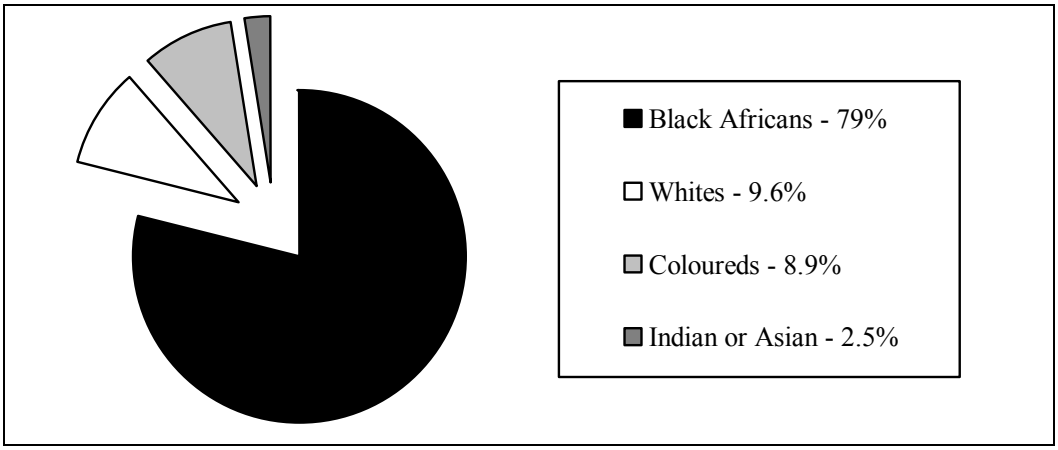
CHAPTER 2

Overview of medical education in South Africa.

The extent to which any of the medical education assessment practice advances described in the literature overview can be implemented within a given country, it significantly influenced by the major factors that determine the socio-political and economic milieu within which medical education is situated in a given country.[1] These factors include: (1) national government policies regarding health care and higher education, (2) regulations governing the training of health care professionals, (3) the funding, size and service demands of the country's public health care platform, (4) the size, distribution, migration, production and education expertise of the country's medical workforce, and (5) the national burden of poverty and disease within the country. Before describing the politically-orientated, resource- constrained environment within which medical education in South Africa is located, I briefly sketch the essential geographic, demographic and fiscal characteristics of South Africa so as to place the rest of the discussion in context. I also sketch an outline of the history of South Africa's eight medical schools and the basic format of undergraduate and postgraduate medical training programmes in South Africa. A brief summary of significant undergraduate and postgraduate medical education reform undertaken in recent years is also provided.

South Africa is home to approximately 45 million people.[2-4] Figure 1 shows that 90.4% of South Africans are black, including black Africans, Whites, Coloureds (people of mixed ancestry) and people of Indian or Asian descent.



Data derived from Statistics South Africa 2001[2,3]

Figure 1. *The ethnic profile of South Africans*

The country is divided into nine provinces (Figure 2). The provincial population distribution, growth rates, and selected poverty and wealth indicators are shown in Table 1.

Map taken from www.places.co.za

Figure 2. *The nine provinces of South Africa*

Table 1. *Population distribution, growth, poverty and wealth parameters*

Province	Current population (2001 census)		Percent population growth 1996-2001	Percent population living in poverty*	Annual per capita disposable income (US$)
	Number	% of total			
Kwa-Zulu Natal	9.4 million	21.1	12.0	61	1 584
Gauteng	8.8 million	19.6	20.3	42	3 721
Eastern Cape	6.4 million	14.3	2.1	72	1 081
Limpopo	5.3 million	11.8	7.0	77	915
Western Cape	4.5 million	10.1	14.3	32	3 282
North West	3.7 million	8.3	9.4	52	1 476
Mpumalanga	3.1 million	6.9	11.5	57	1 395
Free State	2.7 million	6.1	2.8	68	1 816
Northern Cape	0.8 million	1.8	- 2.1	61	1 810

*Data derived from Statistics South Africa 2001;[2,3] Human Sciences Research Council, 2004;[5] Intergovernmental Fiscal Review 2003;[6] Benatar, 2004.[7] * Poverty income defined according to the residents per household e.g. for a household of four = US$ 184 per month*

Within sub-Saharan Africa, South Africa is currently ranked as the wealthiest nation. Figure 6, taken from the latest World Development Report,[8] shows the per capita gross national income (GNI) adjusted for purchasing power parity (PPP) – an indication not only of how much money

people have, but also how well off they are in real terms – for a number of developed and developing world nations. Despite South Africa's wealth, relative to other African countries, the country's per capita GNI is only 25% of that of the USA. Furthermore, Table 1 clearly shows the marked discrepancies between the respective provinces within the country. Gauteng and the Western Cape are the only provinces in which less than 50% of the residents live below the poverty margin, as defined in Table 1. More than 60% of the residents of five of the remaining seven provinces (55% of the total population) live below the poverty margin.[5] Although there are numerous factors contributing to the huge discrepancies observed in the national distribution of wealth in South Africa, a legacy of more than 40 years of Apartheid policies, enforcing racial segregation and inequality, largely accounts for the current situation. It is, thus, not surprising that the two wealthiest provinces with the greatest annual per capita disposable income are home to 60.4% of all white South Africans.

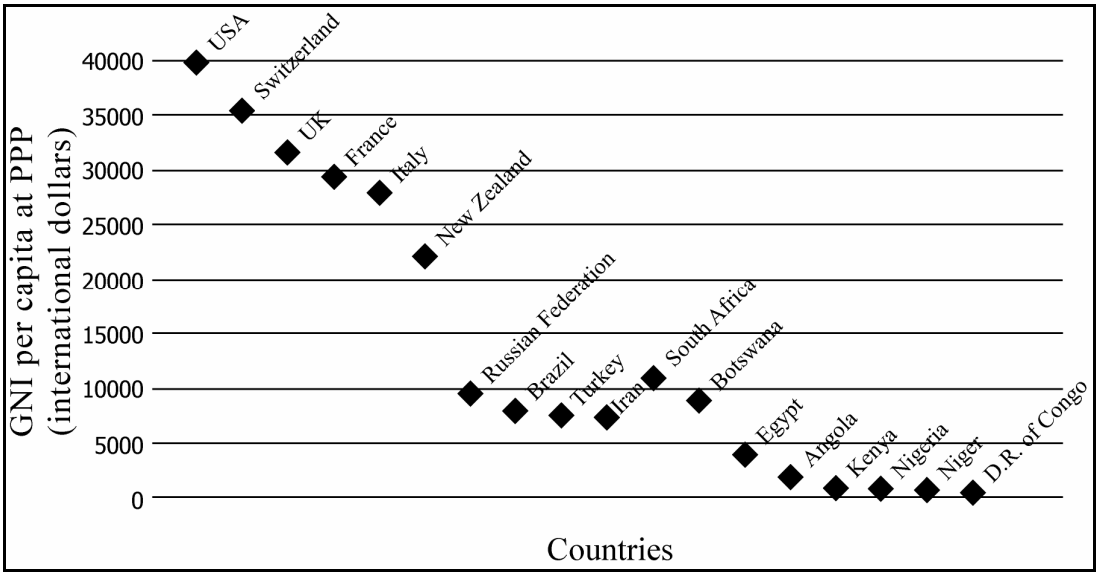


Figure taken from World Bank Development Report 2005[8]

Figure 3. *Gross national income (GNI) adjusted for purchasing power parity (PPP) for selected countries in the developed and developing world, 2004*

Having sketched a very basic picture of South Africa, I now provide an overview of undergraduate and postgraduate medical training programmes. I also highlight major medical education reform initiatives undertaken in recent years. Thereafter, I return to a discussion of the major socio-political and economic factors dictating medical education in South Africa.

Undergraduate medical education

Table 2 provides some basic information about South Africa's eight medical schools located in small to medium-sized campus-based universities. On average, there are approximately 8 500 medical enrolments per year, and almost 1 300 medical graduates per year in South Africa. The two wealthiest provinces, as previously defined, are home to two medical schools each, while three provinces do not have local medical training facilities.

Table 2. *South Africa's eight medical schools*

Institution	Province	Year medical school opened	Total number of on-campus students	Annual medical enrolment (2003)		Annual medical graduates (2003)	
				Number	% of total*	Number	% of total*
University of Pretoria (HWU)	Gauteng	1943	38 500	1 241	14.5	184	14.2
University of the Witwatersrand (HWU)		1921	24 000	1 343	15.7	188	14.5
Stellenbosch University (HWU)	Western Cape	1956	21 700	1 054	12.3	177	13.7
University of Cape Town (HWU)		1900	16 000	1 044	12.2	155	12.0
Free State University(HWU)	Free State	1969	16 000	676	7.9	88	6.8
University of Kwa-Zulu Natal**	Kwa-Zulu Natal	2005	18 000	1 113	13.0	165	12.7
Walter Sisulu University***	Eastern Cape	2005	20 000	475	5.6	56	4.3
University of Limpopo****	Limpopo	2005	3 000	1 590	18.6	283	21.8
National total			157 200	8 536	100.0	1 296	100.0

Data derived from FAIMER International Directory of Medical Schools;[9] Department of Education EMIS database;[10] Breier and Wildschut, 2006.[1] HWU = Historically White university; percentage total may not add up to 100% because of the effects of rounding off; ** UKZN formed by a merger between the University of Natal, which opened a medical school in 1951, and the University of Durban-Westville; ***WSU formed by a merger between the University of the Transkei (UNITRA), which opened a medical school in 1986, and the former Border and Eastern Cape technikons; ****UL formed by a merger between the Medical University of South Africa (MEDUNSA), which opened a medical school in 1977, and the University of the North*

Three important issues regarding medical schools in South Africa, which are relevant to this thesis, are briefly discussed. Firstly, all medical schools in South Africa are government-

funded institutions. In addition to student tuition fees, each institution receives a subsidy (calculated according to the number of registered students) from the national Department of Education. The national government also provides each medical school with an additional grant to fund the training of health care professionals. To date, there are no privately funded medical schools in the country.

Secondly, all South African medical schools were racially segregated until the mid 1980s. On the basis of enforced Apartheid policies, the five historically White universities (HWU) listed in Table 2 were not permitted to admit black African students until the late 1980s.[11] Coloured and Indian students, subject to local government permission, were permitted to attend HWU since the mid 1940s.[11] As can be seen from the data, facilities for the training of black African medical students were only built more than 50 years after the first HWU medical school opened its doors in 1900.

Thirdly, South African medical schools have, until recently, followed the traditional British model of medical school training. Students generally enter medical school directly after completing their final year of a 12-year schooling programme in which medical school entrants are required to have completed Mathematics, Physical Science and English as three of the minimum six subjects taken in senior school (grades 7-12). Until recently most training programmes were of six years duration. The first three years, usually called the pre-clinical years, generally focused on basic science subjects relevant to the practice of medicine – Physics, Chemistry, Medical Biochemistry, Anatomy, Physiology, Anatomical Pathology, Chemical Pathology, Microbiology and Pharmacology. The final three years, called the clinical years, were usually structured as clerkships attached to clinical units representing the various clinical disciplines – Internal Medicine, Psychiatry, General Surgery, Orthopaedic Surgery, Obstetrics, Gynaecology, Paediatrics, Family Medicine and a number of surgical specialties, e.g. Otorhinolaryngology, Ophthalmology, Paediatric Surgery and Neurosurgery. As mentioned earlier, the primary purpose of these apprenticeships (clerkship attachments) is for trainees to acquire, by observation and supervised practise, the cognitive, psychomotor and affective skills appropriate to the specific discipline. Clinical clerkships, varying from 4-8 weeks in duration, constitute most or all of the training time in the final three years of study. Most programmes offer at least two clerkship attachments in each of the major clinical disciplines prior to graduation.

Upon graduating, South African medical trainees are required to complete a 12-month period of internship before registering as a medical practitioner with the HPCSA. As of 2007 this period of obligatory supervised service in an accredited public institution will be extended to two years. The period of internship is equivalent to the pre-registration house officer (PRHO) year completed by medical graduates in the UK. In addition, the national Department of Health

recently introduced a further year of obligatory service in the public health system, called community medical service. Interns who have not completed a year of compulsory community service are not permitted to register as independent medical practitioners with the HPCSA. This has been done in an attempt to improve health services in rural and underserved areas, particularly and at the primary care level. The reasons for this decision are made apparent later in this chapter.

