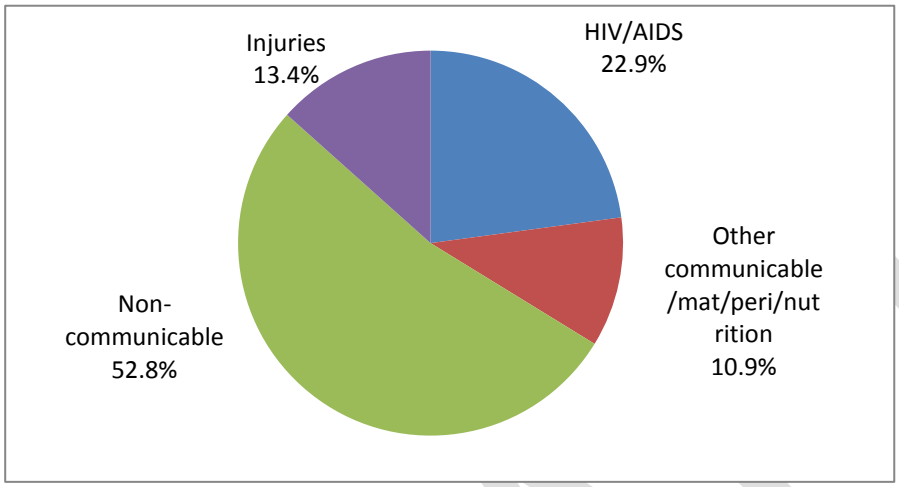


Source: Norman et. al. *2006: 13*

Secondly, YLDs were calculated and then added to YLLs to determine the burden of disease in terms of DALYs for South Africa. Again the burden of HIV/AIDS on the South African society can be seen in Figure

3 below which shows the estimated YLDs per group. As one would expect, non-communicable/chronic diseases (Group II) comprise a very large proportion of YLDs since many of the diseases included in this group will impact more on the quality of life of the patient, rather than causing premature deaths.

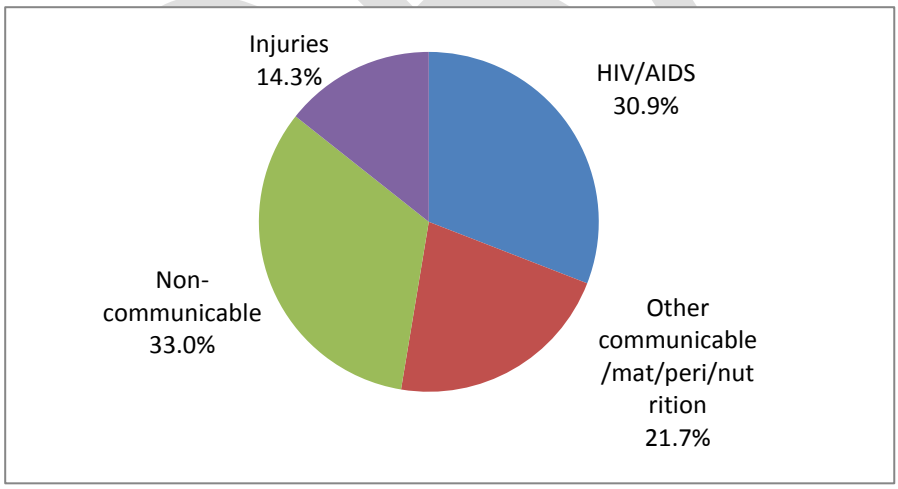
Figure 3: Estimated Years Lived with Disability (YLDs) by Broad Group for South Africa, 2000



Source: Econex calculations based on Norman et. al. *2006*

South Africa's quadruple burden of disease based on the mortality profile in Figure 1 is confirmed in Figure 4 which shows the revised DALY calculation results for 2000.

Figure 4: Estimated Disability-Adjusted Life-Years (DALYs) by Broad Group for South Africa, 2000



Source: Econex calculations based on Norman et. al. *2006*

The revised estimates for numbers of deaths and DALYs for specific causes are summarised in Table 1 by presenting the top 20 causes contributing most to each variable.

