Implications of mortality transition for primary health care in rural South Africa: a population-based surveillance study

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Summary

Background In southern Africa, a substantial health transition is underway, with the heavy burden of chronic infectious illness (HIV/AIDS and tuberculosis) paralleled by the growing threat of non-communicable diseases. We investigated the extent and nature of this health transition and considered the implications for primary health care.

Methods Health and sociodemographic surveillance started in the Agincourt subdistrict, rural South Africa, in 1992. In a population of 70 000, deaths (n=6153) were rigorously monitored with a validated verbal autopsy instrument to establish probable cause. We used age-standardised analyses to investigate the dynamics of the mortality transition by comparing the period 2002–05 with 1992–94.

Findings Mortality from chronic non-communicable disease ranked highest in adults aged 50 years and older in 1992–94 (41% of deaths [123/298]), whereas acute diarrhoea and malnutrition accounted for 37% of deaths (59/158) in children younger than 5 years. Since then, all-cause mortality increased substantially (risk ratio 1·87 [95% CI 1·73–2·03]; p<0·0001) because of a six-fold rise in deaths from infectious disease affecting most age and sex groups (5·98 [4·85–7·38]; p<0·0001), and a modest increase in deaths from non-communicable disease (1·15 [0·99–1·33]; p=0·066). The change in female risk of death from HIV and tuberculosis (15·06 [8·88–27·76]; p<0·0001) was almost double that of the change in male risk (8·13 [5·55–12·36]; p<0·0001). The burden of disorders requiring chronic care increased disproportionately compared with that requiring acute care (2·63 [2·30–3·01]; p<0·0001 *vs* 1·31 [1·12–1·55]; p=0·0003).

Interpretation Mortality from non-communicable disease remains prominent despite the sustained increase in deaths from chronic infectious disease. The implications for primary health-care systems are substantial, with integrated chronic care based on scaled-up delivery of antiretroviral therapy needed to address this expanding burden.

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Introduction

The heavy burden and public awareness of HIV/AIDS, tuberculosis, and malaria in sub-Saharan Africa should not obscure recognition of the substantial health transition that is underway, and the implications of this transition for the delivery of effective primary health care. Moreover, as availability and coverage of highly active antiretroviral therapy (HAART) extends and takes effect, with ensuing improvements in life expectancy, the constraint exerted on cardiovascular and other chronic non-communicable diseases will be loosened, leading to a probable upswing in mortality, morbidity, and risk related to such diseases.

Primary health-care systems have mainly evolved in a pre-transitional era and have adapted little to the growing demand for continuous, long-term care. However, to respond effectively to personal and community needs, and to enhance the effect of services, primary health-care systems should develop an approach to the management of chronic diseases. The imperative of HIV/AIDS, and particularly the urgent need to deliver HAART, is driving the development of health systems in large parts of sub-Saharan Africa. Therefore the opportunity exists to harness this effort and ensure that it is applied to management of both chronic infectious and non-communicable diseases. Up until now, however, public-sector systems supporting primary health care have not been regarded as the approach of choice for management of HIV/AIDS and related illness. Instead, funders and programme leaders have opted to establish new, dedicated programmes rather than invest in strengthening the existing comprehensive but generally weak delivery platforms that are common to the public-health sector.

Influenced by the ideals of the Alma-Ata Declaration,[1] the new South African Government in 1994 articulated a policy of district health development that centred on primary health care. This idea remains national policy, with President Mbeki using his State of the Nation address to emphasise "accelerating our advance towards the achievement of the goal of health for all".[2] Although the envisaged health gains have not materialised,[3] the country could yet turn a corner.

With comprehensive cause-specific mortality data from a border region of rural southern Africa from 1992 to 2005, supplemented by available morbidity and risk data, we aimed to investigate the extent and nature of the

health transition that is underway and to consider the implications for primary health care.

Methods

Study setting and population

The Agincourt subdistrict includes about 70 000 people in 11 500 households and 21 villages. It covers 402 km² in rural northeast South Africa, adjacent to its border with Mozambique. The Agincourt population has been under continuous health and sociodemographic surveillance by the MRC/Wits Rural Public Health and Health Transitions Research Unit since 1992. This surveillance preceded the advent of democracy, was introduced to inform policy about decentralised health systems development, covers the first decade of profound sociopolitical change, and documents the accelerating effect of the HIV/AIDS epidemic. Migration after the Mozambican civil war led to immigrants comprising almost a third of the population.

