Diabetes care in sub-Saharan Africa

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The increasing numbers of people with type 2 diabetes is a worldwide concern. It presents an added challenge in sub-Saharan Africa, where diabetes must compete for resources with communicable diseases. A scarcity of financial resources and appropriate staff mean that many people with type 2 diabetes have complications and that those with type 1 diabetes have an extremely short life-expectancy, whether or not they have been diagnosed with the disorder. We review the current evidence on diabetes care in sub-Saharan Africa and propose an 11-point action plan to address this problem in the region.

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Introduction

Many African countries now face a double disease burden, with increasing numbers of patients with non-communicable diseases, such as hypertension, stroke, coronary heart disease and diabetes, added to the challenges of HIV, malaria, and tuberculosis.[1] This poses challenges to the health care of resource-poor countries, because of the need to invest in systems and training of health-care workers to manage chronic disease. The challenges of diabetes are two-fold—to stem the growing burden of type 2 diabetes due to urbanisation and obesity and to provide accessible care and appropriate medicines to people diagnosed with the disease.

Three-quarters of a century after its discovery, insulin is still not available on an uninterrupted basis in many parts of the developing world.[2–4] A decade ago, a survey in 25 African countries[5] showed that in half the countries surveyed, insulin was often unavailable in the large city hospitals, and regularly available in rural areas in only five countries. Recent data suggest that the situation is virtually unchanged.[6] In countries with an average yearly income of about US$300, the care of a person with diabetes can cost as much as half or two-thirds of this sum, of which about half is the cost of insulin.[7,8] As a result, the life expectancy of a child with newly diagnosed type 1 diabetes in much of sub-Saharan Africa might be as short as 1 year.[9,10] In Bamako, Mali, median life expectancy for a child with type 1 diabetes is 8 years.[11] Life expectancy in rural Mozambique has been estimated to be as little as 7 months.[12]

Challenges

Although epidemiology data for type 1 diabetes in Africa are scarce,[13] its recorded prevalence in sub-Saharan Africa is much lower than in temperate countries, because of three factors: a lower incidence, underdiagnosis and misdiagnosis, and a poorer prognosis. In one study in Tanzania, 21 of 199 patients diagnosed as having cerebral malaria actually had precoma or coma precipitated by uncontrolled diabetes.[14]

Prevalence estimates in sub-Saharan Africa are derived from incidence data[15,16] and an assumed life expectancy of 5 years, and produce a figure of 35 100 people with type 1 diabetes.[13] Estimates suggest that for type 1 diabetes in children, the prevalence in North America and the West Indies is 0·062%, compared with 0·012% in Africa.[13] The incidence of type 1 diabetes is increasing in many parts of the world, especially in low prevalence countries and in younger children.[13] Improved care is also likely to improve prognosis of these patients, with an additional effect on prevalence.

The number of people with type 2 diabetes worldwide was estimated at 171 million in 2000 and is predicted to rise to 366 million in 2030.[17] In a review of diabetes in Africa by Sobngwi and colleagues,[18] the prevalence of diabetes ranged from 1% in rural areas to between 1% and 6% in urban areas. In a population of Indian origin in sub-Saharan Africa the prevalence was between 12% and 13%. Prevalence rates in other African settings range from an apparent absence of diabetes in Togo to rates of 10·4% in northern Sudan.[19] Wild and colleagues[17] estimated that in 2000, 7 146 000 people in sub-Saharan Africa had diabetes, with a projected increase to 18 645 000 in 2030. These projections do not take into account the effect of urbanisation[20] and ageing[21] with UN estimates that by 2025 54·1% of Africans will live in urban areas. These numbers, however, do not account for the rates of obesity which have been increasing strikingly across much of urban Africa.[22]

As the prevalence of diabetes continues to rise, the parallel increase in complications will strain health-care resources.[23] Mbanya and Sobngwi[24] collated data for prevalence of complications, and showed that retinopathy affects 16–55% of people with diabetes, with some 21–25% of people with newly diagnosed type 2 diabetes presenting with retinopathy. These investigators estimated that 15–20% of type 1 diabetes patients in sub-Saharan Africa have overt nephropathy, which is responsible for 50% of all-cause mortality in these patients. Other studies have shown peripheral neuropathy in 10–36% of patients. In Tanzania, treatment of diabetic complications represented 30·8% of total outpatient costs in the main hospital in the capital city[8] with yearly spending per head of US$138, some 19 times more than per head government expenditure on health at average exchange rate.[25]

