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# AJDM

The African Journal of Diabetes Medicine

Patient-centred care in diabetology

Strategy for improving diabetes care in Nigeria

Treatment for diabetic patients with kidney disease

Choosing an insulin regime in developing countries

Peripheral neuropathy in diabetic amputees

# From the Journals

## Sulphonylurea safety questioned

**Phung OJ, Schwartzman E, Allen RW, et al.**
**Sulphonylureas and risk of cardiovascular disease: systematic review and meta-analysis.**
*Diabetic Medicine* **2013; 30: 1160–71**

Sulphonylurea (SU) drugs are amongst the oldest oral hypoglycaemic agents (OHA) available, and are in very widespread use all over the world. They do have their problems however – notably weight gain and hypoglycaemia. It has also been recently understood that they do not have as good 'glycaemic durability' as some other OHAs, with initial improvement in glycaemia, often to be followed by escape from control after 18 to 24 months. What is less well known is that a potential association with increased risk of cardiovascular disease has been questioned for many years. Researchers in the USA have recently reported the results of a wide literature search on the topic, analysed by systemic review and meta-analysis. The analysis was of 33 separate studies including over 1.3 million patients, followed for periods ranging from 0.5 to 10.5 years. Sulphonylurea use was associated with an excess risk of cardiovascular death – relative risk (RR) 1.27. There was also an increase in all cardiovascular events (RR 1.10). In those studies in which SU treatment was compared with metformin, the RRs were 1.26 and 1.18 respectively. This large analysis therefore supports earlier concerns that SU use in type 2 diabetes is associated with a small but significant increase in cardiovascular events and mortality. The researchers do point out that the reason for the association is uncertain, and that the trials analysed were often very variable in design and duration of follow-up. Sulphonylurea use is already declining in many parts of Europe, since the introduction of incretin-based therapies. Alternatives to SU are not, however, as common in Africa. Nevertheless, atherosclerotic vascular disease is less common in Africa, compared to Western counties, so it may be that the SU risks described in this article are less of a problem in African diabetic populations.

## Metformin and gestational diabetes

**Latif L, Hyer S, Shehata H.**
**Metformin effects on treatment satisfaction and quality of life in gestational diabetes.**
*Brit J Diab Vasc Dis* **2013; 13: 178–82**

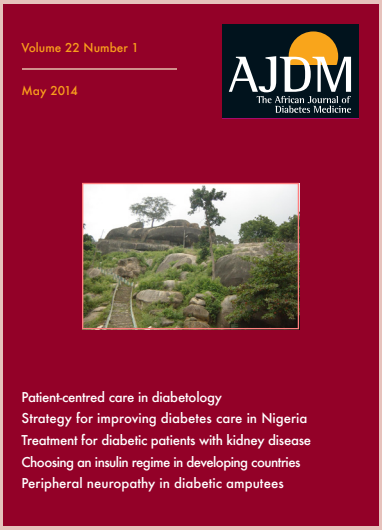
It is now established that the oral hypoglycaemic agents, metformin and glibenclamide, can be used to treat gestational diabetes mellitus (GDM), and that the traditional 'perceived wisdom' of always using insulin when diet fails, is wrong and unnecessary. It is of interest that the original observational work supporting the use of these drugs comes from Africa (Cape Town in South Africa). The safety profile for glibenclamide in GDM is not as well established as for metformin, but the latter drug is certainly safe and effective. Unfortunately, this knowledge is not widespread, and many African patients with GDM are not being offered this drug as second-line therapy when diet alone has failed. A recent UK study has compared life quality and patient satisfaction in three groups with GDM, treated with either metformin (n = 68), insulin (n = 32), or insulin plus metformin (n = 28). The results showed that both life quality and satisfaction scores were highest in the metformin-alone group, compared with the other two groups. This study shows that as well as metformin being an effective drug in GDM, it is accepted and appreciated by patients. Compared with insulin, metformin is also a considerably cheaper and safer alternative. The advantages in resource-limited areas of Africa are obvious, and metformin deserves to be much more widely used in GDM.