Table 1: Estimates of Deaths and DALYs for all persons in South Africa, 2000

Rank	Deaths		DALYs	
	Cause	% of total	Cause	% of total
1	HIV/AIDS	25.5	HIV/AIDS	30.9
2	Ischaemic heart disease	6.6	Interpersonal violence	6.5
3	Stroke	6.5	Tuberculosis	3.7
4	Tuberculosis	5.5	Road traffic accidents	3.0
5	Interpersonal violence	5.3	Diarrhoeal diseases	2.9
6	Lower respiratory infections	4.4	Lower respiratory infections	2.8
7	Hypertensive disease	3.2	Low birth weight	2.6
8	Diarrhoeal diseases	3.1	Asthma	2.2
9	Road traffic accidents	3.1	Stroke	2.2
10	Diabetes mellitus	2.6	Unipolar depressive disorders	2.0
11	Chronic obstructive pulmonary disease	2.5	Ischaemic heart disease	1.8
12	Low birth weight	2.2	Protein-energy malnutrition	1.3
13	Asthma	1.3	Birth asphyxia and birth trauma	1.2
14	Trachea/bronchi/lung cancer	1.3	Diabetes mellitus	1.1
15	Nephritis/nephrosis	1.3	Alcohol dependence	1.0
16	Septicaemia	1.2	Hearing loss, adult onset	1.0
17	Oesophageal cancer	1.1	Cataracts	0.9
18	Protein-energy malnutrition	1.1	Hypertensive disease	0.9
19	Suicide	1.0	Fires	0.9
20	Cirrhosis of liver	1.0	Falls	0.9
	Top twenty %	**79.8**	**Top twenty %**	**69.8**

Source: Adapted from Norman et. al. *2006: 22*

These revised estimates from the SA NBD study presented above, differ marginally from the WHO estimates for 2000. The main causes of death and DALYs are however the same and it is only the relative contributions of specific causes that are different. The WHO, for instance, estimates that 46.9% of total deaths in South Africa for 2000 was caused by HIV/AIDS and it comprises 46.5% of DALYs, unlike 25.5% and 30.9% estimated by the SA NBD study, respectively. The reason for this could be the fact that the WHO uses UNAIDS HIV death estimates, rather than the ASSA2002 model estimates and assumptions.[11]

As mentioned above, the initial SA NBD study estimates were revised for the CRA specifically. In a way, the CRA goes a step further by investigating the causal determinants of South Africa's burden of disease. By identifying certain risk factors, it can be used to "guide a health sector-led response to promoting

[11] See footnote 7.

health and preventing disease and injury."[12] Table 2 lists the 17 risk factors that were selected for South Africa and which can be linked to the underlying causes of death and DALYs in Table 1.

Table 2: Deaths and DALYs attributable to Selected Risk Factors in South Africa, 2000

	Deaths		DALYs	
Rank	**Risk factor**	**% of total**	**Risk factor**	**% of total**
1	Unsafe sex/STIs	26.3	Unsafe sex/STIs	31.5
2	High blood pressure	9.0	Interpersonal violence	8.4
3	Tobacco smoking	8.5	Alcohol harm	7.0
4	Alcohol harm	7.1	Tobacco smoking	4.0
5	High BMI (excess body weight)	7.0	High BMI (excess body weight)	2.9
6	Interpersonal violence	6.7	Childhood and maternal underweight	2.7
7	High cholesterol	4.6	Unsafe water, sanitation & hygiene	2.6
8	Diabetes	4.3	High blood pressure	2.4
9	Physical inactivity	3.3	Diabetes	1.6
10	Low fruit & vegetable intake	3.2	High cholesterol	1.4
11	Unsafe water, sanitation & hygiene	2.6	Low fruit & vegetable intake	1.1
12	Childhood and maternal underweight	2.3	Physical inactivity	1.1
13	Urban air pollution	0.9	Iron deficiency anaemia	1.1
14	Vitamin A deficiency	0.6	Vitamin A deficiency	0.7
15	Indoor air pollution	0.5	Indoor air pollution	0.4
16	Iron deficiency anaemia	0.4	Lead exposure	0.4
17	Lead exposure	0.3	Urban air pollution	0.3