Much of the discourse on access to antiretroviral treatment in resource-poor countries has concentrated on the effects on prices of patents and the trade-related aspects of intellectual property. Such considerations do

not apply for any insulin other than the newer analogues, and so insulin could be purchased by governments or by private pharmacies at a fraction of the price set by the major pharmaceutical companies. The only concern with the lower priced generic suppliers is that of quality. Unlike for antiretroviral therapy, no progress towards any system of prequalification for generic insulin suppliers has been made.[26] On the basis of a dose of 35 units per day and a cost of US$12 per 10 mL vial, a year's supply of insulin costs about $160,[8] which represents a major financial burden to people with diabetes and Ministries of Health where yearly drug spending might be as little as $2 a year.[27] Such costs have led to a situation in which the price of insulin, when available, consumes as much as half of a family's weekly income. In Mali average monthly spending on diabetes care for a person with diabetes in the capital city is estimated to be $21·24, representing nearly 70% of income.[28] The International Diabetes Federation has completed sequential surveys of insulin pricing and access in sub-Saharan Africa during the past 12 years.[2,6,13] Data from the three surveys are presented in the table. Although different questionnaires and different respondents make precise comparison difficult, little evidence exists of any improvement in regular supply or price of insulin during this time. Although a move towards equity of pricing for insulin in the public sector and for non-governmental organisations (NGOs), described later, might be beginning to affect costs in some countries, the price of insulin in the private sector, where most African patients need to buy their insulin for part or all of the time is, if anything, on the increase. Other factors, such as problems with quantification, differences between urban and rural areas, and scarcity of diabetes education are mentioned in the 2006 survey[6] as reasons why access to insulin is difficult, drawing attention to the fact that a number of factors besides the price of insulin are relevant to provision of diabetes care.

Worldwide, 3·2 million deaths a year are attributable to diabetes compared with 3·1 million deaths for AIDS.[29,30] In most developing countries, the main barriers to chronic disease control are inadequate financing and availability of staff, but other impediments exist, including a dearth of information about disease burden and management, and the present orientation of health systems toward acute care. Chronic disease management entails an integrated approach, with the person with diabetes, the family, and the community being active participants over a lifetime of care.[31] Non-communicable disease is responsible for 70% of deaths worldwide.[32] There is little acknowledgment by global funding bodies of these challenges. For example, from 2000 to 2005, the World Bank provided US$4·25 billion in loans for health-sector work, about 2·5% of which was allocated to prevention and control programmes for non-com–municable diseases, all in Eastern Europe.[31]

Opportunities

Various initiatives nationally and internationally have been instigated by several organisations. The International Diabetes Federation and WHO have initiated several programmes aimed at addressing the rising burden of diabetes. The International Diabetes Federation has established a taskforce on insulin, test strips and other diabetes supplies,[33] which has made some attempts to achieve equity of insulin pricing for resource-poor countries supplied by the major manufacturers. The taskforce has a twinning initiative[34] aimed at encouraging International Diabetes Federation member associations in developed countries to twin with associations in developing countries to create and implement projects. Diabetes UK has taken a lead with this initiative, and has recently undertaken a feasibility visit to explore whether Diabetes UK could support diabetes care in Mozambique (personal communication, Richard Holt, University of Southampton, UK), while the Norwegian Diabetes Association is exploring the feasibility of a parallel link with Zambia (personal communication, Jak Jervell, International Diabetes Federation, Norway). A joint International Diabetes Federation and WHO initiative, Diabetes Action Now,[35] aims to stimulate the adoption of effective measures for the surveillance, prevention and control of type 2 diabetes. The International Diabetes Federation Africa Region[36] has championed different regional initiatives,

	Reference	Number of African countries surveyed	Availability of insulin (% of time)			Cost of 10 mL (100 IU) vial (US$), by type of insulin, mean (median, range)		
			<25%	26–99%	100%	Overall	Animal	Human
1994	Deeb and colleagues[2]	7	28%	58%	14%	(9·2–13·8)*	N/A	N/A
2003	International Diabetes Federation[13]	9	22%	78%	0%	N/A	8·6†	18·2†
2006	International Diabetes Federation Task Force[6]	10	30%	60%	10%	13·0 (10·0, 2·5–36) overall‡ 12·5 (10·0, 2·5–34) public 14·0 (13·6, 2·5–36) private	17·1 (15·0, 10–30)	12·2 (8·9, 2·5–36)

N/A=data not available. *Insulin concentration not specified. †Quoted in article as average. ‡Including non-governmental organisations.