## Affordable diabetes care

**Chowdury TA, Bennett-Richards P.**
**Optimal diabetes care – can we afford it? Evidence-based diabetes care could be highly cost-effective.**
*Quart J Med* **2013; 106: 983–7**

Diabetes care is expensive all over the world. In the UK, for example, diabetes consumes over 10% of the total health care budget. With ever-expanding available drugs to treat the disease, as well as new insulins, it is often hard to see how increasing costs can be controlled. Two UK diabetologists have recently suggested that many recent expensive 'advances' are lacking in a firm evidence-base, and that by applying strict evidence-based principles, diabetes care can become affordable. Some of the issues raised are as follows:

- **Insulin use.** Analogue insulins are at least three times the cost of standard human insulins, and have no firm evidence base in type 2 diabetes.
- **Self-glucose monitoring.** Self-glucose monitoring is helpful in those with type 1 diabetes, but is greatly over-used in type 2 diabetes, where it should be reserved for those on insulin.
- **New type 2 drugs.** An increasing number of new classes of agents for treating type 2 diabetes have been introduced over the last 10 years or so. Though some appear useful, their long-term benefits are uncertain, and side-effect issues have arisen with some (e.g. the withdrawal of rosiglitazone). Such new drugs should be used cautiously.
- **Improve in-patient care.** In the UK, over 15% of hospital beds are occupied by patients with diabetes. There is evidence that early specialist input reduces their length of stay, saving considerable costs.
- **Intensive glycaemic control.** In type 2 diabetes, tight glucose control has some microvascular benefits, but no clear benefits in reducing cardiovascular outcomes. Control of hypertension and hyperlipidaemia, as well as smoking cessation, will have more effect on such outcomes.
- **Diabetes prevention.** Type 2 diabetes is a preventable disease, both on a population and individual basis. Lifestyle intervention needs to be fully supported at government level.



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# Contents May 2014



## Editorial

**Insulin treatment in Africa**

The range of available insulins worldwide, and systems of using them, is now very large. In developing countries, however, the range of insulins available is usually limited. In some ways this makes insulin treatment simpler, but in other ways more difficult. In this issue of the *AJDM* Drs Kalra and Gupta discuss the choice of insulin regimens from a developing country viewpoint. They point out that there are a variety of factors which should be taken into account. These include level of overall glycaemic control, pattern of hyperglycaemia, risk of hypoglycaemia, family and healthcare support, ability to self-monitor blood glucose, food supply, and types of insulin available. Thus, the insulin system chosen for a well-paid professional patient attending a city teaching hospital, may well be very different from that recommended to a poor farmer in a remote rural area. Sadly, inequalities of healthcare provision such as this have to be accepted in many parts of Africa.

However, in such poor rural areas of Africa, there may still be opportunities for rational insulin therapy. Some years ago, myself and other colleagues were working in a remote, rural area of northern Ethiopia. Most insulin-treated patients were on once-daily Lente (medium-acting) insulin, and were poorly controlled. There was no laboratory support, self-glucose monitoring, or diabetes nurse availability. We changed a group of 20 to twice-daily injections, simply giving two-thirds of their total daily dose in the morning, and one-third in the evening. $HbA_{1c}$ estimation was not routinely available, but we had a machine at the hospital for a different research project. After 3 months, the group changed to twice-daily injections had a significant fall in $HbA_{1c}$, from 10.5±1.8% to 8.0±1.5% (means ±1. SD).[1] There was a small but non-significant increase in weight and frequency of minor hypoglycaemic episodes. All patients were happy with the new insulin system, and wanted to continue with it. A control group of a different 20 patients were continued on once-daily Lente insulin, and their $HbA_{1c}$ levels remained high and unchanged.

Thus, simple systems such as twice-daily medium-acting insulins can be safe and effective in resource-limited areas. The vital strategy, however, is to fit the insulin regimen to the individual patient and the resources available.

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Reference
1. Gill GV, Gebrikidan A, English PJ, Tesfaye S. Improving glycaemic control in African diabetes patients on insulin: a resource-free approach. *Tropical Doctor* 2009; 39: 3–5.

# In the news

## DAWN: a 'Call to Action'

In 2001, the results of the first Diabetes Attitudes, Wishes and Needs (DAWN) study were published. Producing evidence to support how self-management behaviours are primarily influenced by psychoscial problems was groundbreaking. Healthcare professionals and people with diabetes came together and developed a plan of action.