Source: Adapted from Norman et. al. *2007: 638*

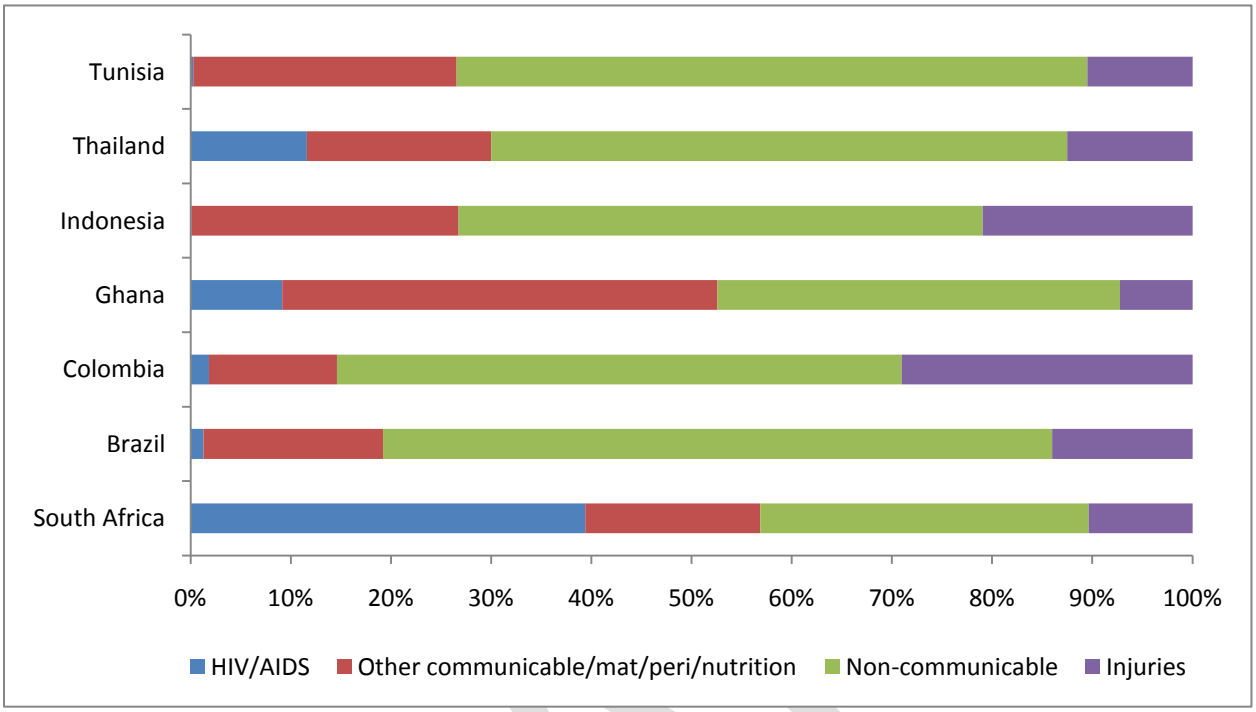
The CRA results again emphasise the extremely high burden of HIV/AIDS and the great risk associated with unsafe sex in South Africa. Alcohol and tobacco abuse, as well as interpersonal violence, also stand out as substantial risk factors in this country.

3.1 International Comparisons

In order to highlight the unique requirements of a national health insurance system in South Africa, we assess the burden of disease in other developing and developed countries. Figure 5 compares South Africa's disease burden with that of six analogous developing countries. The graph is based on DALY figures from the World Health Organization (WHO) for each country in 2004 – the most recent year for which this type of data exists. The WHO DALY figures are divided amongst the three causes of death groups, as explained previously. DALYs are given for each type of disease or injury and it was therefore possible to separate HIV/AIDS from the other communicable diseases in Group I for each country included in the analysis.

[12] See footnote 8; p.637

Figure 5: Disability-Adjusted Life-Years (DALYs) by Broad Group for Developing Countries, 2004



Source: Econex calculations from WHO 2009 data[13]