Table: **Insulin availability and cost in International Diabetes Federation surveys 1994, 2003, and 2006**

such as the African Diabetes Declaration,[37] calling on governments, NGOs, and other stakeholders to ensure adequate and affordable medications, earlier detection, and optimum care.

In the wake of the adverse publicity arising from the South African court action on intellectual property and pharmaceuticals,[38,39] the drug industry has responded with several initiatives to exemplify their social responsibility. As an example, Novo Nordisk has established an equity pricing initiative, offering insulin to public-health systems in the 50 poorest countries at prices not exceeding 20% of the average price in North America, Europe, and Japan.[40] With the adoption of this scheme, the price of insulin in the public sector in Mozambique has dropped by about 50%.[41] However, the equity pricing scheme has not had a substantial effect on insulin availability for several reasons, including inadequate information being available to eligible countries, the exclusion of many poor and populous countries—such as Nigeria and India—from the list of least developed countries, and the exclusion from the scheme of insulin supplied to the private sector, from which patients buy their supplies during the frequent periods when insulin is unavailable in government health units. Novo Nordisk has also established the World Diabetes Foundation to provide grants to support prevention and treatment of diabetes in developing countries. Tanzania presents an example of a successful national diabetes programme in sub-Saharan Africa, where collaboration between the Tanzanian Diabetes Association and Ministry of Health has established a network of diabetes clinics throughout the country, along with health-worker training, guidelines, and patient education material.[42]

WHO, in collaboration with Health Action International, has recently published a report[43] in which glibenclamide (a sulphonylurea), used for the treatment of type 2 diabetes, was shown to cost the equivalent of about 8 days' wages for 1 month of treatment. Insulin was not considered in this survey. The WHO essential drugs list includes short-acting and intermediate-acting insulin formulations,[44,45] and most countries, have created national drugs lists which have also included insulin.

In parallel with these global initiatives, the work of two NGOs (International Insulin Foundation and Santé Diabète Mali) has contributed substantially to improving knowledge of diabetes in sub-Saharan Africa. The International Insulin Foundation aims to help resource-poor countries to develop sustainable programmes of insulin access and diabetes care. A rapid assessment protocol for insulin access has been developed to investigate barriers to insulin access, by studying the path of insulin from its arrival in the country to its reaching the person with diabetes.[46] The foundation also looks at systems of care to provide information on the health system's capability for provision of diabetes care.

***Panel:* Key areas to be addressed if diabetes is to be tackled in sub-Saharan Africa, as identified by International Insulin Foundation**

- Organisation of the health system
- Prevention
- Data collection
- Diagnostic tools and infrastructure
- Drug procurement and supply
- Accessibility and affordability of medicines and care
- Training and availability of health-care workers
- Adherence issues
- Patient education and empowerment
- Community involvement and diabetes associations
- Positive policy environment

The rapid assessment protocol for insulin access has been used in Mozambique, Zambia,[12] and Mali, where recom–mendations have been prioritised by national partners and diabetes programmes implemented. In Mali, Santé Diabète Mali a French NGO, works on several aspects of diabetes, including implementation of the recom–mendations from the rapid assessment protocol for insulin access and training of medical staff. Its regular newsletter, available in French and English, provides a variety of resources for nutritional and other aspects of management of diabetes in a resource-poor setting.[47]

For **World Diabetes Foundation** see http://www.worlddiabetesfoundation.org

Solutions

The International Insulin Foundation has suggested 11 key areas that need to be addressed if diabetes is to be tackled in sub-Saharan Africa (panel).[48]