Five goals for improved diabetes care were identified as a result of those DAWN study findings. The 'Call to Action' identified ways to improve the health and quality of life with diabetes, sending a strong message that addressing the psychosocial and behavioural needs of people with diabetes is an essential component of diabetes care.

## Cities challenged to be 'diabetes aware'

The world's cities will soon have the opportunity to be officially designated 'diabetes aware'. They will be challenged to show that their public services and businesses encourage healthy lifestyles for people with diabetes and those at risk.

The new scheme is being created by the International Diabetes Federation (IDF) and the European Connected Health Alliance (ECHAlliance) who plan to launch it on World Diabetes Day, 14 November 2014. IDF and the ECHAlliance want to create a global network of 'diabetes aware' cities using mobile health tools to promote diabetes awareness and support.

A 'diabetes aware' city will demonstrate that all sections of the community are committed to creating a healthy urban environment. Local public services, businesses, and institutions will demonstrate that they understand the challenges faced by people with diabetes and those at risk. This may include providing appropriate nutritional information in restaurants or city authorities ensuring green spaces are safe and accessible for exercise.

Using mobile health tools and apps, key stakeholders in city life will be able to target diabetes aware options to those at risk of diabetes and those with the disease.

An expert group is being established by IDF and the ECHAlliance to draw up the scheme. It will include representatives from business, NGO and mHealth sectors, amongst others.

'By 2035 one in ten of the world's population will have diabetes unless there is radical change,' says Dr Petra Wilson, IDF's Chief Executive. 'People in urban areas will be particularly vulnerable. Socially and economically this diabetes epidemic will be very costly. It is important that we find new ways of working across all sectors to provide people with targeted information on healthier lifestyle options,' she added.

Brian O'Connor, Chair of the ECHAlliance welcomed the new partnership, 'Providing people with mobile information on healthier places to eat, shop, and exercise in cities is the first step toward making the healthy choice the easy choice. Information is the key to enabling healthy choices.'

## Addressing the challenge of GDM in the developing world

The Academic Model Providing Access to Healthcare (AMPATH) is a partnership between Moi University School of Medicine at the Moi Teaching and Referral Hospital in Kenya, and a consortium of North American universities and schools led by Indiana University.

AMPATH's mission is to provide and expand sustainable access to high quality care through: the development of passionate leaders in global health; research focused on local and global solutions; and the establishment of critical healthcare infrastructure and systems.

An AMPATH study group is in the process of developing a strategy for screening and diagnosing gestational diabetes mellitus (GDM) in resource-constrained settings.

## IDF welcomes two new Member Associations from Africa

At the 22nd IDF General Assembly, 18 new Member Associations were approved, reaching a total of 231 worldwide. Two new Full Members from Africa were included: the Diabetes Association of Botswana in Gaborone, Botswana; and the Association des Diabétoques du Congo (ADIC) in Goma, Democratic Republic of Congo.

The complete list of Full Members can be viewed on www.idf.org/membership/meet-our-members.

## IDF appoints new Chief Executive Officer

The International Diabetes Federation (IDF) has appointed Dr Petra Wilson as its Chief Executive Officer.

Dr Wilson joins IDF from Cisco, where she was Senior Director of the European Health and Care Business Solutions team. At Cisco she worked with the World Health Organization, the European Commission, national and regional governments, and healthcare organisations on policies to use communications technologies to drive safer and more efficient health and care delivery systems.

'I am delighted to be taking up this challenging post. Diabetes is one of the most pressing health challenges globally, which demands that people, organisations, communities and nations work together to create a better future for those affected by the disease. IDF has a deservedly high reputation as a forthright advocate for people with diabetes, and I look forward to being part of such a dynamic global movement,'she said.

## Estimates show that diabetes kills one person every 6 seconds

Diabetes kills one person every 6 seconds and afflicts 382 million people worldwide, according to the International Diabetes Federation, which has been canvassing the help of celebrities to raise awareness about the problem.