Undergraduate medical education reform

Soon after the first democratic election took place in South Africa (1994), the new government embarked on a process of radical reform and transformation of health care and higher education. These new policies and international trends in medical education reform served as the principal catalysts for a process of major curriculum reform in the country's eight medical schools. Ironically, the only university that had already implemented most of the educational changes recommended by the new government policies, prior to 1994, was a HBU, the University of the Transkei, recently renamed the Walter Sisulu University (WSU). This university, built in one of the so-called rural "independent homelands" (Transkei) during the twilight years of Apartheid, was largely founded as a result of the failure of the existing seven medical schools, including two HBUs, to produce sufficient black African medical graduates appropriate to the needs of the country.[12]

Problem-based learning (PBL) strategies have been implemented in several medical schools in South Africa. Within seven years of being founded the WSU, a rural community-based medical training programme, successfully implemented a problem-based learning (PBL) programme[12,13] based on the Maastricht model.[14] At least two other universities have gone on to implement PBL almost a decade later – the University of Kwa-Zulu Natal (UKZN)[15] and the University of Cape Town (UCT).[16] Some universities have implemented aspects of PBL in their programmes – the University of Pretoria (UP), the University of the Free State (UFS) and Stellenbosch University (SU).[17]

A number of other programme reform initiatives have also been implemented. At least four schools have invested significant resources in developing community-based education sites – UP, SU, the University of Limpopo (UL) and the University of the Witwatersrand (Wits). In addition, three schools currently offer five-year programmes – WSU, UKZN and UFS. Finally, one university has adopted a graduate-entry programme akin to those operational in the USA and some Australian medical schools. These programmes only admit students who have already successfully completed another degree programme. This system was implemented by Wits University, in parallel with their ongoing school-leavers programme, two years ago.

Published literature describing all these significant curriculum changes, and their educational impact, is limited. However, based on available information, it is clear that all South African medical schools have undertaken major curriculum reform over the past 15 years. It is probable, indeed desirable, that assessment practices at all these institutions have been revised consistent with the major changes implemented in curriculum design and delivery.[18-20] Unfortunately published reports documenting assessment practice changes or advances, and their educational impact, if any, are not available. The value of this thesis is that it presents a collection of papers describing assessment practice advances implemented in medical practitioner training programmes in South Africa.

Postgraduate medical education

A complex system of postgraduate specialist training, including certification and registration, has evolved over time in South Africa. Currently these three tasks are the collective responsibility of the eight medical schools in South Africa, the Colleges of Medicine of South Africa (CMSA) and the Health Professions Council of South Africa (HPCSA). By tradition the medical schools have always been, and continue to be, responsible for providing the training facilities for all postgraduate trainees. Nationally, the training programmes are located within the public health care system and range from a minimum period of four years for a basic specialty such as Internal Medicine to seven years for a subspecialty such as Cardiovascular Medicine. In the case of subspecialists, the training time includes completion of a basic specialist training programme, including certification and registration. For example, in order to train as a cardiologist, a candidate would be required to complete 13 years of training before being eligible to join a three-year Cardiovascular Medicine subspecialist training programme: a basic undergraduate medical degree programme (five or six years), a two-year period of internship, one year of community medical service, and a basic Internal Medicine specialist training programme (four years), including certification and registration.

Currently, specialist certification may be obtained by one of two routes: (1) admission as a Fellow to one of the member colleges of the CMSA, an umbrella organization comprising 35 specialist colleges founded in 1955,[21] or (2) admission to the Degree of Master of Medicine, relevant to a recognized speciality, at one of South Africa's eight medical schools. To date, the CMSA, akin to the Royal College of Physicians and Surgeons of the UK, has played a key role in specialist certification in South Africa - more than 30 000 members have gained admission to one or more of its member colleges.[22] Fellowship admission requires (1) completion of the minimum required training time, and (2) successful completion of the relevant Fellowship examination(s), which include written and clinical components. A detailed description of the

structure of the Fellowship examination of the College of Physicians (FCP), a member college of the CMSA, is contained in Chapter 5 of this thesis. Admission to the Degree of Master of Medicine (MMed) requires (1) completion of the same period of training as previously outlined, (2) successful completion of a set of university-conducted examinations, including written and oral components, and (3) submission of a research dissertation relevant to the specialty. The written and clinical examinations set by the relevant university are almost identical to those set by the specific CMSA member college. Indeed, the universities and the CMSA share a common pool of examiners since all CMSA examiners work as clinician-educators actively involved in the specialist training programmes conducted at the eight medical schools. This curious process of parallel certification has a complex political history that is not relevant to the theme of this thesis. Suffice to say that a process of discussion between the various university stakeholders and the CMSA has been initiated in an attempt to streamline this parallel process of specialist certification.[23] Specialist registration is the sole responsibility of the HPCSA. Candidates successfully obtaining either admission to a CMSA Fellowship or a university MMed degree may register as a specialist medical practitioner.

Subspecialist training programmes, for all the disciplines, are not conducted at each of the eight medical schools. Programmes are only run at centres where the required training expertise exists. Certification for subspecialist training is obtained by a process of training and examination similar to the specialist certification examination process already described. Successful candidates are awarded a certificate of subspecialist training by the relevant college of the CMSA after completing at least two years of further training and successful completion of the certification examination. Successful candidates are eligible for subspecialist registration effected through the HPCSA.

Postgraduate specialist certification assessment practices were recently reviewed at a national symposium attended by more than 100 delegates representing all eight South African medical schools and all 35 member colleges of the CMSA.[23] By a process of consensus, specialist certification examination guidelines, similar to those recently published by the Postgraduate Medical Education Training Board in the UK,[24] were drafted.[25] The guidelines, approved by the Senate Council of the CMSA, now serve as a guide to the review and, where necessary, revision of all specialist and subspecialist certification examinations currently offered by the CMSA.

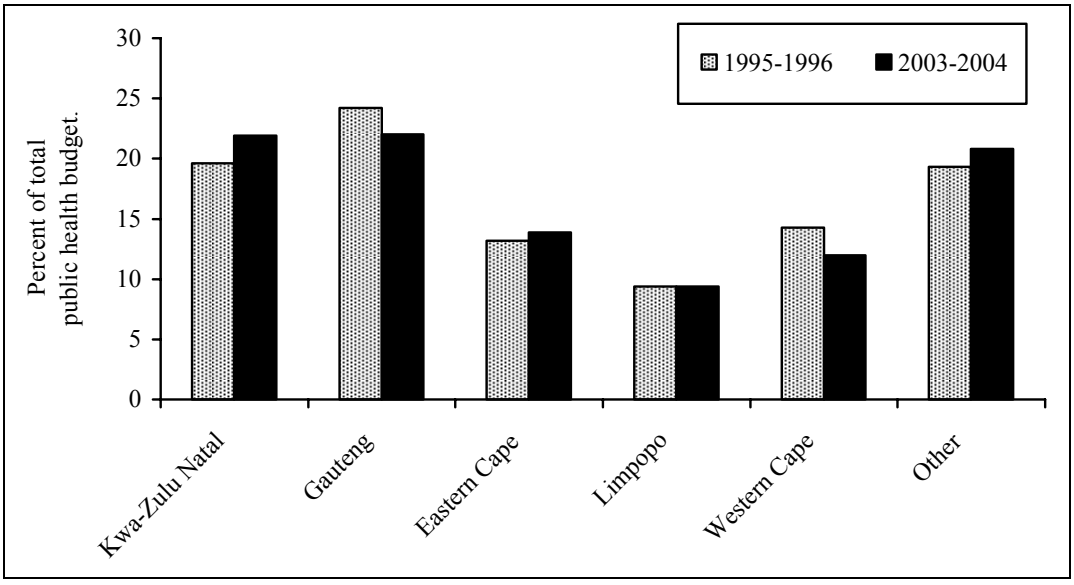
Having provided a broad overview of South Africa's medical schools and its undergraduate and postgraduate medical training programmes, I now return to a discussion of the five most important factors currently impacting upon medical training programmes, including assessment practices, in South Africa.

Government policies regarding health care and higher education

As already mentioned, South Africa embarked on a process of radical reform and transformation soon after the first democratic election of a new government in 1994. In this section I briefly outline the most important health care and higher education policy changes implemented in the past decade. The discussion is restricted to policy issues relevant to the main theme of the thesis.

Health care policies

Despite the new government's questionable policies regarding the management of HIV /AIDS, considerable progress has been made in the development of a more equitable national health system.[1,7,26] A government policy outlining transformation of the health system in South Africa,[27] tabled in parliament in 1997, set the tone for the radical changes required. To date this has included: (1) a major focus on the increased delivery of improved primary health care services, (2) provision of free health care services for pregnant women and children under the age of six years, and (3) a significant shift of financial, infrastructural and human resources from well-resourced tertiary care settings to poorly resourced primary care and secondary care settings. The latest available data, shown in Figure 4, indicate the extent of financial resource re-allocation that has taken place at provincial level. Of the five most densely populated provinces, only Gauteng and the Western Cape, the two wealthiest provinces, have been allocated less financial health care resources since 1994.

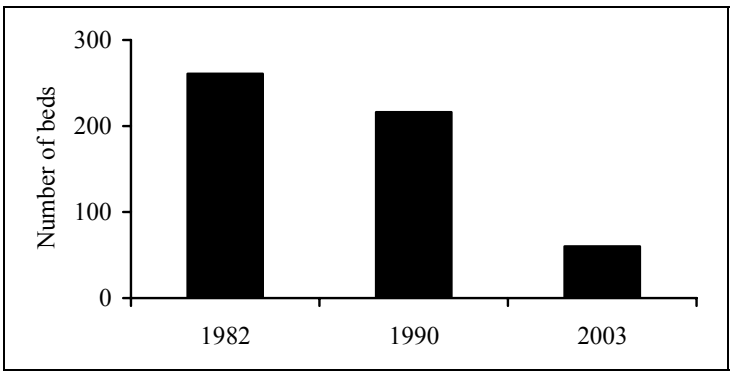


Data derived from Intergovernmental Fiscal Review 2003;[6] Benatar, 2004[7]

Figure 4. *Provincial public health expenditure in South Africa*

The reduction in total public health funding has been accompanied by a significant reduction in both human and infrastructural resources. Between 1995 and 2000, the public sector in the Western Cape closed 3 601 beds (24.4% reduction) and terminated the services of 9 282 health and support personnel (27.9% reduction).[7]

The tertiary services have borne the brunt of the shift in resources required to provide better, primary health care. A simple example illustrates the point. Figure 5 demonstrates the number of beds available in the Department of Internal Medicine at Groote Schuur Hospital, the main academic teaching hospital of UCT. Between 1982 and 1990, 17.2% of beds were closed. Since 1990 a further 72.2% of beds have been closed.



Data derived from Benatar and Saven, 1985;[28] Benatar, 2004[7]

Figure 5. *Beds available in a Western Cape teaching hospital department*

While the impact of these changes on tertiary level service provision are apparent,[7] and beyond the scope of discussion of this thesis, the impact on medical training programmes has not been formally evaluated. It is, however, self-evident that the new national health policies are impacting upon medical training programmes in at least three ways: (1) bed closures have limited the training capacity of academic teaching centres, necessitating the move of student training programmes to regional and district level hospitals, (2) loss of personnel at the highest level of service provision has limited the number of clinician-educators available to provide training and supervision both on-site, as well as off-site at regional and district level hospitals, and (3) limited educational expertise of clinician-educator at lower levels of service provision may impact upon the quality of student learning in clinical clerkship attachments.

The implications of these resource limitations for clinical training programmes are obvious: (1) student teaching programmes in off-campus clinical sites need to be well-structured so as to facilitate student learning in less supervised environments, and (2) supervision and feedback from less experienced clinician-educators working in off-campus sites needs to be

well-structured and embedded within teaching programmes so as to ensure that students continue to receive adequate feedback regarding clinical performance regardless of the clinical learning site or the educational expertise of the clinician-educator. Both these issues are addressed in this thesis.