Similar to much of rural southern Africa, the Agincourt subdistrict is a labour-sending area, with most adults seeking work in industrial, mining, or agricultural centres elsewhere, and offers limited local employment and farming opportunity. Household income comes from migrant remittances and employment in the public sector, and through tourism. In South Africa, social transfers (pensions and child-support grants) have a crucial role in redistribution of income to poor households. Migrant labour is a constant feature, involving some 60% of men aged 30–54 years and a quarter of women aged 25–49 years.[4] The area has poor infrastructure despite improvement to electricity and water supply. Health facilities include a health centre with five satellite clinics and three district hospitals that are 25–60 km away from Agincourt.

Demographic transition has been shown by a sustained decrease in fertility since the mid-1970s which, most unusually, has stabilised at near replacement level with little recent change in population size.[5] Decreases in mortality were sustained until the mid-1990s when the HIV/AIDS epidemic took off, inducing a major reversal in mortality in young adults and children younger than 5 years.[6] By 2005, life expectancy at birth had fallen by 12 years for women and by 14 years for men.[7]

Data collection

Health and sociodemographic surveillance included registration of the entire subdistrict population through a baseline census in 1992, and subsequent prospective follow-up through yearly updates that systematically recorded basic demographic events (births, deaths, and migrations).[8] Household interviews were undertaken by experienced fieldworkers who interviewed the most knowledgeable adult available, verified existing data, and carefully recorded new events. Data were entered onsite, had many validity checks, and were stored and manipulated in a secure relational database. Quality assurance included field and data checks to ensure robust numerator and denominator data for the calculation of rates.

For every death, a probable cause was established through a verbal autopsy that was undertaken by lay fieldworkers.[8] The fieldworker gathered information from a close caregiver about signs and symptoms of the terminal illness, lifestyle behaviours, and treatment sought. Cause of death was established through physician assessment of the verbal autopsy, and all diagnoses were coded according to the International Classification of Diseases (ICD-10). When two physicians working independently reached the same diagnosis, this was accepted as the probable cause of death. When their assessments differed and agreement could not be reached, a third physician arbitrated to achieve consensus. This method was validated in Agincourt in the mid-1990s.[9] After revalidation to assess the validity of HIV/AIDS diagnoses, HIV/AIDS and tuberculosis were combined, resulting in sensitivity and specificity approaching 80% for the one category. HIV/AIDS and tuberculosis share similar signs and symptoms, resulting in misclassification when attempting to distinguish the two on verbal autopsy. Both diseases commonly co-exist, especially in younger adults, justifying their combination into one HIV and tuberculosis category.

With expert guidance from physician-researchers experienced in the clinical management of children and adults, we classified every death as requiring either acute or chronic care. Acute disorders were defined as potentially curable with up to 1 month of appropriate treatment, and chronic disorders as either incurable or requiring more than 1 month of treatment. We assigned an undetermined cause of death to a category of unknown care.

All surveillance-based studies were reviewed and approved by the Committee for Research on Human Subjects (Medical) of the University of the Witwatersrand, Johannesburg, South Africa (protocol M960720). Informed consent was obtained at individual and household level at every follow-up visit, whereas community consent from civic and traditional leadership was secured at the start of surveillance and reaffirmed from time to time.

Statistical analysis

We calculated period (1992–94, 1995–97, 1998–2001, and 2002–05), sex-specific, age-specific, all-cause, and cause-specific mortality rates by dividing deaths by person-years exposed within each category. Mortality rates by health-care category (acute or chronic) were calculated in the same way. We calculated age-standardised crude death rates using the standard age structure from the International Network for the Demographic Evaluation of Populations and Their Health (INDEPTH), which is a standard appropriate for sub-Saharan Africa.[10] The top five causes of death by period and age were

For more about the **International Network for the Demographic Evaluation of Populations and Their Health (INDEPTH)** see http://www.indepth-network.org

identified as percentages of total deaths within each category. We used Microsoft SQL Server 2005 for data management and extraction, and did all analyses with Stata (Intercooled version 9.0 and SE 10.0) and Microsoft Excel.