The number of diabetes cases has climbed 4.4% over the past 2 years and is more than 5% of the world's population, according to new figures the Brussels-based federation released in March. The number of people affected by the disease is expected to climb 55% to 592 million by 2035 as factors including poor diet, a more sedentary lifestyle, increases in obesity, and life expectancy fuel an epidemic, it said. There were only 285 million sufferers worldwide in 2009.

# Patient-centered care in diabetology: sub-Saharan African perspectives

S Chinenye, A O Ogbera, and S Kalra

## Introduction

Patient-centred healthcare, while a common terminology, is a concept that is rarely understood by many care providers. It is **not** technology-centred, doctor-centred, hospital-centred, or disease-centred. Patient-centred care is part of a shift in healthcare focus that has been occurring over time. As the number of patients with chronic conditions, e.g. diabetes, continues to increase, health systems cannot cope if they remain focused on a disease rather than the person. They require the involvement of the patient to adhere to treatment, make behavioural changes, and to self-manage. There is a group realisation that patient-centred care (PCC) which addresses the needs and preferences of patients, may also be the most cost-effective way to improve health outcomes for the growing number of patients with diabetes.[1]

## Historical background

The term 'patient-centred care' (PCC) was introduced by Michael Balint in 1970, in order to give a name to a particular way of thinking.[2] PCC referred to a concept attempting to understand the complaints offered by the patient, and the symptoms and signs found by the healthcare professional, not only in terms of illness, but also as expressions of the patient's unique individuality, tensions, conflicts, values, and problems.[2]

This was in contrast to the illness-centred way of thinking which considered the human being as a complex bio-medical machine and thus attempted to understand the patient's complaints in terms of illness, that is, in terms of a pathologically changed part of the body or of a part-function of the body.

These two ways of thinking led to different understandings of the patient and his problems. The understanding based on illness-centred thinking, Balint called traditional diagnosis; the understanding based on PCC, he called the overall diagnosis.[2]

Capra[3] gave an account of the holistic medical traditions namely:

- the phenomenon of shamanism which is so prevalent in non-literate cultures of Asia and Africa, even till date;
- the system of classical Chinese medicine that forms the basis of most Eastern medical traditions;
- the tradition of Hippocratic medicine that lies at the roots of Western medical science.

The Hippocratic tradition, in contrast to shamanism and classical Chinese medicine, holds firmly the conviction that illnesses are not caused by supernatural forces, but are natural phenomena that can be studied scientifically. However, an emphasis on the fundamental interrelations of body, mind, and environment is shared by all three traditions.

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## Aims and methods

The aims of this review areas follows:

- To underscore the rationale of PCC which should be entrenched in the minds of those working in the field of diabetology and accepted in the same way as evidence-based care.
- To identify, highlight, and promote the principles of PCC from the African perspective.

Data were collected by consultation of information on the internet (using search engines and online databases) and in libraries. Sources used included: international, regional, national, and local healthcare policies and regulations; and peer-reviewed academic and research papers (including theses); as well as printed books and reports. Review papers were particularly vital to ensure we did not 'reinvent the wheel' and this review acknowledges and cites such works.

## Evolution of patient-centred care

The central hypothesis of the client-centred approach is that the patient has within himself or herself vast resources for self-understanding and for constructive changes in ways of being and behaving and that these resources can best be released and realised in a relationship with certain definable qualities. It is the quality of the relationship between the health professional and the patient that is central to the therapeutic process. The three key attitudinal elements or characteristics of the health professional that are vitally important in providing PCC are: genuineness, unconditional positive regard and empathy.[4,5] Empathy is one of the most powerful ways

we have to impact on the PCC because almost always, when a person realises he has been deeply heard, his eyes moisten and in some real sense 'he weeps for joy'.[6]

This focussing on the person rather than the disease became one of the key principles of family medicine[4] and is central to the concept of PCC. The family physician is committed to the person rather than to a particular body of knowledge, group of diseases, or special technique.[7] The re-discovery of the concept of PCC during this century has been a most exciting process. It actually began with the recognition by general practitioners (family physicians) of a lack or deficiency in their medical training.[2]