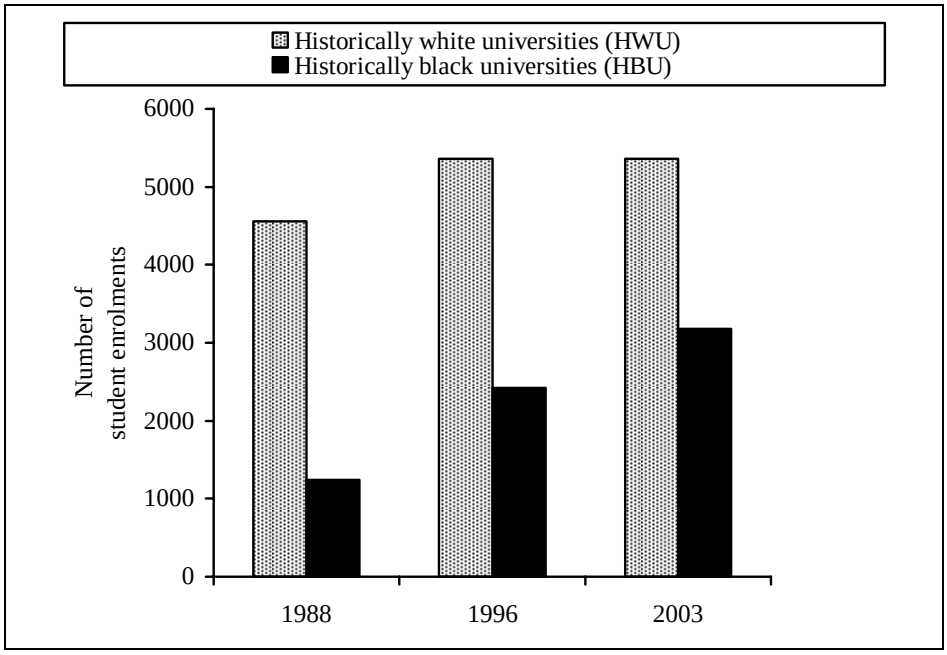
In Chapter 4, I describe the use of a portfolio learning and assessment method that carefully structures student learning around patient encounters so as to maximise patient exposure and ensure that students avail themselves of as many clinical learning encounters as possible, despite limited supervision. The impact of this assessment strategy on student learning behaviour during clerkship attachments is discussed. The paper presented in Chapter 6, describes the implementation of a structured bedside formative assessment strategy that ensures that students obtain structured feedback, regarding directly observed performance, from clinician-educators during bedside tutorial sessions. The feedback process is simple and well-structured so as to facilitate its use by clinician-educators with little or limited clinical teaching experience. The utility of this assessment strategy, in the opinion of both staff and students, and the impact thereof on student learning in the clinical workplace, are discussed.

Higher education policies

Just as in the health care system, a legacy of Apartheid policies has required implementation of radical reform and transformation policies to address inequalities in the setting of higher education in South Africa. A detailed account of the political history of educational inequality in South Africa is beyond the scope of this thesis. The interested reader is referred to a more detail account.[29] For the purpose of this thesis, I provide a summary of changes implemented since 1994. A government policy outlining strategies for the transformation of higher education,[30] also published in 1997, has spurred on many of the required changes, which include a radical change in the ethnic profile of university student enrolments and programme graduates, as well as improved throughput of black students enrolled in tertiary training programmes. In the context of medical education, three strategies have been adopted: (1) increase the number of medical student enrolments at HBU, (2) increase the number of black medical student enrolments, especially black African students, at HWU, and (3) develop ways of improving retention and graduation rates of black students in medical programmes. Information relevant to each strategy is briefly discussed.

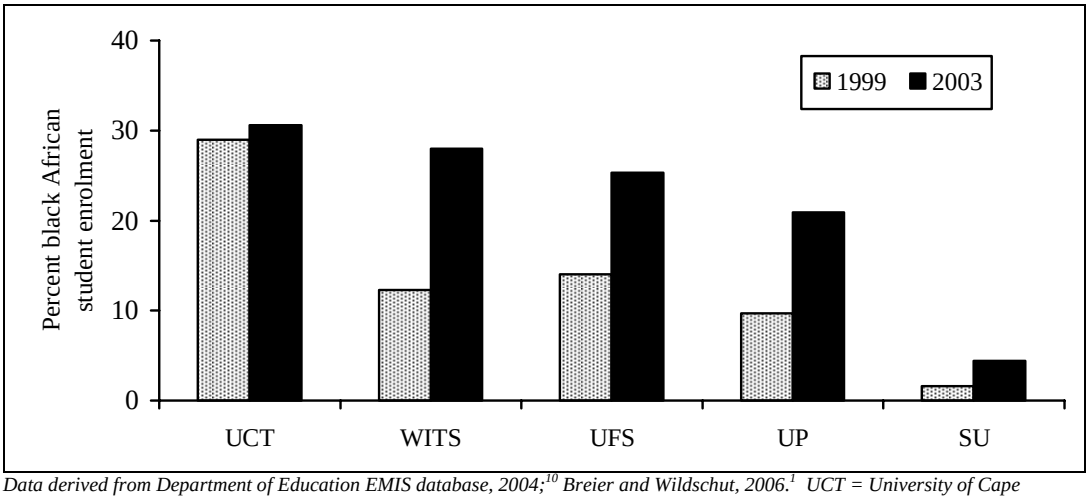
Figure 6 demonstrates the progressive increase in medical student enrolments at HBU since the late 1980s. The most significant increase took place between 1988 and 1996 – an increase of 95.3% from 1 241 to 2 424 enrolments. The increase since 1996 has been less – an increase of 31.1% from 2 424 to 3 178 enrolments. The increase in medical enrolments at HWU

(all ethnic groups) was considerably less and took place predominantly between 1988 and 1996 – an increase of 17.7% from 4 554 to 5 362 enrolments.



Data derived from Department of Education EMIS database;[10] Breier and Wildschut, 2006[1]

Figure 6. *Number of annual medical student enrolments in South Africa, 1988-2003*



Data derived from Department of Education EMIS database, 2004;[10] Breier and Wildschut, 2006.[1] UCT = University of Cape Town, WITS = University of the Witwatersrand, UP = University of Pretoria, UFS = University of the Free State, SU = Stellenbosch University

Figure 7. *Percent black African student enrolments at HWUs in South Africa, 1999-2003*

Figure 7 shows the progressive increase in black African enrolments at HWU between 1999 and 2003. As can be seen, the University of Cape Town enrolled the greatest proportion of black African medical students in 1999. By 2003, two of the remaining four HWUs were approaching the 30% enrolment mark.

A more comprehensive picture of the enrolment of black medical students at HWUs, is obtained by reviewing the current enrolment of all black students, including black Africans, Coloureds and Indians. This information is depicted in Figure 8. As seen, black medical student enrolments at UCT and Wits University currently exceed 60% (64.9% and 62.8%). This is at least double the proportion of black medical students enrolled at the other HWUs.

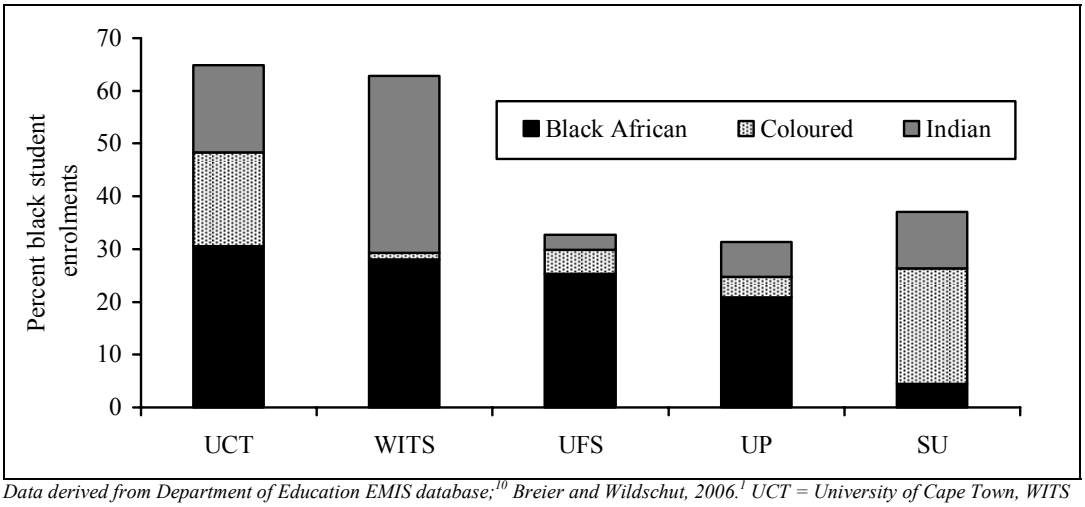


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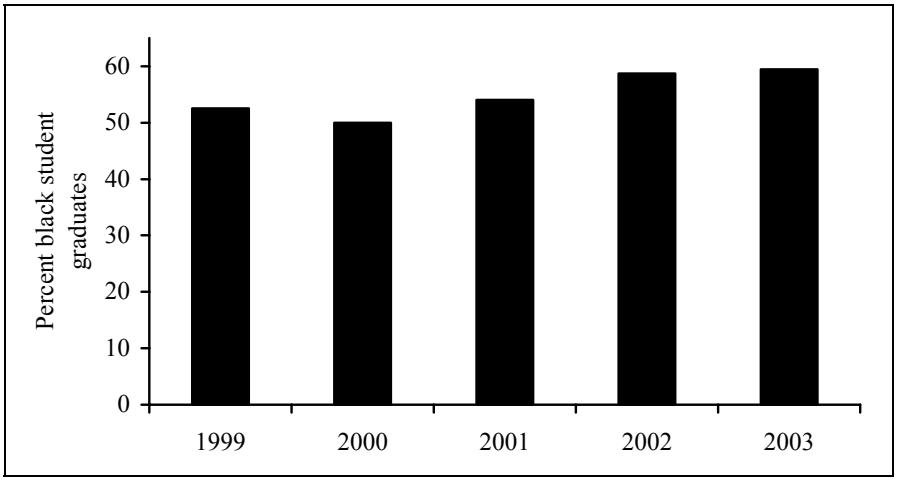
Figure 8. *Percent black medical student enrolment at HWUs in South Africa, 2003*

Based on the available information, it is fair to conclude that UCT engaged the process of increased black medical student enrolment more aggressively and earlier than the other HWUs; they have maintained a leadership position in this regard since 1999. In the interim the other HWUs, especially Wits University, have greatly improved black student enrolments. Clearly there is an ongoing need to maintain current black student enrolment numbers at HWUs, and increase them even further in most cases.

While the enrolment of more black students in medical training programmes is clearly a key priority, the throughput of black medical students is equally important. Figure 9 suggests that transformation of the ethnic profile of medical graduates, on a national scale, is slowly beginning to emerge. The percentage of black graduates has increased from 52.5% to 59.5%

over the past five years. This trend, however, needs to be sustained and improved upon, before the results can be considered significant.



Data derived from Department of Education EMIS database;[10] Breier and Wildschut, 2006[1]

Figure 9. *Percent black medical student graduates in South Africa, 1999-2003*

The most recent data for black medical graduates indicate that at least 50% of current medical graduates at UCT and Wits University are black (Table 3). Furthermore, UCT currently produces significantly more black African medical graduates than any other HWU in South Africa. The data in Table 3 demonstrate an additional interesting finding. HBUs do not produce exclusively black African medical graduates. More than 50% of black graduates from UKZN are Coloured or Indian. This means that the greatest proportion of black African graduates still come from WSU and UL.

Table 3. *Percent black medical graduates in South Africa, 2003*

	Historically White universities					**Historically Black universities**		
	UCT	**WITS**	**SU**	**UFS**	**UP**	**UKZN**	**WSU**	**UL**
All black graduates (%)	56.8	50	28.3	19.3	15.8	92.7	100	100
Black African graduates (%)	24.5	10.1	1.1	11.4	12	38.2	66.1	81.6

Data derived from the Department of Education EMIS database;[10] Breier and Wildschut, 2006.[1] UCT = University of Cape Town, Wits = University of the Witwatersrand, UP = University of Pretoria, UFS = University of the Free State, SU = Stellenbosch University, UKZN = University of Kwa-Zulu Natal, WSU = Walter Sisulu University, UL = University of Limpopo

While the proportion of black medical students graduating each year provides some indication of the success of black students in medical programmes, it does not permit calculation of graduation rates that can be monitored in order to determine progress in the process of higher education graduate ethnic profile transformation. The National Plan for Higher Education (NPHE)[31] has suggested that a crude estimate of graduation rates may be obtained by expressing the number of graduates as a percentage of the number of enrolments, given the best expected performance calculated as a function of the expected duration of the degree programme, i.e. 100÷A, where A is the minimum duration of the degree programme in years. Using this formula, the best expected performance for a six-year programme is 16.7%, i.e. approximately 16% of all students enrolled in a six-year programme are expected to graduate each year. Thus, if a six-year medical degree programme annually enrols 500 students, and graduates 50 students per year, the observed proportion of graduates for the programme is 10%, i.e. the programme is producing graduates at only 59.9% of its maximum capacity. The NPHE have not yet determined a formal benchmark figure for six-year programmes, but Breier and Wildschut suggest that it should be estimated at 16%.[1] By using the most recent national enrolment and graduation data, the calculated national programme graduation rate is almost 15% (Table 4). There appears to be a measure of ethnic variation, but long term follow up is needed before this calculation can be declared a useful way of determining the success of the higher education transformation process.