Role of the funding source

The sponsors of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

Results

Table 1 presents age-standardised death rates for four periods from 1992 to 2005, showing that mortality rates have increased substantially since the mid-1990s. All rate ratios indicate change in the most recent period (2002–05) relative to the base period (1992–94). All-cause mortality increased by 87% over the whole period, largely because of a six-fold rise in infectious and parasitic disease and a modest increase in non-communicable disease (table 1). The increase in infectious and parasitic disease mortality was significant in all age and sex groups apart from children aged 5–14 years (for whom the change in HIV and tuberculosis mortality was significant; p=0·012) and adults 65 years and older (data not shown). The increase in mortality from non-communicable disease was significant for males (rate ratio 1·32 [95% CI 1·08–1·60]; p=0·006) but showed little change for females (1·02 [0·82–1·60]; p=0·85). Age-specific mortality from non-communicable disease increased significantly in adults who were 30 years and older (1·22 [1·02–1·46]; p=0·026); the change in younger age-groups was not significant. By contrast, external causes remained constant at a fairly high level of mortality (table 1). Undetermined causes increased significantly, partly because of the emergence of HIV/AIDS which can be difficult to assess by verbal autopsy.

With respect to increased infectious and parasitic disease mortality, the change was driven by HIV and tuberculosis (rate ratio 10·75 [7·89–14·63]; p<0·0001), with the change in female risk of death (15·06 [8·88–27·76]; p<0·0001) almost double the change in male risk (8·13 [5·55–12·36]; p<0·0001). Other infectious diseases that significantly increased mortality rates included acute respiratory infections, which were probably affected by co-morbidity with HIV/AIDS, and malaria, which was possibly affected by inadequate control measures in neighbouring countries.[11] With respect to non-communicable disease, change was less evident because of the overwhelming effect of HIV and tuberculosis. Age-standardised rates for deaths due to diabetes increased significantly, although numbers were small (2·57 [1·20–6·32]; p=0·008); this finding was also true for the conditions grouped into the category termed other non-communicable diseases (1·50 [1·01–2·28]; p=0·038). In adults aged 65 years and older, deaths due to vascular disease (stroke, ischaemic heart disease, and hypertensive diseases) increased by 65% (1·65 [0·99–2·76]; p=0·056) and deaths due to malignant neoplasms (excluding female genital malignancies) more than doubled (2·20 [1·04–4·66]; p=0·040).

Table 2 ranks the five most common causes of death from 1992 to 2005. The early 1990s were characterised by diseases of poverty in children (acute diarrhoea and malnutrition made up nearly 40% of deaths), accidents and violence in those aged 15–49 years, and non-communicable disease in middle-aged and older adults (aged ≥50 years). The mid-1990s was the turning point: over the ensuing decade, mortality from HIV and tuberculosis increased from little over 10% to a third of all deaths in children younger than 5 years; from a fifth to almost half of deaths in those aged 15–49 years; and from a sixth to more than a quarter of deaths in people aged 50–64 years (table 2). In people aged 15–49 years, violent and accidental deaths were displaced by HIV and tuberculosis as the top ranking cause by the mid-1990s, but remained in second and third place over the remaining years (table 2). In women aged 15–49 years, obstetric deaths ranked first in the early period but not subsequently (data not shown). In adults aged 50–64 years, non-communicable disease took the top five places in the early 1990s, with vascular disease ranked first. By the mid-1990s, HIV and tuberculosis were ranked first, followed by vascular and other cardiac disorders (table 2). Non-communicable disease and tuberculosis dominated in the oldest age group throughout, with vascular disease constituting the largest proportion of deaths from the mid-1990s; by the late

	Years				Relative change	
	1992–94	1995–97	1998–2001	2002–05	RR (95% CI)	p value
Broad cause categories						
All causes	593	604	737	1111	1·87 (1·73–2·03)	<0·0001
Infectious and parasitic diseases	74	147	255	446	5·98 (4·85–7·38)	<0·0001
Non-communicable diseases	197	158	187	227	1·15 (0·99–1·33)	0·066
External causes*	76	63	61	72	0·95 (0·74–1·21)	0·673
Ill defined or unknown	198	178	115	237	1·19 (1·03–1·38)	0·019
Broad health-care categories						
All health care	593	604	737	1111	1·87 (1·73–2·03)	<0·0001
Acute care†	162	148	192	212	1·31 (1·12–1·55)	0·0003
Chronic care‡	209	230	330	550	2·63 (2·30–3·01)	<0·0001
Ill defined/unknown care§	222	225	215	348	1·57 (1·37–1·80)	<0·0001

All rates are per 100 000 person years (N=6153). RR=rate ratio. All rate ratios indicate change in last time period (2002–05) relative to first period (1992–94). *External causes include homicide, suicide, road traffic accidents, accidental injuries. †Acute care: for disorders that are potentially curable with up to 1 month of appropriate treatment. ‡Chronic care: for disorders that are incurable or need more than 1 month of appropriate treatment. §Difficult to classify as acute or chronic care.