The theme of PCC represents the application of holistic thinking to patient care and recognising the person as an integrated biopsychosocial whole at a given stage of his or her life-cycle.[8] Healthcare professionals must realise that before explanation and advice can be given to a patient, they must make three diagnosis: the diagnosis of the disease, the diagnosis of the concept or fears of the disease in the minds of the patients or parents, and thirdly the diagnosis of the patient's capacity to understand the explanation and follow the advice.[9] The patient's reasons for coming to the doctor have been found to include ideas, attitudes, feelings, and expectations. The ascertainment of these reasons for coming is in addition to the doctor's task of making a diagnosis.[10]

Essentially the health professional's role is that of a catalyst, facilitating the inherent potentials exist within each patient and family, and helping them to find healthy solutions to their problems instead of disease.[11]

## Dimensions of PCC

PCC is a collaborative effort patients, patients' families, friends, and healthcare professionals aimed at achieving the common goal of the patients' recovery. This is placing the patient at the centre of the healthcare system and developing good services that revolve around them and are responsive to their needs and preferences. This is depicted graphically in Figure 1 in which the attributes of PCC, as discussed above, are represented and reorganised in a system theory format. A system theory approach basically involves a system of input, process, and output situated within an environment.[12] The environment in which the proposed system is situated is the field of healthcare (be it medical, nursing, or pharmacy practice).

## PCC versus African health systems

The concept of PCC has attained centre stage in diabetology. Current guidelines, released by the American Diabetes Association and the European Association for the Study of Diabetes (ADA/EASD) use the term 'patient centred approach' while defining strategies for management of hyperglycaemia.[13] This has led many students of diabetes to feel that PCC is a modern concept. Yet others assume that PCC is a Western idea, whose utility is limited only to advanced, educated-nation societies. Many African healthcare professionals doubt the relevance of PCC, and its sister concepts of shared decision making (SDM) and patient empowerment (PEM), in their setting.

The definition chosen by the authors of the ADA/EASD guidelines', and crafted by the Institute of Medicine, USA, encapsulates the essence of PCC. PCC is defined as 'care that is respectful of and responsive to individual patient preferences, needs, and values' and that ensures 'that patient values guide all clinical decisions.'[14] Does African medicine embody PCC? Is PCC relevant for

Africa? What can be done to strengthen PCC in the context of African diabetology? While these questions have been addressed earlier, in the context of the holistic approach of Afro–Asian cultures, the concept of PCC has not been discussed from a sub-Saharan viewpoint.[15]

## Traditional African medicine

Traditional medicine has existed in various parts of the African continent for centuries. Modern medicine, including diabetology, is judged by the yardsticks of traditional beliefs. The fact that a significant proportion of educated Africans still turn to traditional medicine for diabetes care, should cause one to wonder why? Is it perhaps that traditional African medicine is more patient-centred than modern diabetology? Do people with diabetes expect PCC, and turn to traditional healers for this care?

## Aetiology of diabetes

The traditional medical systems of Africa do not conceptualise chronic disease, and do not follow a biomedical model of disease. Rather, acute illness are explained by a psychological model which utilises supernatural happenings as aetiologic factors. The patient's existing belief systems and knowledge level is taken into consideration while making a diagnosis. A chronic disease such as diabetes is broken down into a series of acute episodes, and explained accordingly. The aetiology of illness, including diabetic complications, may be explained by the supernatural. The IKung tribe of the Kalahari desert, for example, believe that all disease is caused by the God '*Hishe*', who also sends down cures through medicine men. The Ibos of Nigeria attribute disease to multiple causes, including enemies who practice '*ígba ogwu*' (*ígba ntụtụ*, *nshi*) or implantation of harmful objects into a person's body. Ifa medicine, practiced by Yorubas of Nigeria, ascribes disease to a disturbance of the internal or external milieu of the individual. In this context, If a medicine predates modern medicine by many centuries, by propounding and utilising the biopsychosocial model of illness. All African-belief medical systems keep the patient at centre stage while explaining the aetio pathogenesis of disease, and do so in comprehensible culture-specific terminology. This basic rule should be followed by modern health providers too, if optimal adherence to prescribed therapy is expected.