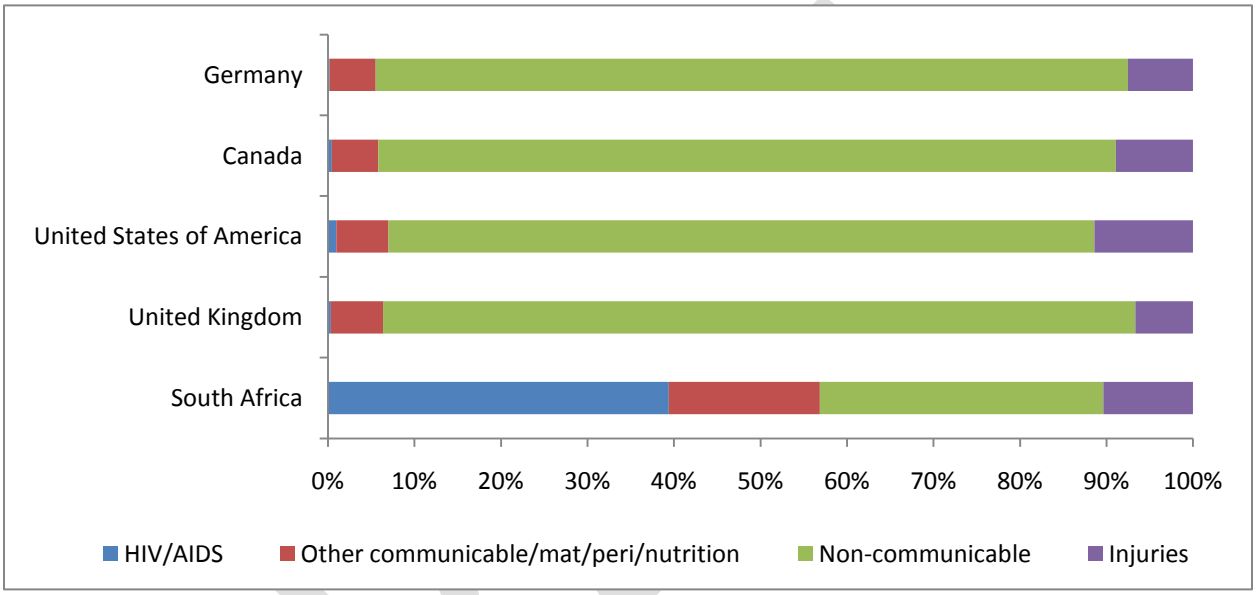
South Africa's quadruple burden of disease arising from the grave HIV/AIDS burden is clearly visible in the above graph. One might notice that the South African numbers are somewhat different from those in Figure 4, specifically because this is for a different year (2004 as opposed to 2000) and for the same reason mentioned previously – the WHO uses the UNAIDS model, as well as other data sources than the SA NBD study.

What is also strikingly evident from Figure 5 is the well-known double and, in some cases, triple burden of disease which developing countries are most often plagued with. As pointed out before, the type of disease burden is determined by the relative contributions of each of the three disease groups. Important to remember, is the fact that HIV/AIDS is usually included with Group I and only singled out here to emphasise a point and draw attention to South Africa's unique situation. When the first two categories for each country in Figure 5 are then viewed together as Group I, the double burden of disease is most clearly depicted in the case of Ghana, Thailand and Tunisia. The graph shows a triple disease burden for Indonesia, and also for Colombia and Brazil, albeit to a lesser extent.

[13] World Health Organization, 2009. "Mortality and Burden of Disease Estimates for WHO Member States in 2004." Available at: http://www.who.int/healthinfo/global_burden_disease/estimates_country/en/index.html

As countries develop further, the burden of disease is known to change from one with many different facets, spread across the three groups, to a single disease burden, usually concentrated in Group II (non-communicable diseases such as cancers, cardiovascular diseases, diabetes and other chronic diseases). In Figure 6 South Africa is again compared to other countries, but here we analyse the burden of disease in developed countries such as Germany, Canada, the USA and the UK.

Figure 6: Disability-Adjusted Life-Years (DALYs) by Broad Group for Developed Countries, 2004