Table 1: **Age-standardised death rates for broad cause categories and broad health-care categories in Agincourt subdistrict, 1992–2005**

	1992–94		1995–97		1998–2001		2002–05	
0–4 years of age								
Total		158		140		336		417
1	Diarrhoea	31 (20%)	Diarrhoea	33 (24%)	HIV/tuberculosis	73 (22%)	HIV/tuberculosis	141 (34%)
2	Malnutrition	28 (18%)	HIV/tuberculosis	16 (11%)	Diarrhoea	39 (12%)	Diarrhoea	43 (10%)
3	Perinatal disorders	12 (8%)	Acute respiratory infection	11 (8%)	Acute respiratory infection	34 (10%)	Acute respiratory infection	32 (8%)
4	Accidental injuries	9 (6%)	Malnutrition	9 (6%)	Perinatal disorders	30 (9%)	Malnutrition	32 (8%)
5	Other infectious and parasitic diseases	8 (5%)	Accidental injuries	6 (4%)	Malnutrition	26 (8%)	Perinatal disorders	23 (6%)
5–14 years of age								
Total		28		37		50		75
1	Other NCDs*	7 (25%)	Malaria	4 (11%)	Accidental injuries	12 (24%)	Accidental injuries	11 (15%)
2	Road traffic accidents	4 (14%)	Other NCDs*	3 (8%)	Malaria	6 (12%)	HIV/tuberculosis	11 (15%)
3	Epilepsy	3 (11%)	Accidental injuries	3 (8%)	HIV/tuberculosis	5 (10%)	Road traffic accidents	9 (12%)
4	Congenital	3 (11%)	HIV/tuberculosis	3 (8%)	Suicide	5 (10%)	Other NCDs*	5 (7%)
5	Accidental injuries	3 (11%)	Road traffic accidents	2 (5%)	Road traffic accidents	3 (6%)	Other infectious and parasitic	4 (5%)
15–49 years of age								
Total		159		251		609		1352
1	Assault	27 (17%)	HIV/tuberculosis	53 (21%)	HIV/tuberculosis	252 (41%)	HIV/tuberculosis	651 (48%)
2	Road traffic accident	14 (9%)	Assault	25 (10%)	Assault	32 (5%)	Assault	37 (3%)
3	HIV/tuberculosis	13 (8%)	Road traffic accident	22 (9%)	Road traffic accident	32 (5%)	Road traffic accident	35 (3%)
4	Other cardiac disorders†	10 (6%)	Other NCDs*	12 (5%)	Other NCDs*	28 (5%)	Malaria	29 (2%)
5	Neoplasms‡	9 (6%)	Neoplasms‡	11 (4%)	Malaria	24 (4%)	Other NCDs*	27 (2%)
50–64 years of age								
Total		105		154		217		453
1	Vascular disease§	20 (19%)	HIV/tuberculosis	24 (16%)	HIV/tuberculosis	38 (18%)	HIV/tuberculosis	126 (28%)
2	Chronic liver disease¶	8 (8%)	Vascular disease§	10 (6%)	Vascular disease§	26 (12%)	Vascular disease§	31 (7%)
3	Other cardiac disorders†	7 (7%)	Other cardiac disorders†	10 (6%)	Other NCDs*	10 (5%)	Other cardiac disorders†	31 (7%)
4	Other NCDs*	7 (7%)	Other NCDs*	10 (6%)	Neoplasms‡	10 (5%)	Other NCDs*	26 (6%)
5	Neoplasms‡	6 (6%)	Assault	9 (6%)	Female genital neoplasms	10 (5%)	Neoplasms‡	22 (5%)
≥65 years of age								
Total		193		355		479		578
1	Other cardiac disorders†	30 (16%)	Vascular disease§	39 (11%)	Vascular disease§	62 (13%)	Vascular disease§	76 (13%)
2	Vascular disease§	18 (9%)	Other cardiac disorders†	33 (9%)	Neoplasms‡	49 (10%)	Other cardiac disorders†	58 (10%)
3	Tuberculosis||	15 (8%)	Tuberculosis||	24 (7%)	Other cardiac disorders†	38 (8%)	Neoplasms‡	54 (9%)
4	Neoplasms‡	8 (4%)	Neoplasms‡	20 (6%)	Tuberculosis||	31 (6%)	Tuberculosis||	28 (5%)
5	Chronic liver disease¶	5 (3%)	Diarrhoea	18 (5%)	Other NCDs*	29 (6%)	Other NCDs*	26 (4%)