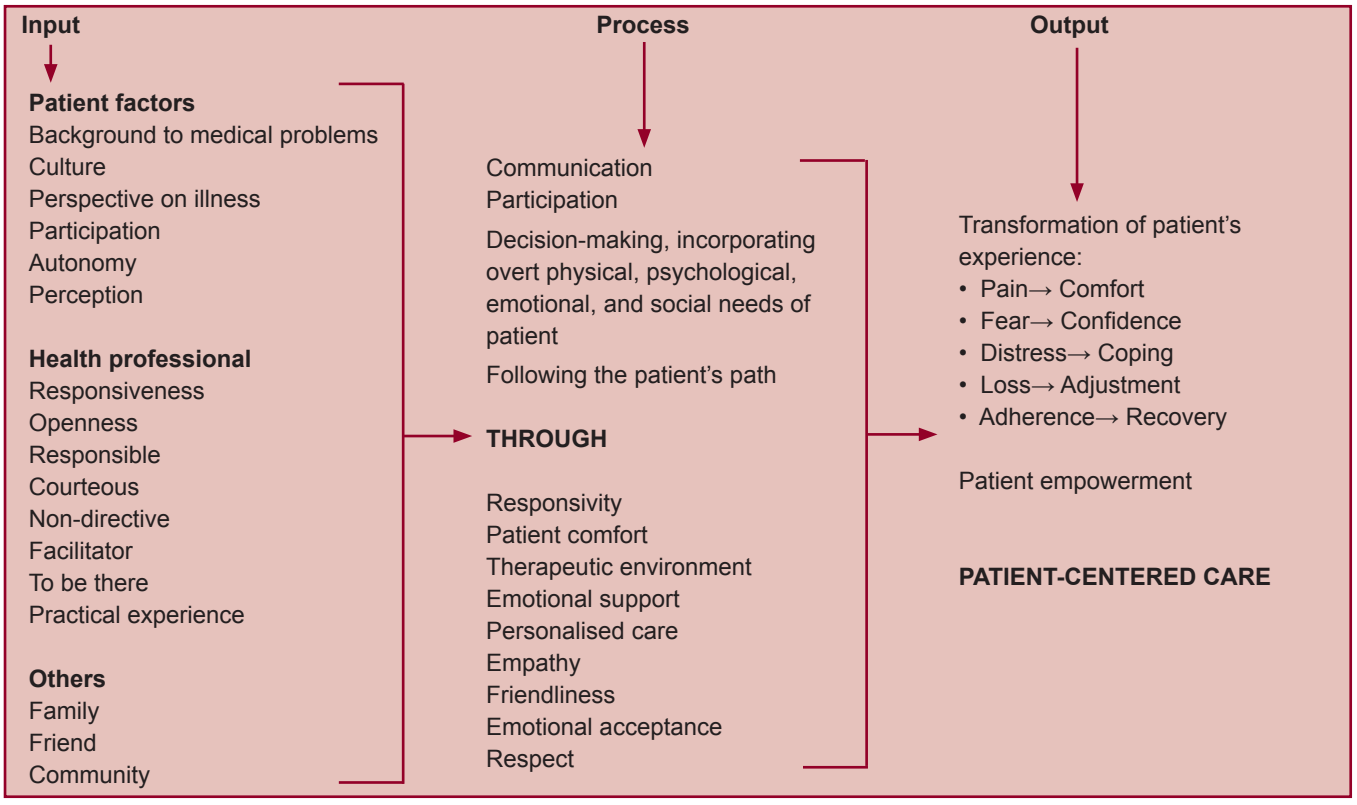


*Figure 1 A system perspective on patient-centred care (modified from reference 12)*

## Diagnosis of diabetes

African medicine, in general, follows a patient-centred trajectory. Diagnosis of disease is done by history taking, observation, and touching, which again make the individual feel at the centre of the therapeutic process. Other methods such as divination and dream interpretation are used by the sangomas of South Africa and Ifa priests of Nigeria. These methods of diagnosis require active involvement of the patient, which is a feature of PCC. While laboratory investigations are essential, asking people with diabetes to keep food diaries, self-monitoring logs, or record their insulin doses regularly, are means of strengthening patient involvement in the process of diagnosis.