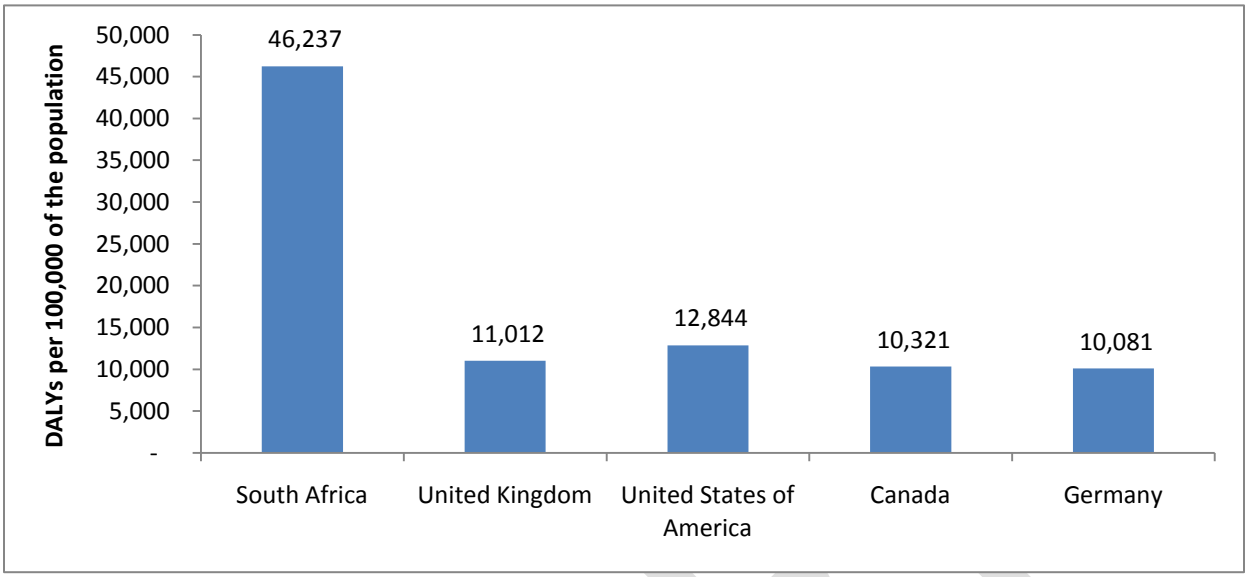


Source: Econex calculations from WHO 2009 data[14]

A clear picture emerges – Group II causes of death comprise between 80% and 90% of the disease burden in the developed countries examined here; with South Africa's one of a kind quadruple burden of disease once again accentuated. The severity of South Africa's disease burden is however better assessed by comparing the absolute number of DALYs for the countries above. Figure 7 and Figure 8 present the same underlying data used in the above analysis, but illustrates the gravity of the various disease burdens, rather than its composition.

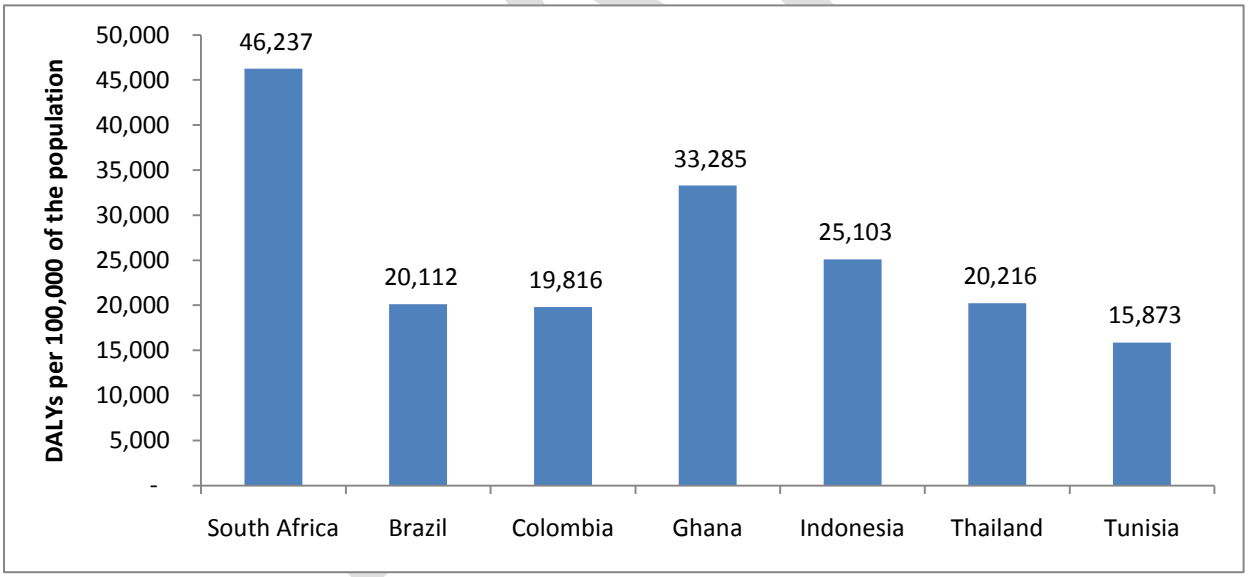
[14] See footnote 13.

Figure 7: Absolute Burden of Disease compared with Developed Countries, 2004



Source: Econex calculations from WHO 2009 data[15]

Figure 8: Absolute Burden of Disease compared with Developing Countries, 2004



Source: Econex calculations from WHO 2009 data[16]

In addition to the unique composition of South Africa's burden of disease, the above graphs emphasise the fact that this country has substantially higher quantities of sick people who are also sicker than those in other countries (especially compared with the ill in developed countries). South Africa's burden of

[15] See footnote 13.
[16] See footnote 13.

disease is on average four times larger than that of developed countries, and in most instances almost double that of developing countries. It is reasonable then to expect also a larger burden on finances, facilities and human resources in this country, compared to these requirements in other countries. As stated in the introduction to this note, these graphs underscore the fact that much thought and careful planning is needed for the design of a national health system addressing South Africa's severe, complex burden of disease.