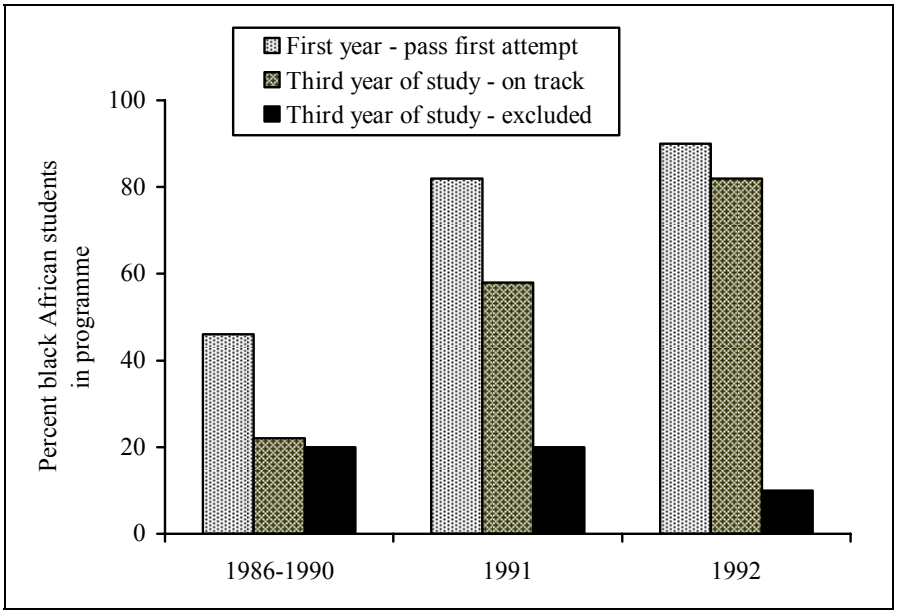
The principal reason for expressing reservation about the use of this "graduation rate" calculation is that it requires stable enrolment numbers in each ethnic group in order to produce meaningful data. The spuriously high graduation rate of white students shown in Table 4 demonstrates the impact of declining enrolment in this ethnic group – 3 370 in 1999 as compared to 2 928 in 2003, while the apparently lower graduation rate for black African students can largely be attributed to the increasing enrolment of students in this ethnic group – 2 680 in 1999 as compared to 3 500 in 2003. This calculation, therefore, has limited utility while the number of enrolments in each ethnic group changes on an annual basis.

Table 4. *National annual graduation rates for medical students in South Africa, 2003*

	Black African	**Coloured**	**Indian**	**White**	**Total**
Enrolments	3 500	590	1 518	2 928	8 536
Graduates	422	76	233	526	1 257
Graduation rates*	12.1%	12.9%	15.4%	18.0%	14.7%

*Data derived from Department of Education EMIS database;[10] Breier and Wildschut, 2006.[1] *Best possible rate for a 6-year programme would be approximately 16%*

Taken overall, however, the available information indicates that medical training programmes have begun to implement the new higher education policies put in place a decade ago. The University of Cape Town has led the way in changing the ethnic profile of medical student enrolments and graduates at HWUs in South Africa. This was largely achieved by offering a specially supported extended medical programme called the Academic Development Programme (ADP) throughout the 1990s.[11] Between 1986 and 1990 it was recognised that racially segregated schooling was not adequately preparing black university entrants, particularly black African students, for medical school (Figure 10).

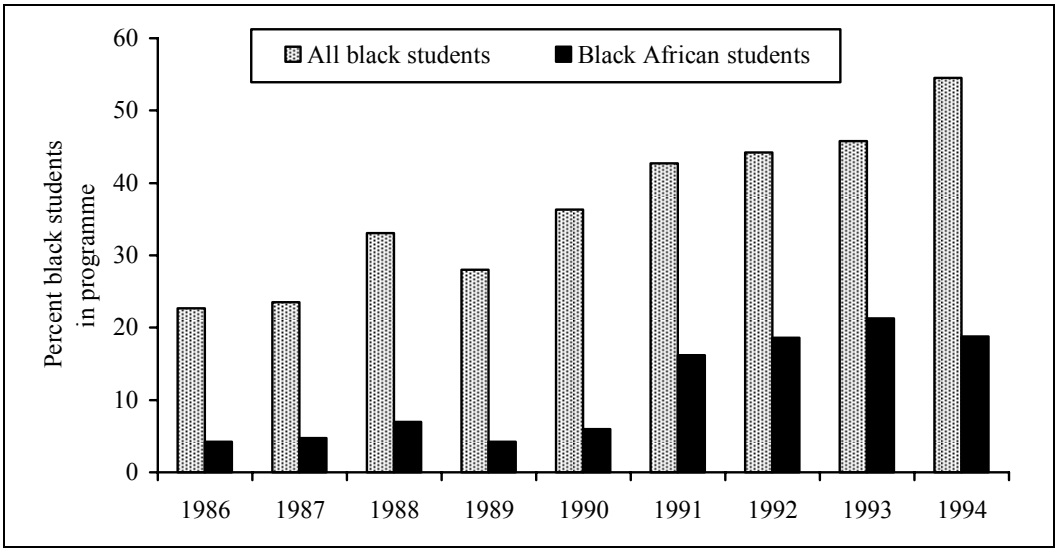


Data derived from Colborn, 1995[11]

Figure 10. *Performance of black African students at the University of Cape Town, 1986-1992*

In response to this observation the ADP, initiated at UCT in 1991, was designed to provide black medical students, specifically black African students, with additional educational support in a specially adapted programme that allowed them to complete the traditional six-year undergraduate medical degree programme in seven years. Two outcomes were intended: (1) an increase in the enrolment of black medical students at UCT, and (2) an improvement in the retention rates and throughput of black medical students at UCT.[11] Figure 10 shows the dramatic improvement in the academic performance of black African students in the first two years of the existence of the ADP, as compared to their performance in the period 1986-1990, prior to implementation of the ADP.

Figure 11 demonstrates the successful initiation of the ethnic profile transformation process of UCT medical school between 1986 and 1994, the year of the first democratic election in South Africa. The figure shows (1) the number of black African enrolments as a percentage of total enrolments, and (2) the number of black enrolments, including black African, Coloured and Indian, as a percentage of total enrolments. The increase in black African enrolments after initiating the ADP in 1991 is apparent.



Data derived from Colborn, 1995[11]

Figure 11. *Black medical student enrolments at the University of Cape Town, 1986-1994*

From the information presented it is clear that UCT embarked on an aggressive ethnic transformation policy more than a decade ahead of national political transformation. It is, therefore, not surprising that this university demonstrates the earliest and most dramatic ethnic profile change of all the HWUs in South Africa – the reader is referred back to Figure 7. In 2002 the ADP at UCT was discontinued, and an alternative academic support system was implemented when the new PBL-based MBChB programme commenced. The new support system is outlined in the paper contained in Chapter 8 of the thesis.

One of the most important considerations in the process of equity transformation is the impact that medical training programme changes, as undertaken by UCT, may have upon the enrolment and graduation rates of black students, particularly students emerging from inadequate black schooling programmes. Since racially segregated schooling was abolished in 1994, more than 93% of South Africa's school-going population, 13.7 million black children,[3] are now free to attend schools of their choice. However, good quality schools previously

reserved for white children, representing less than 10% of school-goers, do not have the capacity to accommodate this volume of black children. Hence, good quality education is currently available to only a tiny minority of black school children.[32-35] Given the reality that it will require a considerable amount of additional time and resources, financial, human and infrastructural, to provide adequate schooling for all children in South Africa, it becomes self-evident that many black university entrants continue to be at risk of performing poorly at university.

As a result of the ongoing schooling inadequacies prevalent in the new South African democracy, it is imperative that all higher education curriculum change processes be carefully monitored to determine their impact on the performance of academically-at-risk students, particularly black African students where throughput demands are greatest. This specific issue is raised in the paper presented in Chapter 8 of this thesis, in which I examine the impact of the introduction of PBL on the retention rates and academic performance of academically-at-risk medical students enrolled at UCT. Recent work in this regard, undertaken at Walter Sisulu University, demonstrated that student dropout rates (10.3% as compared to 23%) and the percentage of students graduating within the minimum period of six years (67% as compared to 55%) was significantly better in their PBL programme (initiated in 1992) than in the traditional programme (discontinued in 1998).[36] The results of my work are discussed in light of the findings recently published by Iputo and Kwizera.

Regulations governing the training of health care professionals

Regulations governing the training of medical students in South Africa, and the accreditation of South African medical school training programmes, have been extensively revised by the new Health Professions Council of South Africa (HPCSA) founded in 1997. This parastatal organization replaced the South African Medical and Dental Council, founded in 1928, and is currently responsible for developing and maintaining guidelines regarding medical practitioner training programmes, accrediting all undergraduate and postgraduate health care practitioner training programmes in South Africa and the annual registration, and renewal of registration, of all health care practitioners working in the country. I briefly highlight key issues relevant to this thesis.

Medical training programme guidelines

As part of the process of health care reform, undertaken since the first democratic election in 1994, the Department of Health issued regulations governing the training of medical practitioners in South Africa.[37] In addition, the HPCSA drafted a set of regulations that currently

govern the training of all medical practitioners in South Africa.[38] These guidelines were drafted after careful review of a number of key international medical education documents including the Edinburgh Declaration of the World Federation for Medical Education,[39] the Cape Town Declaration of the WFME,[40] (3) the "Five Star Doctor" as described by Charles Boelen,[41] recommendations made by the UK General Medical Council,[42] and the recommendations of the World Summit on Medical Education held in Edinburgh in 1993.[43] The HPCSA guidelines highlight several basic requirements of undergraduate medical training programmes. They include: a decrease in the amount of information contained in programmes; early clinical contact between students and patients; horizontal and vertical integration of courses; elimination of the dividing line between pre-clinical and clinical training years; provision for the mastery of generic skills; implementation of problem-based learning as a preferred teaching modality; public health as a prominent curriculum theme; an understanding of national health issues and available resources; emphasis on communication skills; sensitivity to cultural, religious, racial, language and gender issues; community-based education; a thorough undergraduate assessment of skills required for the internship years; and an assessment system focusing on "achieving professional competence and cultivating specific social values and not the mere retention and recall of factual knowledge".[38,44] The guidelines also emphasise the importance of self-directed learning, the changing role of the teacher to a "facilitator" of learning, the need to encourage the development of lifelong learning habits and the use of active rather than passive study methods. These guidelines thus advocate implementation of all the major educational advances, including improved assessment practices, outlined earlier in the literature review. In educational terms, therefore, this document is an entirely appropriate tool for driving medical education reform in South Africa.

Given the national importance of the HPCSA guidelines, it is appropriate that the assessment practice issues highlighted in the guidelines are addressed in the work included in this thesis. The paper presented in Chapter 4 describes a portfolio assessment system designed to focus on the assessment of professional competence, not merely the retention of facts, in a professionally authentic, integrated way. The paper also indirectly addresses the issue of self-directed learning, a key principle of portfolio-based learning. All the assessment principles outlined in the HPCSA document imply the use of multi-component assessment strategies, the topic of discussion in Chapter 5 of the thesis. The role of the clinician-educator as a "facilitator of learning" is highlighted in Chapter 6 which explores the educational value of a bedside formative assessment strategy. The importance of procedural skills competence, appropriate to internship, is specifically addressed by the paper presented in Chapter 7. The use of student academic performance data to endorse the change to a PBL programme at UCT is the focus of the work described in Chapter 8. Finally, Chapter 9 addresses the question of assessment utility

and the selection of resource-appropriate assessment methods, a critical issue determining assessment practices in any developing country, including South Africa. As stated, most major advances in medical education assessment practices over the last 30 years, as outlined in the literature review, are contained in the guidelines currently informing undergraduate medical training programme content, design and delivery in South Africa. The rationale for making these specific assessment issues the focus of attention of this thesis is self-evident.

Medical programme accreditation guidelines

A new system of programme accreditation was implemented in South Africa in 1999. A recent review of the system of programme accreditation showed that it is very similar to systems operational in other developing countries, and akin to the system used in the USA.[45] Based on feedback received from accreditation panels and accredited institutions,[46] as well as review of international accreditation guidelines recently published by the WFME,[47-49] the HPCSA have recently proposed an improved set of accreditation criteria for implementation in 2007.[50,51] These criteria are closely aligned with the HPCSA training programme requirements previously mentioned.

In terms of assessment, the accreditation criteria specifically highlight the following: the need for educational concordance between programme learning outcomes, assessment methods used and the content of assessment processes; thorough assessment of clinical competence; the use of valid, fair and reliable assessment methods; the use of assessment as learning opportunities; the use of assessment strategies in which the appropriate cognitive, psychomotor and affective skills, also referred to as knowledge, skills and professional attributes, are assessed in an integrated manner.