NCD=non-communicable diseases. *Includes disorders omitted from other categories such as anaemia, dementia, chronic obstructive pulmonary disease, asthma, peptic ulcer disease, etc. †All circulatory system diseases excluding hypertensive disease, ischaemic heart disease, and cerebrovascular disease. ‡All malignant neoplasms excluding those of female genital organs. §Cerebrovascular disease, ischaemic heart disease, and hypertensive disease. ¶Excludes all infectious causes. ||The combined HIV/tuberculosis category was not used in the oldest age group because of the virtual absence of HIV/AIDS deaths.

Table 2: **Five most common causes of death by age and time period in Agincourt subdistrict, 1992–2005**

1990s, non-communicable diseases had displaced tuberculosis from third to fourth place (table 2). Although numbers are small in the 5–14 year age-group, accidents remained most common overall, although we noted a growing number of deaths from HIV and tuberculosis (table 2).

We also classified diseases according to the type of patient care that they required (acute or chronic). Mortality rates in each care category increased over time, indicating an overall increasing care burden on the health system (table 1 and the figure). Notably, the burden of disorders requiring chronic care increased disproportionately relative to the burden requiring acute care (table 1 and the figure).

Discussion

Changes in mortality patterns provide insight into the evolving course of health transition in South Africa. In all but the oldest age group, HIV and tuberculosis has had an overwhelming effect, supressing deaths due to acute infection and malnutrition in children, injury in people aged 15–49 years, and non-communicable disease in adults aged 50–64 years. However, non-communicable diseases had already emerged as prominent causes of death in middle-aged adults during the pre-HIV era (table 2). Despite the rise in mortality due to HIV and tuberculosis, and related infectious disease, mortality from non-communicable disease remains evident,

particularly in males for whom the relative increase in HIV and tuberculosis mortality, although substantial, was much less than that for females. Significantly rising mortality is not limited to younger age groups, but is pronounced in adults aged 40–59 years and even older.[12] Thus, were it not for HIV and tuberculosis, we suggest that mortality from non-communicable disease would be higher.

Because census updates occur only once a year in the Agincourt subdistrict, a small number of events might have been missed—eg, when a death occurs soon after birth and then both are not reported by the household respondent. This limitation could result in slightly lowered estimates of infant mortality, although the problem affects a very small proportion of births and would not affect our findings or conclusions.

Complementary research in Agincourt has focused on stroke morbidity and cardiovascular risk. Thorogood and colleagues' findings in 2003 from the Agincourt subdistrict showed substantial prevalence of hypertension in men and women (more than a quarter of adults aged 35–49 years and more than two-fifths of all adults 35 years and older); pronounced obesity in women (mean body-mass index of 27·2 kg/m² in women 35 years and older); more frequent cigarette smoking in men than in women; and modest cholesterol and high HDL-cholesterol concentrations compared with typical high-income populations (webtable).[13] This risk factor profile is reflected in vascular disease morbidity. The prevalence of stroke in Agincourt in 2001 was about half that typically recorded in high-income regions of the world, with an age-standardised prevalence of 290 (95% CI 238–343) per 100 000 people aged 15 years and older, but double that noted elsewhere in Africa.[14] Stroke prevalence increased with age, as it did elsewhere. Age-specific prevalence was similar in adults aged 45–54 years (598 per 100 000) to that recorded in New Zealand (615 per 100 000), but was lower in other age groups.[14,15] These data accord with an anticipated increase in vascular non-communicable disease in younger age groups during transition. Despite fairly favourable cholesterol concentrations, there is evidence of subclinical peripheral atheroma in the study population, and adults 35 years and older had a distribution of the ankle brachial index which was similar to that noted in high-income populations with peripheral vascular disease.[16] Although sub-Saharan Africa is usually cited as a region in the earliest stage of epidemiological transition,[17] this risk and morbidity profile suggests a population in a later stage of transition, one that is typically dominated by hypertension-related disease. Moreover, there is potential for the rural Agincourt population to advance yet further to a stage which is typified by the emergence of ischaemic heart disease, as has already occurred in people from urban South Africa.[18]