While the comparative analyses presented here, clearly emphasise the need for some type of national health insurance system in South Africa, it also implies that a South African NHI will have to take into account the specific quadruple burden of disease which South Africa faces. Any expectation that a national health insurance scheme, similar to e.g. the NHS of the UK or other advanced economies' national health systems, could be introduced within a short time frame is probably overoptimistic.

4 Implied Resource Requirements

Given the specific burden of disease that was described here, the resource requirements and rationing systems of a national health insurance system in South Africa would be unique. Although the quadruple burden of disease has very distinct implications for the *supply* of healthcare, this also implies that the *demand* for healthcare looks completely different here, than elsewhere in the world. The type of in- and out-patient treatment, medication, primary and other care needed in South Africa are different from most other countries. One implication is, for instance, that more hospital beds, and therefore medical as well as other staff, will be required in a country where there is such a high prevalence of HIV/AIDS, communicable diseases and also injuries. The financial and costing demands will of course then also be different from say, a country with a single burden of disease and where the severity thereof is less than a quarter of South Africa's.

In this section then specifically, we limit our attention to the implied human and physical resource requirements related to South Africa's unique disease burden. In other words, we assess the impact of specific demand patterns and other factors on the supply of healthcare services as far as human resources for health (HRH) and health facilities are concerned.

4.1 Group III: Injuries/Trauma[17]

While all four categories of South Africa's burden of disease presents with emergencies, approximately 30% of emergencies is trauma-related. In comparison, only 12% and 8% of admissions to emergency centres are due to injuries in the USA and UK, respectively.[18] It is difficult though, to separate injuries from the other categories comprising the burden of disease, since most patients have co-morbidities. This also impacts on the type of care being delivered and the specific skills needed to treat the majority of cases.

With regards to pre-hospital emergency medical services (EMS) the international norm indicates a response time of around 8 minutes and the rule of thumb is to do as little as possible on the scene of the emergency and rather get the patient to a hospital as quick as possible. While it usually takes longer, the target response time in South Africa is 15 minutes. There are a number of reasons for the slower response time which includes the deteriorating quality of the roads, difficulty in finding the addresses in townships, etc. All these factors contribute to the patients being in a worse state when EMS finally arrives than what would have been the case in many other countries. It also means that the patients are more

[17] I would like to thank Prof. Lee Wallis (Provincial Government, Western Cape; University of Cape Town) for valuable inputs to this section.

[18] Wallis, L.A., Garach, S. R. & Kropman, A., 2008. "State of emergency medicine in South Africa," *International Journal of Emergency Medicine,* Vol.1, p.69-71

difficult to treat, requiring more advanced staff to travel with. Often this then implies that the patient is handed over at the hospital to lower levels of care (less qualified staff), specifically in the public hospitals where the emergency departments are usually understaffed.

In addition to these complications, "in all parts of the country, emergency centres are seeing an ever increasing patient load, with above 10% annual increases in patient volumes."[19] As one might imagine, this trend has significant implications for both HRH and physical requirements such as beds, space in health facilities, consumables and other surgical products, etc.

It is difficult to put an exact number to the various HRH and other related requirements, but the proposed NHI does present an opportunity to revamp EMS in South Africa to better cater for the unique demands. At the moment, for instance, there is an excess of small emergency centres which makes it very hard to maintain skills and train staff. It may therefore be a more efficient use of resources to have a few larger, well-staffed and better equipped emergency centres in each province. However, the current numbers of small emergency centres are a result of geographical and other social determinants which may prove difficult to overcome.

EMS may also be one of the first areas of interaction between the public and private sectors under a NHI system. Since private hospitals also have to treat non-medical scheme members in emergency situations, the reimbursement and referral models will have to be carefully considered and designed before implementing the NHI. EMS also presents an ideal opportunity for public-private partnerships, both for pre-hospital and in-hospital care.

Overall then, both the magnitude and severity of this part of South Africa's burden of disease have a significant impact on the required HRH (in terms of the number and type of staff needed), as well as the number and type/size of health facilities that are required in each district/province. A co-ordinated national response is also needed in order to address the specific demand for healthcare services due to this heavy burden of injuries on our society. This would entail careful planning around response vehicles, EMS staff (for pre- and in-hospital treatment of patients), location of health facilities, integration of public and private systems regarding human and physical resources, etc.

[19] See footnote 18. (p.70)