The key assessment practice issues included in the new programme accreditation criteria, to be initiated in 2007, form the focus of attention of much of the work presented in this thesis. The critical importance of educational concordance and the development of reliable, sustainable methods of assessing clinical competence that are professionally authentic and demand the integrated use of the appropriate cognitive, psychomotor and affective skills, a function of daily clinical practice, are addressed in the paper presented in Chapter 4. The importance of using assessment events to serve as learning opportunities is a key issue highlighted in the bedside formative assessment strategy discussed in Chapter 6. This paper examines both student and staff perceptions of the learning value and feasibility of providing structured feedback to students after observing their performance during bedside patient encounters. The impact of this assessment tool on student learning behaviour is also discussed. The findings of the intern procedural skills OSCE presented in Chapter 7 endorse the accreditation guideline recommendation regarding the comprehensive assessment of clinical

competence, including procedural skills proficiency. Issues regarding the validity, reliability and perceived fairness of assessment methods used in South African medical training programmes are addressed in four papers included in this thesis – Chapter 4 examines the reliability of the portfolio interview assessment method, while the reliability of a composite high stakes postgraduate specialist certification examination is evaluated in Chapter 5. The perceived fairness and validity of a bedside formative assessment tool is evaluated in the paper presented in Chapter 6, and finally Chapter 9 discusses a simple way of determining the overall fitness for purpose of assessment methods within the resource constraints typical of developing countries. The assessment practice issues addressed by the papers included in this thesis are, therefore, well aligned with priority assessment issues identified in the new accreditation guidelines soon to be implemented in South Africa..

The public health care platform

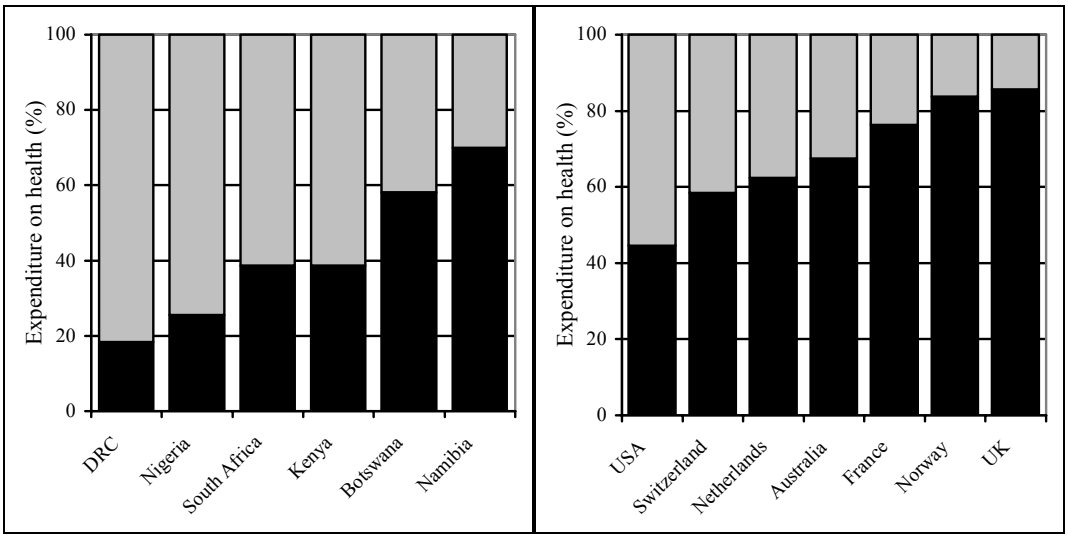
In South Africa, as in many countries around the world,[52] undergraduate and postgraduate medical training is located on the public health care service platform. Furthermore, as is the case in South Africa, the funding of training on this platform is largely derived from government funds allocated to public health care service provision.[7] While there is currently much debate regarding this issue, and more appropriate ways of funding the training of health care professionals are being explored, this system remains in place in South Africa until further fiscal funding policies are developed. Given the context, it is clear that the funding, size and service demands of the public health care service are critical determinants of the quality of medical training programmes, including assessment practices, in countries like South Africa where this system is in place. This has not been formally evaluated in the developing world. Given the lack of information in this regard, it is, thus, especially critical to understand the vast differences that exist between public health care in the developed and developing world. A basic understanding of these differences provides the insight needed to appreciate the magnitude of public health care constraints that currently influence the implementation of assessment practice advances in developing countries like South Africa.

Funding of public health care services

Internationally, two basic systems of health care funding are operational. Government-funded health care is usually free, or a reduced fee is applicable, and health care services are readily accessible to all citizens, e.g. the National Health Service (NHS) in the UK.[53] Such systems are financed by general taxation and offer comprehensive ambulatory and hospital-based health care. However, in some developed countries, like the USA, privately-funded health care is the predominant system of service provision. In such countries, citizens who are unable

to afford private health insurance are obliged to use the public health care system which is usually considerably less well funded.[54] Overall, most developed world countries favour a comprehensive government-funded health care service modelled on the NHS, to a greater or lesser extent. Privately funded health care represents less than 50% of total health care expenditure in most countries, except in the USA.[4]

In the vast majority of developing countries the situation is considerably different. Public health care is poorly funded; less than 50% of all health care funding in sub-Saharan Africa is derived from government sources.[4] However, the vast majority of Africans do not have access to private health insurance and are totally dependent upon these poorly funded public health care systems. The situation in South Africa serves as a good example. Only 38.6% of the country's total health expenditure is government-funded,[4] yet at least 85% of South Africans do not have any form of private health insurance.[55] This means that less than 40% of South Africa's total health expenditure is available to provide health care for more than 80% of the country's population. The inadequate funding of public health care is even worse in other African countries. For example, most of Nigeria's 128.7 million people rely on a public health care service funded by only 25.5% of the country's total health expenditure,[4] Figure 12 shows the general government expenditure and private expenditure as a percentage of the total expenditure on health for a spectrum of developing world and developed world countries.

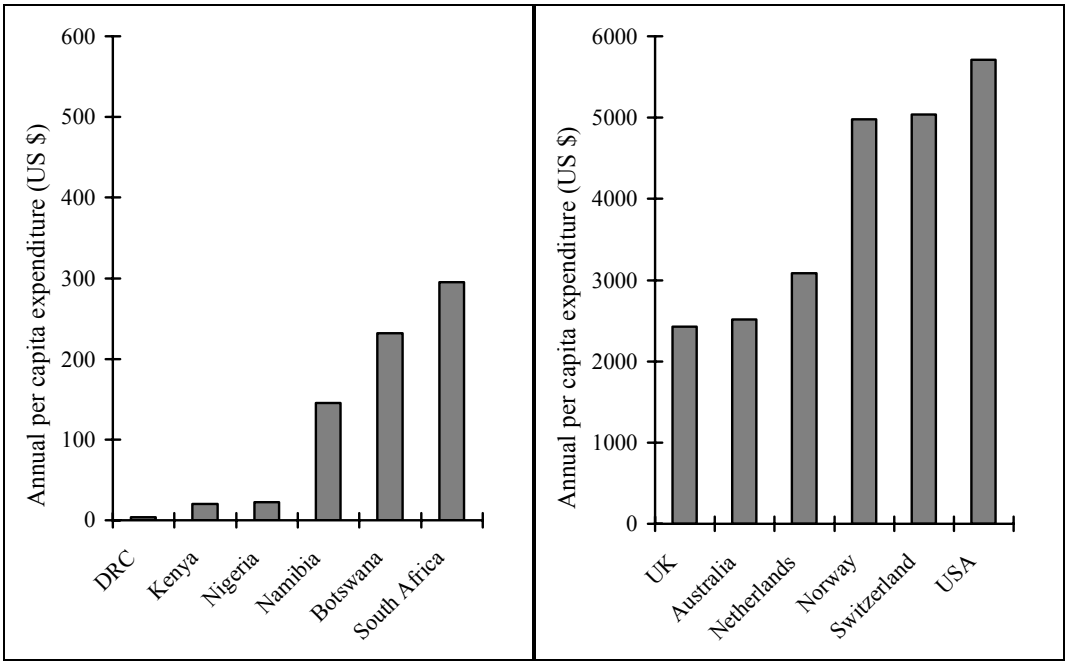


Data derived from World Health Report 2006[4]

Figure 12. *General government ■ and private ▒ expenditure on health as a percentage of total expenditure on health for selected African countries and developed world countries*

The inadequacy of government-funded health care is sub-Saharan Africa is clearly demonstrated. Only Namibia and Botswana have a government-funded public health care system based on the NHS philosophy. South Africa is currently exploring the possibility of establishing such a system, but implementation is a long way off.[26]

Not only does the primary source of health care funding differ significantly between most developed and developing world countries, but total health expenditure in the developing world represents only a tiny fraction of total health expenditure in the developed world. While the total expenditure on health, as a percentage of GDP, has a fairly narrow range globally – a minimum of 4% for the Democratic Republic of Congo (DRC) and a maximum of 13.1% for the USA – the vast differences in absolute financial terms are apparent.



Data derived from World Health Report 2006[4]

Figure 13. *Per capita total expenditure on health (US$) for selected African and developed world countries*

Figure 13 shows the annual per capita expenditure on health is US$ expressed as a percentage of gross domestic product (GDP). The differences are so great that a 10-fold smaller scale is required to depict health expenditure in the sub-Saharan African countries shown. Although South Africa's per capita total health expenditure (US$ 295 per person) is the highest in Africa – more than 73 times the expenditure of a country like the DRC (US$ 4 per person) – this does need to be seen in a global context. South Africa's total health expenditure amounts to

less than 10% of the annual per capita total expenditure of developed world countries such as the Netherlands, Australia or the UK.[4]

While the health care impact of such inequitable financial resource distribution is readily appreciated, the impact of these enormous financial constraints on medical education in this world region has not been quantified. It does, however, seem reasonable to postulate that the public health care financial constraints evident in sub-Saharan Africa significantly influence the ability of this world region to implement and sustain many of the medical education advances discussed in the literature review of this thesis. Indeed, these resource constraints are probably the most significant challenge facing medical educators working in developing world regions such as sub-Saharan Africa.

A significant part of the work described in this thesis, therefore, focuses on the implementation of medical education assessment practice advances within the resource constraints described. Chapter 4 of the thesis describes the implementation of a human resource-efficient, sustainable portfolio assessment system, while Chapter 5 describes strategies for improving the reliability of a postgraduate specialist certification examination within the human resource constraints described. Chapter 6 explores the feasibility of a bedside formative assessment strategy while Chapter 7 highlights the critical importance of appropriately trained graduates, given the enormous financial resources required to train doctors. The paper in Chapter 8 evaluates the impact of PBL, an expensive curriculum intervention, on the performance of academically-at-risk students, currently a high training priority at all South African universities. The fiscal implications of such an undertaking are apparent, and the significance of the findings highlighted in the paper is self-evident. Finally, Chapter 9 proposes the use of a model for objectively determining the utility of assessment tools, including resource requirements, when selecting programme assessment methods. This tool specifically focuses on recognising the impact of resource constraints on the selection of assessment tools in sub-Saharan African medical schools, including South Africa.

Size of the public health care platform

An extensive discussion of the size of the public health care service platform in South Africa is beyond the scope of this thesis. The most relevant issue in this regard has already been mentioned – the reduction of tertiary health care services, in favour of developing primary health care services, and the potential impact thereof upon medical training programmes in South Africa.

Public health care service demands

The service demands made of the South African public health care service need to be considered in two separate categories: (1) health care service demands, and (2) academic

training service demands. The health care service demands have already been clearly articulated. At least 85% of South Africans (40 million people) are dependent on a health care service funded by 38% of total national health care expenditure. The resource allocation implications of this inadequately funded system are apparent and are not discussed any further.

In addition, however, the public service platform also provides training facilities for both undergraduate and postgraduate medical training. The extent of this academic service demand is poorly quantified. A recent survey of the world's medical schools showed that up to 50% of medical student teaching training and assessment activities in developing world regions are conducted by clinician-educators not employed as full-time university staff.[52] Thus, South African public sector doctors make a major contribution to medical education. The critical shortage of doctors working in the South African public health sector, burdened by this additional demand, is outlined later in this chapter. At this point it is sufficient to recognise the origin of the tension between teaching, training and service delivery in the poorly funded, overburdened public health care system of South Africa. This is currently a source of great debate and a workable solution is urgently required. The national Department of Health and the universities are engaged in a process of revising the joint employment contract which governs the number of hours public service doctors may devote to university-related teaching and training duties. Unfortunately the complex relationship between service delivery and clinical training remains unresolved, and a revised agreement is still awaited after several years of debate and discussion. While the potential impact of these tensions on the quality of medical training is not difficult to imagine, it has not been formally documented. This situation, a common occurrence in developing countries like South Africa, needs to be understood in order to appreciate the major constraint this poorly quantified stress places on the implementation of medical education practice advances in developing world countries.