Agincourt is one of 37 sites in the developing world that make up the INDEPTH network and undertake prospective monitoring of populations living in defined geographic areas. A comparison of mortality profiles from surveillance sites during 1999–2003 showed that malaria-related mortality was highest in west African sites, with AIDS-related mortality highest in South Africa. Nevertheless, all regions showed emerging cardiovascular mortality, with malignant neoplasms, diabetes, and digestive disorders also being important.[19] Findings from sites in urban settings such as Dar-es-Salaam (Tanzania),[20] Nairobi (Kenya), and Bissau (Guinea-Bissau) reinforce this emerging trend (unpublished data).

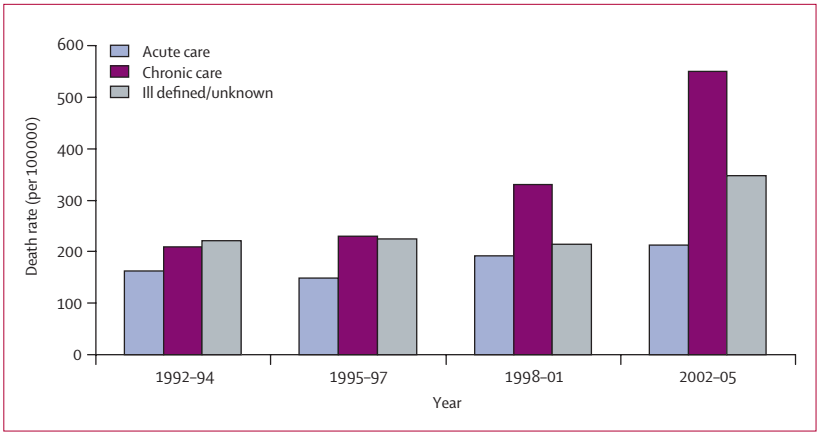

Figure: **Age-standardised death rates by health-care categories in Agincourt subdistrict, 1992–2005**

Growing evidence draws attention to the prevalence of hypertension in rural and urban locales across the continent.[21–23] This finding affirms the conclusion that rising blood pressure levels, increasing stroke prevalence and associated mortality,[20,24,25] and emerging ischaemic heart disease[26] are indicators of African communities that are already advancing through early stages of cardiovascular transition.[27]

Projections forecast that in sub-Saharan Africa, despite the excess mortality due to AIDS, the number of people aged 60 years and older will double from 34 million in 2005 to more than 67 million in 2030—a rate of growth which is greater than that in industrialised countries.[28] Older adults contend with an extremely stressful reality: high morbidity and mortality from HIV/AIDS leaves them responsible for the care of their own sick children and for the wellbeing of their grandchildren. They themselves, however, are at risk not only for HIV/AIDS but also for stroke, diabetes, hypertension, and related chronic disorders (table 2). The health transition is thus directly and indirectly affecting three generations, with the oldest of these, who have an irreplaceable social role, clearly vulnerable to chronic non-communicable diseases.

For local health systems development, national and especially subnational data are essential. The Agincourt data series conveys robust information that is well suited to consideration of the challenges facing primary health-care systems. Evidence suggests that, in the same community and to a substantial degree, chronic infectious

Panel: Management of chronic non-communicable disease in Agincourt

As in much of southern Africa, subdistrict services are based on a network of clinics that are staffed by primary-care nurses; support is inadequate, drug supply irregular, and medical supervision sporadic. Recent work examining the management of stroke, blood pressure, and tuberculosis described a major gap in the capacity to manage chronic illness.