Health system organisation, data collection, and diabetes prevention

Health systems in sub-Saharan Africa are currently organised for the treatment of acute rather than chronic conditions.[49] These systems face an immense challenge to tackle HIV/AIDS, tuberculosis, malaria, diarrhoeal disease, and respiratory infections.[50] Chronic disorders, such as diabetes and hypertension share with HIV/AIDS and tuberculosis several common factors, including the need for diagnostic tools, trained personnel able to initiate and adapt treatment of a life-long condition, a referral system for management of complex regimens or complications, and the need for an effective system for regular supply of medicines throughout the country. Prevention of diabetes is needed not only to avert much of the suffering for people with the disorder, but also to prevent increased use and costs engendered by complications. For type 2 diabetes, primary prevention will need political courage, because the advancing tide of globalisation and its effect on both urban migration and the obesity epidemic needs to be confronted.[51]

For **International Insulin Foundation** see http://www.access2insulin.org

For **Santé Diabète Mali** see http://santediabetemali.org

Systematic recording, analysis, and dissemination of data for mortality, morbidity, and risk factors, are the key to effective care planning.[52] Patient registers can be used to organise patient and population data both for health-care planning and to improve care.[53,54] Such registers have been undeveloped in many African countries but WHO regional office for Africa is encouraging the expansion of local databases of disease burden, risk factors and principal determinants of non-communicable diseases.[55] Standardised registers kept at each facility can be regrouped on a district, regional, and national level, while also providing a basis for a patient clinical record. Other measures are available to assist governments in assessing the chronic disease burden and effectiveness of health systems, including WHO's stepwise approach[56] and the rapid assessment protocol for insulin access.[46]

Diagnostic aids and drugs

The cost to the health system and the patient of testing for diabetes might be an important constraint to care. In Mozambique, only 18% of health facilities have the ability to measure blood glucose concentration and even fewer (8%) test for urinary ketones, implying that people with type 1 diabetes who present in ketoacidosis are likely to die without diagnosis.[12] Each level of the health system needs a means of measuring blood glucose concentrations, something which needs staff training, but which would also be helped by standardisation of the types of instruments and testing strips used.

Continuous availability of medicines plays an essential part in the provision of health care for chronic conditions. As discussed, WHO's essential drug list[44] includes oral hypoglycaemic agents and both short-acting and intermediate-acting insulin formulations. Reliable health and supply systems, sustainable financing, affordable pricing, and rational use are necessary for proper access to medicines,[57] with improved tendering or pooled procurement[58] used to minimise cost. Evidence from in-country studies show that improvement is needed in quantification, procurement systems, and distribution to prevent unnecessary waste, with improved training for prescribers and dispensers.[28,59] What is notable, however, is that despite the availability of generic insulin on the world market, the market power of the major suppliers, and particularly of Novo Nordisk remains a major influence on insulin procurement in sub-Saharan Africa. The International Union Against Tuberculosis and Lung Disease has introduced an asthma drug facility to make good quality essential drugs for asthma affordable for low-income countries,[60] modelled on a similar concept for the supply of antituberculosis drugs. This is an excellent model, which would substantially improve access to insulin and which, in a situation where WHO's concerns lie with drugs for conditions with major effects on global disease burden, one which the International Diabetes Federation and its insulin taskforce might consider.

Diabetes and other chronic diseases place a large financial burden on people with these disorders and their families in many countries, often leading the household into poverty.[61] Medicines for diabetes care should be accessible at public facilities free of charge, or at subsidised price where feasible. Clearly defined and applied exemption criteria, or other means of financing care for patients, exist in few countries[28,62–65] and are necessary for consultation fees, laboratory tests, and medicines, perhaps based on age, income, type of disease, and employment. These criteria need to be easily verifiable and should not cause treatment delays.

Health-care workers

Health-care workers need to coordinate treatment, educate patients in self-care, and have an active role in prevention.[66] Understanding of diabetes management is generally poor among health-care workers, especially those in rural areas in Africa.[12] Training programmes, such as those in Tanzania[43] or Mali[47] need to be rolled out to improve knowledge, with appropriately developed materials as guidelines and protocols. An initiative by the International Diabetes Federation in Africa is developing guidelines for health-care workers and education material for patients that will be suitable for widespread use. Pharmacists, laboratory technicians, and other ancillary staff also need appropriate training. The major problem with diabetes planning is the dearth of senior specialists in diabetes care, and the resultant scarcity of specialist training in the region, with most of the specialists having been trained abroad.

Patient adherence, education, and empowerment

Many factors, such as health service organisation and accessibility of care, will affect adherence, but studies have shown that cost of treatment is the main barrier to adherence in chronic disease.[67] Patient education material needs to be available and accessible in terms of language and culture, especially for children and illiterate patients.