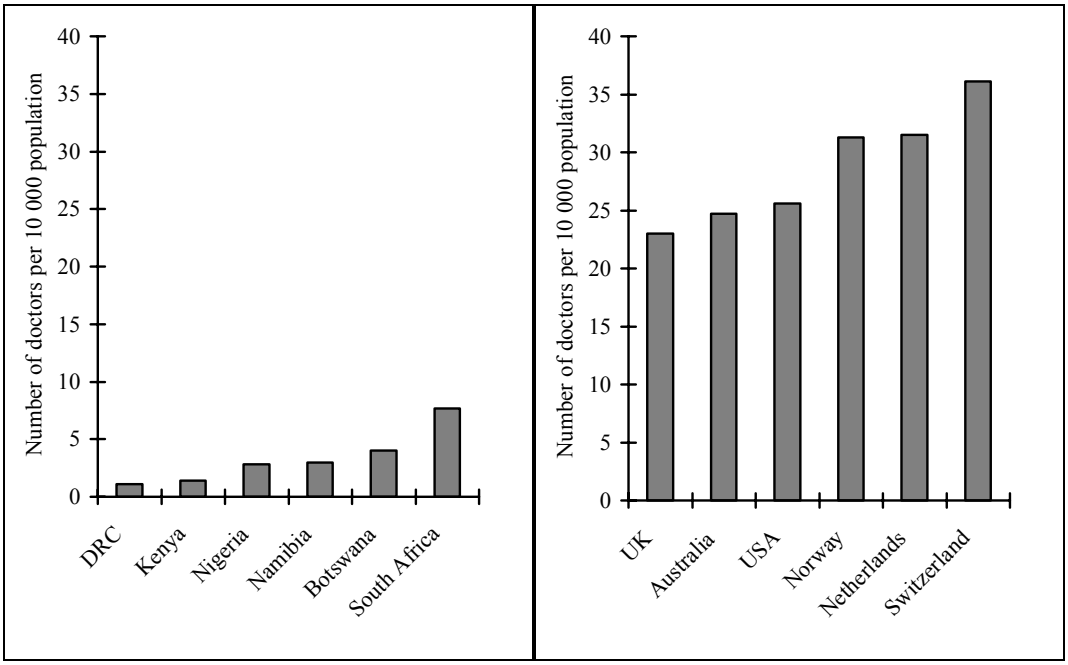
The medical workforce

The medical workforce of any country comprises a range of professionals. This thesis focuses on medical practitioners. Hence, the discussion is limited to this category of staff.

Size and distribution of the medical workforce

Global inequalities in the funding of health care mirror the inequitable distribution of doctors around the world. The WHO currently recommends a minimum of 2 doctors per 10 000 population.[4] In sub-Saharan Africa, with a total population of approximately 663.5 million inhabitants, the average number of doctors per 10 000 population is currently 1.3.[4] At least 38 of 47 (80.9%) sub-Saharan countries do not meet this WHO recommended minimum.[56] The critical

shortage of doctors in sub-Saharan Africa is graphically depicted in Figure 14. It is worth noting that four of nine sub-Saharan African countries that currently meet or exceed the WHO minimum of 2 doctors per 10 000 population are depicted in Figure 14. Thus, the African countries depicted in Figures 12-14 represent the best end of the spectrum of health care available in this developing world region.

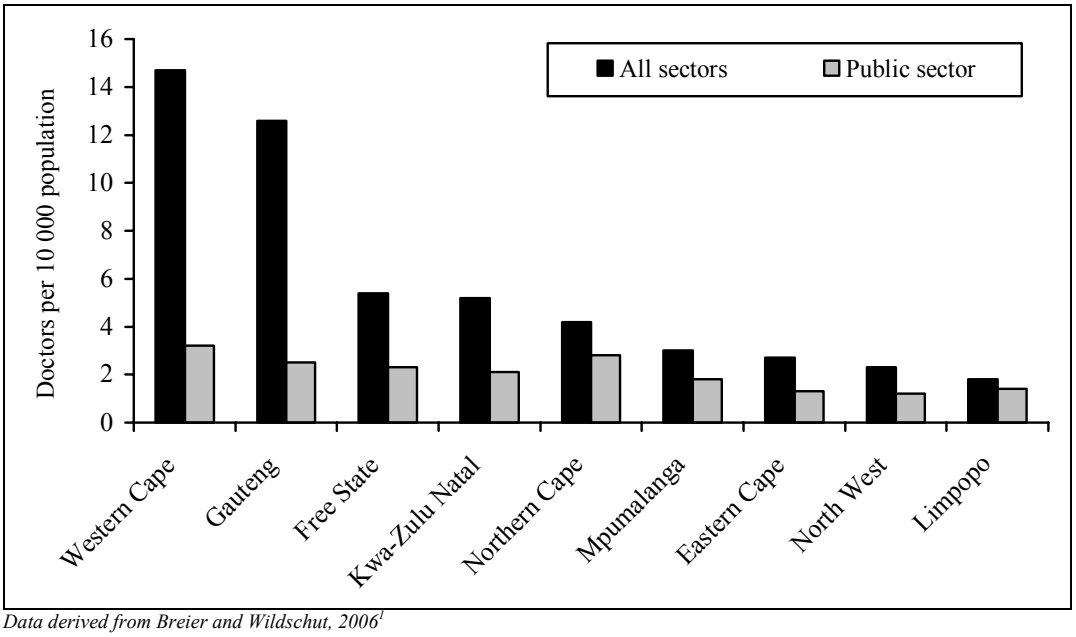


Data derived from the World Health report 2006[4]

Figure 14. *The number of doctors per 10 000 population for selected African countries and developed world countries*

While South Africa clearly has a larger medical workforce than any other sub-Saharan African country, a national average of 7.7 doctors per 10 000 population,[4] significant differences exist between the nine provinces that make up the country and the number of doctors working in the public and private health care sector, respectively (Figure 15). While Gauteng and the Western Cape, the two wealthiest provinces, are significantly better resourced than the other provinces, it is useful to recognise that the doctor to population ratios in these two provinces still fall far short of the ratios described for most developed world countries – refer back to Figure 14 for comparison. The most striking feature of Figure 15, however, is the yawning gap between the overall provincial doctor to population ratios and the ratios for the public health care system in each of the respective provinces. These findings are concordant with the observation that 63% of all medical doctors working in South Africa are employed in

the private sector.[1] It is thus not surprising that the national average doctor per 10 000 population ratio in the public sector is 2.0, i.e. the WHO suggested minimum discussed earlier. Indeed, 41.3% of the country's total population reside in four provinces that fall below this WHO recommended minimum. Thus, despite a national doctor to population ratio that is considerably better than any other sub-Saharan African country, a more detailed analysis reveals that almost half of South Africans are served by a public health care system that is no better staffed than that of some of the poorest countries in sub-Saharan Africa – the reader is referred back to Figure 14 for comparison.



Data derived from Breier and Wildschut, 2006[1]

Figure 15. *Provincial distribution of doctors in South Africa*

Recognising this huge gap between the distribution of doctors in the public and private health care systems of South Africa is critically important from an educational perspective. The implication is that medical education endeavours, implemented within the South African public health care context, are as much threatened by human resource shortages as in the rest of Africa. It is thus fair to suggest that studies evaluating medical assessment practice innovations and advances in South Africa are of relevance to the rest of sub-Saharan Africa, since the clinical setting in which these assessment practices are implemented resembles that present in other countries on the continent.

Migration of the medical workforce

Throughout history, doctors have been a mobile workforce, migrating both within and between countries.[57] There has, however, been a steady increase in international medical migration, particularly in the last decade. Recent work shows that migration is predominantly in the direction of the developed world. Approximately 56% of migrating doctors move from developing to developed nations; only 11% migrate in the opposite direction.[58] Currently, the USA, UK, Canada and Australia are the top beneficiaries of large-scale foreign medical graduate (FMG) migration.[59,60] They constitute up to 28% of the workforce in these four countries.[59]

Using Mullan's formula for calculating the "emigration factor" for the eight major geographical regions of the world, sub-Saharan Africa has been identified as the world region worst affected by medical emigration (Table 5).

Table 5. *Emigration factors for eight regions of the world*

	Location of doctor's practice		**Emigration factor**
	Recipient countries*	**Source countries**	
Region	***Number of doctors***		
Sub-Saharan Africa	13 272	82 100	13.9
Indian subcontinent	78 680	656 876	10.7
Caribbean	8 010	87 443	8.4
Middle East and North Africa	27 010	489 464	5.2
Central and South America	12 103	707 416	1.7
Europe and Central Asia	44 988	2 741 717	1.6
East Asia and Pacific	39 910	2 808 400	1.4
North America	14 519	1 076 398	1.3

Data derived from Mullan, 2005.[59] * The recipient countries are the USA, UK, Canada and Australia

This simple calculation reflects the extent of physician emigration as a function of the total workforce remaining in the source country, and is calculated as follows:

$$\text{Emigration factor} = [A \div (A+B)] \times 100$$

where A is the number of doctors from the source country practicing in the recipient countries, and B is the total number of practicing doctors remaining in the source country.

While most emigrating doctors come from India (59 500), the Philippines (18 300) and Pakistan (12 800), the greatest losses, as a function of the remaining workforce, are from sub-

Saharan Africa – more than one third of the top 20 source countries are located in this world region (Table 6).

Table 6. *Emigration factor and number of medical schools for African source countries*

Region	Location of doctor's practice		Emigration factor	Number of medical schools
	Recipient countries*	Source country		
	Number of doctors			
Ghana	791	1 842	30.0	3
South Africa	6 993	30 740	18.5	8
Ethiopia	359	1 971	15.4	3
Uganda	195	1 175	14.2	3
Nigeria	4 053	30 885	11.6	16
Sudan	622	4 973	11.1	14

Data derived from Hagopian et al, 2004;[56] Mullan, 2005.[59] * The recipient countries are the USA, UK, Canada and Australia

While Mullan's work represents the first appropriate estimate of the massive exodus of doctors from sub-Saharan Africa, the extent of the problem in South Africa is significantly underestimated. A more accurate estimate of the total number of South African-trained doctors practicing abroad, including New Zealand, amounts to approximately 8 900 practitioners.[61] Based on this figure, the emigration factor for South Africa is more correctly estimated to be 22.5.

An important consideration, in terms of this thesis, is the capacity of source countries to replace emigrating health care professionals. This is, after all, the critical factor determining the sustainability of health care service provision and medical practitioner training programmes in donor countries. The capacity to replace emigrating African health care professionals is determined by the number of medical schools in sub-Saharan Africa and the average number of medical graduates per year. There are currently 87 medical schools in the 47 countries that constitute sub-Saharan Africa. At least 11 countries do not have a medical school, 24 countries have one medical school, and only 12 countries have two or more medical schools (Hagopian et al, 2004). Six of these 12 countries (Table 6)[56] rank as the top donor countries in sub-Saharan Africa. Thus, African countries, including South Africa, best resourced to produce doctors for Africa, are producing a significant number of doctors for export. Further analysis identifies an even more important issue – 86% of more than 5 000 African-trained FMGs currently practicing in the USA originate from only four African countries: Ghana, South Africa, Nigeria and Ethiopia. Table 7 lists the top 10 "export" medical schools in these four countries. Based on all

the available information, it is clear that South Africa is the principal source country of emigrating medical practitioners in sub-Saharan Africa.