Of 103 confirmed stroke survivors, only one was taking aspirin; of 85 with evidence of hypertension, eight were being treated but only one was adequately controlled. Thus no system of secondary prevention seemed to be in operation.[24]

In a survey of adults aged 35 years and older, 43% showed some degree of hypertension; 24% of these patients had used drug treatment in the past week, half of whom had a blood pressure reading less than 140/90 mm Hg, indicating the limits of primary prevention.[33]

Although hospital management of pulmonary tuberculosis was effective, most patients with active disease that was missed, or those who died before receiving treatment, had presented to a local clinic.[33] Some two-thirds of patients, already seen at a clinic, presented to hospital after self-referral or at the insistence of family, friends, or employers, leading to delays in start of treatment.[34] Care-seeking was pluralistic, involving allopathic, traditional, and faith-based healers; notably, however, most first visits were to local clinics, underlining their pivotal role.[34,35]

illness and chronic non-communicable disease coexist; moreover, that the explosive progression of HIV/AIDS mortality has slowed an already advancing transition in non-communicable disease. However, scaled-up efforts at HAART delivery, and the resulting population effect, can be expected to decrease adult mortality and raise life expectancy.[29] Thus, levels of non-communicable disease and risk should rebound in parallel with growing numbers of people who are receiving long-term antiretroviral therapy. Already, however, prevailing mortality patterns—documented in Tanzania at an earlier stage of transition[30,31]—suggest an escalating need for chronic-care services that cut across conventional categories of infectious and non-communicable disease.

Public-health leadership is thus at a crossroads. Failure to grasp the changes underway and adjust the prevailing model of care—which was born in a pre-transitional era and focused on acute, episodic infectious disease management[31,32]—will probably lead to a deteriorating relation between community needs and services provided. And it will be accompanied by progressively demotivated staff, loss of confidence by users, and little effect on population health. The problem is shown by consideration of chronic-disease management in Agincourt (panel).

Placement of integrated chronic care at the centre of primary health-care systems will ensure a comprehensive response to one of the most important health problems confronting local communities. In view of overriding concern with HIV/AIDS in sub-Saharan Africa, major impetus for chronic systems development should derive from efforts to accelerate the delivery of HAART, particularly through decentralising delivery to local level. Further, integration of HAART (and the full package of chronic infectious disease management) within general chronic care could well reduce stigma and enhance access and use.[36] But it will need a different outlook from service leadership and their funders—ie, one that recognises the fundamental compatibility between enhanced HIV/AIDS management and the strengthening of health systems. If scaled-up delivery of HAART can provide the means and opportunity to re-engineer primary health-care systems in an integrated way, rather than foster their further fragmentation, this approach will provide a basis to fully exploit the strengths of primary health care, many of which are still unrealised.

The primary health-care system spans a crucial interface between first-line clinical care, which is generally provided by mid-level health workers, and community-based prevention and promotion, involving a range of community workers, local organisations, and households. It is this level of care that holds much promise for health development in resource-poor settings. Yet for much of sub-Saharan Africa, health-system performance has fallen far below expectations.[37] How then could added complexity, in the form of integrated chronic care, invigorate primary health care?

Arguably, the complexity of establishing effective primary health-care systems has never been properly acknowledged. As a result, the sustained skill and creativity of national planners and the research community have been applied elsewhere. Further, individual recognition and promotion within the public service is generally associated with movement away from local and district levels and into provincial or national offices. These deficits, and not only international funding for single-purpose initiatives, have contributed to the proliferation of vertical programmes that have divided the integrated platform which is needed for effective community-level care. A clearer, more realistic perspective on the challenges presented by primary health care, and the policy, planning, and programming expertise required, could revitalise the research and development efforts that are needed to bring success.

Potential for widespread decentralised provision of HAART is high, and the evidence and experience now exist to support it.[29,38,39] Certainly this is the case in South Africa, where growing numbers of community health centres are belatedly being accredited to deliver comprehensive care, the government has increased available resources, and political support is more overt. The requirements for effective, decentralised provision