People need not only knowledge and skills, but also motivation to improve the quality of their lives.[68,69] Patient education should focus on prevention as well as treatment, with materials that are culturally appropriate and adapted to populations with poor reading skills since nearly half the population in this region is classed as illiterate.[70]

Community involvement and diabetes associations

Illness is expensive in terms of costs of care, and also causes loss of family income.[59] In many societies, illness of one person can affect the whole community. Family members and the community need education about participating in care. Traditional healers need to be

integrated into the formal system of care and trained in appropriate referral to the formal health sector.

As is evident from the Tanzanian example, diabetes associations can play a vital part in improving patterns of care.[42] These organisations can help with care and also provide advocacy on issues such as the growing disease burden, costs, and availability of treatment. When diabetes associations provide care, for reasons of geo–graphical equity and sustainability the care should complement and fully integrate with the formal health sector. World Diabetes Day provides a yearly opportunity for diabetes associations to raise public awareness about diabetes.

Positive policy environment

Many countries in sub-Saharan Africa do not have a policy framework for non-communicable diseases and diabetes. Such a framework should incorporate pre–vention, organisation of care, import duties on medicines and supplies, subsidies for medicines and care, education, disease monitoring, and allocation of appropriate resources.[64,71] Multilateral donors need to recognise the growing burden of non-communicable diseases, including diabetes, in developing countries. An expanded Millennium Development Goal for non-communicable diseases has been proposed.[72,73] High level political commitment is needed to address issues, such as food availability, cash crops, and urbanisation, which will have a major role in determining the success or failure of prevention and care.

Conclusion

The Nigerian President Olusegun Obasanjo has said, "We cannot afford to say, 'we must tackle other diseases first—HIV/AIDS, malaria, tuberculosis—then we will deal with chronic diseases'".[74] Health care in sub-Saharan Africa faces many challenges, including a high burden of communicable disease and a scarcity of financial and human resources. Diabetes and other chronic conditions present an additional challenge. But these also present an opportunity—the challenge of developing functioning health systems to deliver continuing integrated care. In this respect, the challenge of non-communicable diseases is not so different from that of HIV/AIDS. By strengthening health systems, the aim should be to ensure that they can cope with type 1 diabetes as well as with communicable disease.

Several issues remain, which together conspire against raising the profile of diabetes management on the global agenda. Firstly, WHO's non-communicable disease division gives little attention to problems of managing patients with clinical disease. Secondly, when the WHO essential drugs and medicines division considers access to medicines or prequalification to assure quality, emphasis is on the major contributors to burden of disease, with less attention to drugs such as insulin, for which the need is absolute but the numbers small. Finally, the International Diabetes Federation is an association of national Diabetes Associations, rather than an international organisation with staff and projects. We suggest that a development office as part of the secretariat could achieve substantial progress in improving care for people with diabetes in the least developed countries, with the costs of sustaining such an initiative being relatively modest. In the absence of a procurement and quality assurance scheme for insulin being made available through the essential drugs and medicines division of WHO, such a task needs to fall to an NGO, as for drugs for asthma[60] and should also be considered by the International Diabetes Federation.

In 1901, a missionary doctor wrote in his notes on diseases he saw in Africa "diabetes is very uncommon but very fatal"[75] 105 years later, type 1 diabetes in Africa is still uncommon and fatal, whereas type 2 diabetes is arising in epidemic proportions. The efforts needed to improve the outcomes for both types of diabetes are similar to those for HIV/AIDS—trained health-care workers, a functioning health-care system, guidelines, continuing availability of drugs and monitoring reagents, and a functioning referral system. The campaign for World Diabetes Day in 2006 is Diabetes Care for Everyone. While new technologies have improved the spectrum of insulin profiles and delivery systems in developed countries, outcomes from diabetes in developing countries are similar to those before the discovery of insulin. The battle to stem the rising tide of type 2 diabetes is being lost, with the disorder having gone from affecting mainly the developed world to one that will dominate the health facilities of resource poor countries, especially in urban areas. Action is needed to ensure that diabetes does not erase all the advances in health since 1921 when Banting and Best discovered insulin.[76]

For more information on **World Diabetes Day** see http://www.worlddiabetesday.org

Conflict of interest statement

We declare that we have no conflict of interest.

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