Table 7. *Sub-Saharan medical schools most frequently attended by emigrating graduates*

Source country	Medical school	Sub-Saharan African FMGs currently practicing in USA, 2005	
		Number of FMGs	% of total FMGs
South Africa	University of the Witwatersrand	1 053	24.9
	University of Cape Town	655	15.5
	University of Pretoria	132	3.1
Nigeria	University of Ibadan	643	15.2
	University of Lagos	429	10.1
	University of Nigeria	394	9.3
	University of Benin	183	4.3
	University of Ife	156	3.7
Ghana	University of Ghana	389	9.2
Ethiopia	Addis Ababa University	200	4.7

Data derived from Hagopian et al, 2004[56]

The large-scale emigration of medical professionals from sub-Saharan Africa has serious implications for the delivery and sustainability of medical education in this world region. Eastwood and colleagues have warned that the diminishing pool of experienced clinician-educators, responsible for sustaining medical training programmes in sub-Saharan Africa, may be the most serious problem for the future of this world region.[57] Indeed, closer review of the paper by Hagopian and colleagues shows that African FMGs working in the USA are older (mean age of 43 years), more likely to be enrolled in specialist training programmes (20%), and are typically based in urban teaching hospitals.[56] This should sound a serious warning to sub-Saharan Africa – we may be selectively losing our current and future high-quality clinician-educators, i.e. those who are more likely to specialise and work in public service teaching hospitals. Attempts to quantify the loss of this particular group of health care professionals from sub-Saharan Africa have not been made. Information regarding the migration patterns of doctors who serve as both clinicians and educators, two critical functions in sub-Saharan Africa, is a matter that requires urgent attention. A recent survey by Longombe, Burch and colleagues, however, highlights the difficulties encountered when attempting to obtain data about medical graduates from source countries in Africa.[62]

The issue of medical emigration from Africa, specifically South Africa, has been discussed primarily to alert the reader to the medical education implications of the African physician "brain drain" phenomenon: (1) the ongoing loss of doctors, particularly skilled clinician-educators working in the public health care service and (2) potential changes in the quality of clinical training (clerkships) and assessment since workplace-based teaching, training and assessment may need to be conducted by less experienced clinical staff. The most pragmatic response to this current and ongoing crisis, in terms of medical education practice, is to ensure that: (1) student clerkship attachments are well-structured so as to maximise clinical learning experiences despite limited supervision; (2) trainee observation and feedback in the workplace environment are maintained as part of the clinical teaching programme, so as to ensure ongoing feedback even in off-campus sites; (3) reliable, sustainable performance assessment methods, robust enough to be implemented by less experienced clinician-educators, are used; (4) composite assessment packages are crafted on the basis of objective evidence and the most efficient use of scarce resources, i.e. clinician-examiners is ensured; (5) objective methods, which take account of all major resource (human, financial and infrastructural) limitations that determine assessment utility, are developed to assist less experienced clinician-educators with the selection of resource-appropriate assessment tools; (6) test results, particularly performance-based assessment procedures, are used to initiate curriculum change appropriate to the desired outcome competencies of new graduates, and (7) student performance data are used as one of many measures to educate less informed clinician-educators of the benefits of modern educational practices such as problem-based learning.

Each of these responses is focused, to a greater of lesser extent, on appropriately adapting the medical training system of developing countries where the ongoing loss of doctors, especially experienced clinician-educators from public service clinical training sites, currently threatens the survival of these training systems. Each issue is addressed in one or more of the papers included in this thesis. The use of portfolio learning to structure clinical clerkships, discussed in Chapter 4, has already been highlighted. The formulation of psychometrically robust composite assessment strategies using objective data and the efficient use of scare resources (clinician-examiners) is addressed in Chapter 5. The use of structured bedside formative assessment to ensure ongoing trainee feedback is outlined in Chapter 6. The use of an OSCE to determine the adequacy of graduate procedural skills proficiency, and make informed decisions regarding the need for curriculum changes, is the focus of attention of the work described in Chapter 7. The next chapter, Chapter 8, focuses on the use of student performance data to endorse expensive curriculum innovations, especially in resource-poor settings. Finally, Chapter 9 describes a method for facilitating the selection of resource-appropriate assessment tools by clinician-educators with little or no formal medical education training.

Production of the medical workforce

It was mentioned earlier that the number of medical schools and the number of graduates per annum are the two critical factors that determine the capacity of any country or world region to sustain the size of the workforce required to deliver health care services. One of the principal mechanisms of workforce loss in sub-Saharan Africa is the large-scale medical migration previously outlined. Other sources of loss, such as the HIV /AIDS epidemic, have not been defined in Africa. While the number of medical schools in sub-Saharan Africa have been quantified,[9] detailed information regarding the annual number of African medical graduates is not readily available.[62]

Information made available by the Education Management Information System (EMIS) database of South Africa, indicates that the country's eight medical schools currently produce approximately 1 300 medical graduates per year.[10] According to the latest available information, the annual number of graduates has not declined over the past three years. Unfortunately data are not available to compare current medical graduate outputs to a decade ago. The National Human Resources Plan for Health, released by the government in mid-2006, does, however, indicate the need to double the national medical graduate output to 2 400 by 2014.[63] This suggests that the need for more doctors is recognised. The resources and planning required to achieve this ambitious goal are beyond the scope of this thesis and are not discussed in any further detail.

The more critical question, however, is the retention of qualified medical practitioners in South Africa. According to Breier and Wildschut[1] the latest available information available from the Health Professions Council of South Africa (HPCSA), the national regulatory authority that annually registers all medical practitioners working in South Africa, indicates that the national medical practitioner workforce has not declined over the past three years – 29 903 doctors in 2002, 30 578 doctors in 2003 and 31 214 doctors in 2004. This information is, however, of very limited value. Almost 10 years ago, the University of the Witwatersrand expressed concern that more than 40% of its graduates migrated to developed countries.[64] Meaningful longitudinal comparisons of the size and stability of the medical practitioner workforce in South Africa, therefore, really require information dating back to the 1980s. It seems that such information is not readily available. Simply accepting the most recent information released by the HPCSA, however, seems naïve in the face of the earlier discussion. Hopefully longitudinal data collected over the next decade will better inform critical stakeholders of the need to address the African "brain drain", a well documented phenomenon still not fully appreciated by all stakeholders.[65]

Burden of disease

Not only are sub-Saharan African public health care services inadequately funded and insufficiently staffed, but the burden of disease, particularly the four global pandemics – HIV /AIDS, tuberculosis, malaria and measles – place further strain on health care service demands. In addition there is an additional emerging epidemic – the diseases of lifestyle, e.g. hypertension, diabetes mellitus, ischaemic heart disease and cerebrovascular disease. The interplay of the critical relationship between the size of the health care workforce and the overall burden of disease, for a given world region, is clearly depicted in Figure 16, taken from the WHO World Health Report for 2006.[4] This simple figure clearly demonstrates the magnitude of the problem – approximately 5% of the world's health care workforce is dealing with 25% of the global burden of disease.

Figure taken from the World Health Report, 2006[4]

Figure 16. *Distribution of health care workers by burden of disease for the six world regions, as defined by the WHO*

Indeed, minimum standards of health care are currently being overwhelmed by the imbalance between the burden of disease in sub-Saharan Africa and the available workforce. Some simple data illustrate the extent of the problem. It has been estimated that at least one million additional health care workers are currently required in sub-Saharan Africa to deliver the health services necessary to meet the Millennium Development Goals by 2015.[66] Sub-Saharan Africa is currently the only world region unlikely to meet these goals by 2015. At best, given the current workforce, Africa is only likely to meet these targets by 2050.[67]

A detailed discussion of the burden of disease borne by sub-Saharan Africa is clearly beyond the scope of this thesis. A brief outline of the HIV /AIDS pandemic, however, serves as a useful example to highlight the major differences between the developing and developed world. By 2004 it was estimated that there were at least 39.4 million HIV-positive people living in the world,[68] and that more than 20 million had already died since the first cases were described in the early 1980s.[69] Figure 17, taken from a recent review paper by Hamers and Downs, indicates that the epidemic is largely contained in the developed world regions, e.g. Western Europe.[70] The sharp decline in the incidence of new AIDS cases and AIDS-related deaths in Western Europe can largely be ascribed to the efficient use of highly active antiretroviral therapy (HAART) and public health campaigns focusing on safe sex and /or intravenous drug use practices.[70] An appropriately skilled medical workforce of sufficient size was clearly also required to effect these changes.

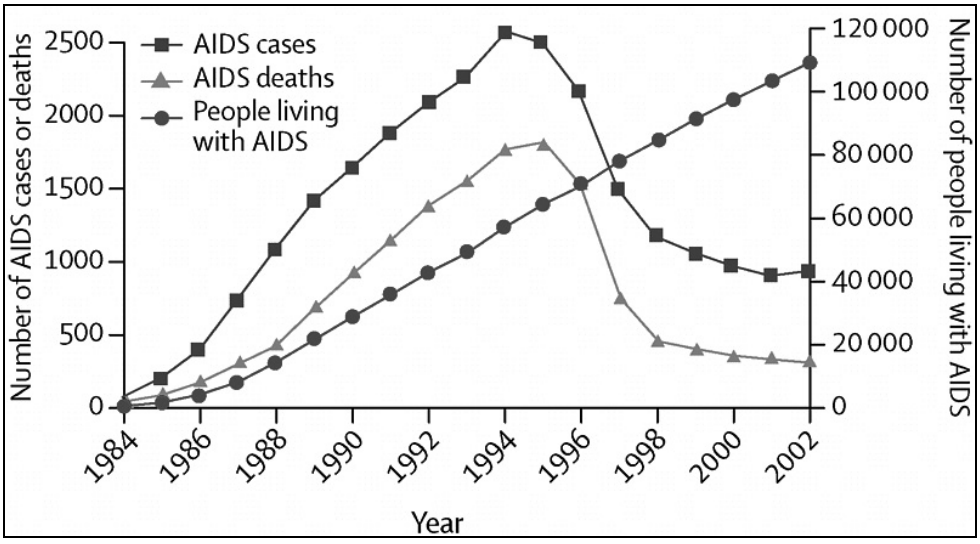
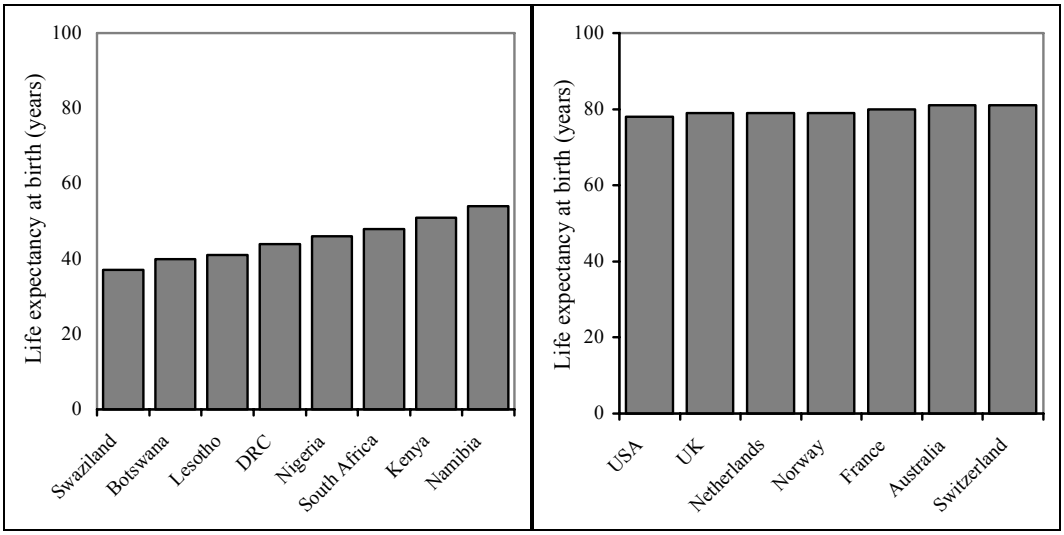


Figure taken from Hamers and Downs, 2004[70]

Figure 17. *Trends in AIDS incidence, AIDS deaths and AIDS prevalence in Western Europe*

The situation in sub-Saharan Africa, the epicentre of the global HIV /AIDS pandemic, does not in any way reflect the circumstances described in Western Europe. By the end of 2002, it was estimated that more than 25 million HIV-positive people, approximately 64% of the world's HIV-infected population at that time, were resident in this world region.[71] Within this world region there are, however, significant variations in HIV prevalence with Southern Africa (25.7%) reporting a higher prevalence than East (11.4%) or West Africa (4.3%).[71] Within Southern Africa HIV infection is present in approximately one third or more of people residing in some countries, e.g. Botswana (37.3%) and Swaziland (38.8%).[71] Although the national

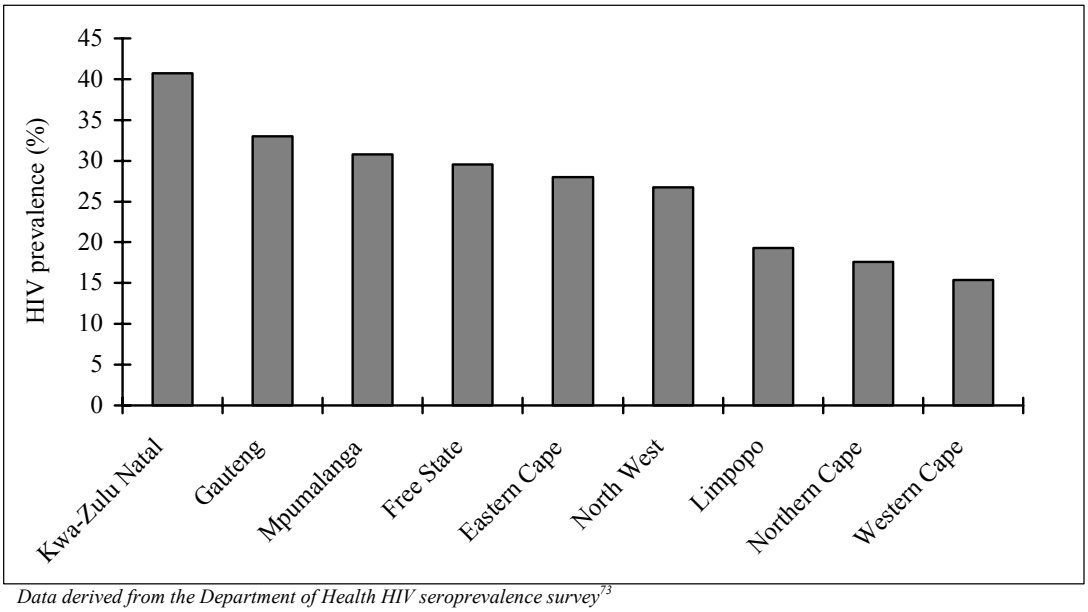
prevalence figure for South Africa (29.5%) is less than for some other countries in the region, the impact of the HIV /AIDS epidemic is greatest in this country because of the absolute size of its population – an estimated 5.6 million people are HIV-infected in South Africa.[71] The devastating impact that this epidemic has had on life expectancy in sub-Saharan Africa, as compared to the developed world, is shown in Figure 18. Adult life expectancy in African countries where HIV prevalence is high ranges from 37-51 years, in contrast to the average life expectancy of 71-81 years in developed world nations.