	HAART	Chronic NCD care
Primary care facility		
Clinic management	Continuity and coordination	As for HAART
Quality assurance	Continuity and coordination	As for HAART
Clinic infrastructure	Specialised space within general service for counselling, treatment literacy, data capture	As for HAART
Support services	Laboratory; drug supply	As for HAART
Health worker skills and attitudes: training and mentoring; promote morale and motivation	Extend and diversify health-care team: eg, clinical assistants, lay health workers and counsellors, pharmacy and laboratory assistants, data typist	As for HAART
Patient-centred care and support	Decision support; self-management support; patient support groups	As for HAART
Screening	Voluntary counselling and testing; tuberculosis	Blood pressure, blood glucose, lipids, etc
Standard treatment protocols	For HAART, PMTCT, opportunistic infections, tuberculosis	For diabetes, blood pressure, epilepsy, cardiac failure
Interface: facility and community		
Patient adherence: counselling; peer education	Promote patient adherence to reduce risk of drug resistance	Encourage treatment compliance to improve individual outcomes
Prevention and promotion programmes: community awareness/mobilisation; involvement of other sectors	Address issues of stigma	Intervene across disease continuum
Referral systems: community–clinic–hospital	Transport; communication	As for HAART
Community		
Community-based care and support	Community health workers support home-based care; complementary providers: traditional and faith healers; support groups: church-based, revolving funds, income-generating	As for HAART
Primary health-care system		
Monitoring and evaluation	Treatment cohorts; programme coverage and effectiveness	As for HAART

HAART=highly active antiretroviral therapy. NCD=non-communicable disease. PMTCT=prevention of mother-to-child transmission.

***Table 3*: Key elements of primary health care in practice—integration of HAART and chronic non-communicable disease care**

of HAART, and those needed for competent local management of chronic non-communicable diseases, are closely aligned (table 3). Thus the effort, services, and resources which are directed at people and communities infected and affected by HIV/AIDS can be harnessed to fundamentally strengthen a crucial delivery platform for the range of chronic disorders. Doing so would greatly enhance the technical efficiency of key elements of the general primary health-care system, and realise the diagonal—"a strategy in which explicit intervention priorities are used to drive the necessary improvements into the health system".[40]

WHO has given serious attention to formulating and testing frameworks for chronic care systems,[32,41,42] and to the skill-set that is required of multipurpose health workers to support long-term patient-centred care.[31] WHO staff repeatedly note that an incremental approach is unlikely to succeed; rather, that a concerted shift, amounting to the redesign of delivery systems, is needed to achieve meaningful change. The challenge in adapting normative frameworks to underperforming systems in sub-Saharan Africa should not be underestimated. The gains from integration of care for chronic infectious and non-communicable diseases—in terms of service efficiency, quality and acceptability to users, and the effects on health status—will need to be shown. Thus a serious research and development agenda is needed that addresses which aspects of service integration are likely to be effective, how best to introduce them, and ensuring that assessment is based on rigorous study designs (including controlled trials of such complex interventions, the costs incurred, and probable sustainability). Results from earlier efforts to integrate reproductive health services are mixed, although recent evidence on the benefits of integrating primary child-care services is encouraging.[43]

Thorough understanding of the dynamics of health transition is important to achieve a serious appraisal of primary health-care systems in southern Africa and further afield. We conclude that a new approach to primary health-care systems is needed, with management of chronic disorders a key element. Central to health-system performance are leadership and staff competence. Service leaders at primary-care level will need to develop innovative responses to the demanding realities that they face. A range of less-practised skills—addressing personal behaviour and the influence of peer-groups, partnerships with community groups, service monitoring and assessment, and alliance formation across health and development sectors—will need emphasis to ensure that adequate levels of service coverage and treatment adherence result. Given high levels of labour migration in the region, and the many ill migrants who return to their rural homes for social support and medical care,[12] continuity of care will depend on effective communication of treatment histories between urban clinics and rural services. Chronic illness can impose heavy social and

monetary costs on poor households.[44] The imperative, therefore, to develop quality primary health-care systems, which are able to address effectively the rapidly expanding burden of chronic illness, could not be greater.

Contributors

SMT conceptualised the paper. SMT and KK wrote the paper, directed analyses, and interpreted results. MLG and SJC led mortality analyses, and BS ensured a clean dataset and undertook detailed statistical analysis. SMT directs the MRC/Wits Rural Public Health and Health Transitions Research Unit (Agincourt), including its health and sociodemographic surveillance system (HDSS). KK leads the Agincourt mortality studies. MAC has responsibility for the Agincourt HDSS and database and oversees yearly updates. All authors contributed to the report, and read and approved the final draft.

Conflict of interest statement

ST served as Chair of the INDEPTH Board of Trustees 2002–06. All other authors declare that they have no conflict of interest.

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