Data derived from the World Health Report 2006[4]

Figure 18. *Life expectancy in selected countries in Africa and the developed world*

In South Africa, the epicentre of the African HIV /AIDS pandemic, with more than 5 million infected people, the estimated cumulative mortality currently exceeds 1.2 million people.[72] A recent antenatal survey data, an internationally accepted indicator of disease prevalence in developing countries, shows the marked inter-provincial variation in the estimated prevalence of HIV infection, ranging from figures as low as 15.4% in the Western Cape to the highest national prevalence figure of 40.7% in Kwa-Zulu Natal (Figure 19).



Data derived from the Department of Health HIV seroprevalence survey[73]

Figure 19. *Estimated provincial HIV prevalence data, 2004*

Caution is, however, required when interpreting this data. More than 45% of all South Africans reside in the three provinces where HIV infection prevalence figures exceed 30%, not unlike Botswana and Swaziland. Thus, the national prevalence figure of 29.5% seriously underestimates the prevalence trend in the most densely populated provinces of the country. Furthermore, a recent survey of HIV prevalence amongst women attending antenatal clinics in the Western Cape indicated a significant variation in HIV infection prevalence within the 25 defined health care districts; the estimated adult prevalence varied from 1.2% to 33.0%.[74] Since more than 25% of the Western Cape's total population resides in the two Cape Town metropolitan health care districts[2] with the highest HIV infection prevalence, provincial averages are masking district trends in the same manner that the national average is masking provincial trends.

While the HIV /AIDS epidemic has clearly reached a crisis situation, there are other equally important priority health care needs in this world region, e.g. tuberculosis, malaria and measles.[4] Further elaboration regarding the size of these epidemics is beyond the scope of this thesis. The point has been made – the overwhelming clinical workload of the disease burden in sub-Saharan Africa, including South Africa, is seriously threatening to undermine the quality and sustainability of medical training programmes in this world region. While a warning has been sounded about the potential medical education crisis being precipitated by the African medical "brain drain",[57] the impact of the overwhelming burden of disease has not provoked a

similar response in the literature. It seems that the potential implications of the situation are not widely recognised in the developing world[75] and of limited consequence to the developed world.

Summary

South Africa is home to more than 45 million people, 90% of whom are black (including black African, Coloured – people of mixed ancestry and Indian or Asian). Despite being the wealthiest country in sub-Saharan Africa, there are vast discrepancies between the gross national income (GNI) of South Africa and developed world countries, e.g. South Africa's GNI is only one third to one quarter that of countries such as the UK or the USA, respectively. Furthermore, there are huge discrepancies in the distribution of wealth within the country. Approximately 57% of the total population live below the poverty margin and more than 60% of white people live in the two wealthiest provinces. This is largely the persisting legacy of more than 40 years of enforced racial segregation policies.

Within the constraints of this political legacy eight government-funded medical schools have been training doctors since 1900 when the University of Cape Town first admitted white medical students. There were no training facilities for black African medical students until 1951 when three medical schools for black students were opened (1951, 1977, 1986). Historically White universities (HWU) started admitting black students in the 1980s, despite racial segregation policies still being in place. Restricted access to HWUs was only completely abolished after the first democratic election in 1994. Currently there are approximately 8 500 medical enrolments and 1 300 graduates nationally per year. Approximately 61% of graduates are derived from the HWUs.

Until recently, South African medical schools followed the traditional British model of undergraduate and postgraduate medical education. The process of radical political reform, particularly the transformation of health care and higher education, as well as international trends in medical education have, however, served as powerful catalysts for a process of major undergraduate curriculum reform. This has included: (1) implementation of problem-based learning methods, to a greater or lesser extent, in six schools, (2) a shift towards community-based education in all schools, (3) shortening of six-year programmes to five-year programmes in three schools and (4) the introduction of a graduate-entry programme in one school. Postgraduate training programmes are also undergoing a process of reform, but lag behind undergraduate trends. One of the critical issues being targeted in postgraduate education, as a matter of national priority, is the review of high stakes assessment practices.

While significant health care and educational reforms have been achieved in the past decade, a number of major challenges currently face clinician-educators wishing to maintain and further improve the quality of medical education, specifically assessment practices, in this developing country. These challenges include: (1) powerful political forces driving redress of previous racial inequalities that continue to hamper the training of black medical students, particularly black African students; (2) the restructuring of health care services, particularly better primary health services, so as to provide equitable, accessible health care for all; (3) achieving the desired outcomes articulated in the recently published national programme training and accreditation guidelines issued by the Health Professions Council of South Africa (HPCSA) – both documents address the priority assessment advances outlined in the literature review of this thesis; (4) the inability of the limited number of public service doctors to continue providing adequate health care services and function as clinician-educators for medical training programmes located in the public service; (5) the potential impact of the ongoing medical "brain drain" on the sustainability of good-quality medical training programmes; (6) the massive burden of disease, particularly the HIV /AIDS pandemic, threatening the future of both health care services and medical training programmes in South Africa. Each of these points is briefly summarised.

The need to radically alter the ethnic profile of medical enrolments and graduates is a matter of national priority. Although more than 60% of enrolments in some HWU are now black, including up to 30% black African students at two of five institutions, further transformation is required. This includes admission of significant numbers of educationally disadvantaged black students to medical schools traditionally admitting academically outstanding candidates only. The financial and human resource implications of ensuring the academic success of these at-risk students are a major priority and challenge to all schools. Currently, at least 50% of graduates are black; up to 24% are black African at one HWU. The need to replicate these findings at other HWU is apparent.

The redistribution of financial resources required to improve primary health care services in South Africa has severely impacted upon academic training centre resources, particularly human resources and in-patient services. Between 1995 and 2000, the Western Cape province, home to two medical schools, closed 24% of its provincial tertiary service in-patient beds and terminated the services of 28% of health and support personnel. While the development of primary care services are clearly a priority, the "knock-on" effect on training institutions has not been fully appreciated until recently. The impact of major resource limitations is now being felt by training programmes, and innovative ways of dealing with the infrastructural and human resource shortages are urgently being addressed.

The per capita health expenditure in South Africa is less than 10% of that of developed world countries like the Netherlands. Furthermore, only 38% of national health expenditure funds service provision for approximately 85% of South Africans who do not have any form of private health care insurance. However, the situation is more serious than just an issue of inadequate funding. The public service platform is also seriously understaffed. Nationally the doctor per 10 000 population ratio is 7.7; in the public health sector it is currently 2 per 10 000 population, i.e. the WHO minimum for health service provision. This stands in stark contrast to the average of 20-30 doctors per 10 000 population in developed countries. In summary this means that less than 37% of medical doctors working in South Africa are responsible for providing health care for more than 40 million people funded by only 38% of the national health expenditure. The gross inequalities of this situation are apparent.

This situation is, however, further aggravated by the training and supervision needs of medical trainees located within the public service sector. Up to 50% of training, supervision and assessment of medical students in developing countries are conducted by non-university staff, i.e. doctors working in the public sector. This added burden accounts for much of the tension between teaching, training and service delivery commonly expressed by doctors working in the public service. The situation is further complicated by increasing tension between the major stakeholders – the universities need significant teaching and training assistance from doctors employed by the national government to deliver clinical service.

The extent of the medical "brain drain" from sub-Saharan Africa is increasingly well quantified. This world region has now been identified as the major donor region of the world – more than one third of the top 20 donor countries in the world are located in this region. Specifically, Ghana, South Africa and Nigeria have been identified as the top three source countries in the world using an emigration factor calculation that mathematically expresses physician emigration as a function of the total workforce remaining in the donor country. Three of South Africa's HWUs head the top 10 "export" medical schools list in the world. Thus, South Africa's "brain drain" problem is amongst the worst in the world. Of greater concern, however, from an educational perspective, is the percentage of emigrating experienced clinician-educators. This has not been quantified to date, but probably represents a bigger subset of the "brain drain" population than may be currently speculated.

Data recently released by the HPCSA indicate that the number of doctors registered in South Africa has remained stable over the past three years. These figures are, however, of limited value. Data over the past decade are needed to establish migratory trends. The suggestion by the national government that medical graduate output needs to double, i.e. at least 2 400 graduates per annum as compared to 1 300 currently, suggests a recognition of service needs in keeping with the Millennium Development Goals prediction – Africa needs one million

additional health workers to achieve these goals by 2015. Failing that, the current workforce is only likely to meet the goals by 2050.

The overwhelming burden of disease in sub-Saharan Africa is perhaps the single greatest threat to sustainable health care and medical education. Approximately 5% of the world's medical workforce is trying to deal with 25% of the global burden of disease located in sub-Saharan Africa. The HIV /AIDS pandemic serves as a good example. At least 25 million HIV-positive people reside in sub-Saharan Africa. National infection prevalence data are the worst in Southern African countries; 30% or more. This has effectively halved life expectancy in the worst affected countries, i.e. 37-51 years in high HIV prevalence African countries as compared to 71-81 years in developed world countries like the UK, the Netherlands and the USA. The health care implications of this pandemic are apparent. However, the impact thereof on the sustainability of medical teaching programmes, located within the already overcrowded public health care system responsible for dealing with this pandemic, has not been considered at all. The situation is considerable aggravated by the fact that HIV /AIDS is only one of a number of epidemics in Africa; other important killer diseases include tuberculosis, malaria and the emerging epidemic of lifestyle-related diseases, e.g. hypertension, diabetes mellitus, ischaemic heart disease and cerebrovascular disease. Taking these additional disease epidemics into consideration paints an even bleaker picture for medical education in sub-Saharan Africa.

From an educational perspective it is critical to recognize that medical education in sub-Saharan Africa, including South Africa, is in trouble. The massive ongoing loss of trained health professionals, in excess of production capacity, and the overwhelming burden of disease are seriously threatening the sustainability of current medical training programmes in this world region. Implementing educational advances, specifically those referred to in the literature review, and endorsed by the HPCSA national training and accreditation guidelines, seem almost impossible unless the advice of Schuwirth and van der Vleuten is heeded – "Rather than adopting a method that has been successful in a certain situation, one should adopt the underlying concepts and translate them to fit the unique demands of the local situation." Indeed, adopting this approach to medical education, specifically in extremely resource-constrained environments typical of public health care practice in Africa today, is the only way forward. This approach will need to be applied in an exponential fashion if African medical schools, including those in South Africa, are to keep abreast of medical education innovations and advances in resource-constrained settings that developed world countries do not even begin to comprehend.

Concluding remarks

This chapter has outlined the stark reality of the extreme resource constraints within which medical education in sub-Saharan Africa exists. Most of the data has described the situation in South Africa, the wealthiest country in sub-Saharan Africa. In the next chapter I outline six questions pertaining to assessment practice advances highlighted in the literature review in Chapter 1. These six questions are systematically addressed in the chapters that follow on Chapter 3.

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