## Traditional management

Traditional healers or medicine men have used available herbs, animal products, and non-pharmacological ways of treatment to help patients fight acute illnesses such as fever and pain. Management of disease is effected in an individualised, multitherapeutic manner. Dietary restrictions are an important aspect of all African medical systems. Herbs are used by many traditional medical practitioners including the Inyanga of Swaziland. Yet others use charms, incantations and dances to cure disease. These are the fore runners of placebos, psychotherapy, and physical therapy used in modern medicine. In all these aspects traditional African medicine displays characteristics of lifestyle modification and PCC, which are embedded in traditional practice.

## The African community and diabetes

African society lays a strong emphasis on the family, community, tribe, and religion. This implies that a person with diabetes cannot be treated in isolation. Appropriate modulation of the family and village is an integral part of traditional medical care. As such, this mirrors (or rather, predates) the family therapy and community involvement strategies of modern diabetology. Traditional African medicine has a strong religious and cultural dimension, and is integrated in the social fabric of society or community. Treatment is prescribed not only to an individual, but often to the family or community as well.

In the rapidly changing social scenario that we live in, the importance of family in diabetes care cannot be underestimated.[16] Domestic causes of stress, such as marital discord and financial challenges, are common precipitating factors for uncontrolled hyperglycaemia. Correcting these, and involving the family in providing a positive nutritional, physical and emotional environment, certainly helps in achieving good glycemic control. At the same time, the role of the community cannot be overlooked.[17] An extension of PCC is requesting community leaders to encourage healthy habits, infrastructure such as playgrounds, and allow diabetes education at social platforms such as weekly markets. Community elders can function as 'diabetes evangelists', spreading

the word about diabetes care, and promoting healthy diabetes care-seeking behaviour in the population. Religious leaders and traditional chiefs have an important role to play in this regard. One should utilize the services of traditional medicine practitioners to improve diabetes awareness as well.

## Modern African environment

The modern Africa is changing rapidly. In the current socioeconomic environment, the average African enjoys better literacy, education, communication, and awareness than before. This holds true for the average African person with diabetes as well. Given a choice, he or she would expect to have a say in his or her medical management; he or she would certainly make appropriate choices, provided they are made diabetes literate and numerate, through a process of patient education.[18] The concept of PCC should also incorporate the financial aspect of therapy, especially in countries where people pay from their pocket for medical expenses. It should understand geographical realities as many patients have to travel long distances to seek medical advice or obtain drug supplies. The existence of social support, cold chain facilities, and laboratories for the monitoring of glycaemia are other issues which need to be addressed while formulating a PCC programme.

## Conclusion

PCC as a concept is perfectly suited to the current African health environment. In fact, this approach needs to be expanded and developed to fit the African context. Family-centred and community-oriented therapy must be practised, keeping the family and community as interventional units. Elements of traditional medicine must be incorporated into counselling strategies to make them more effective. PCC should be considered an integral, centuries-old part of African diabetes care, rather than being thought of as a Western concept which has to be forcibly transplanted on to African soil.

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# Diabetes education: strategy for improving diabetes care in Nigeria

**T H Raimi, O C Alebiosu, J O Adeleye, W O Balogun, B A Kolawole, O B Familoni, R T Ikem, O F Adesina, O Odusan, S A Oguntona, T Olunuga, and O Ogunsemi**

## Introduction

Chronic diseases are now the major causes of death and disability globally. According to the World Health Organization (WHO), 60% of all deaths in the world are attributable to chronic non-communicable diseases (NCDs), about half of which are cardiovascular diseases.[1] The increase in this global burden is a result of the rapid increase of risk factors for NCDs caused by lifestyle changes, especially in the developing countries. WHO[2] estimated that chronic diseases accounted for 24% of all deaths in Nigeria in 2005 and that over the next 10 years death from chronic diseases will increase by 24% – most markedly, death from diabetes will increase by 52%.

Diabetes mellitus is now one of the most common NCDs globally with an estimate of 366 million in 2011 (projected to increase to 552 million by 2030), and is undoubtedly one of the most challenging health problems in the 21st century.[3] The diabetes pandemic has evolved in association with rapid cultural changes, an ageing population, increasing urbanisation, dietary lifestyles, and unhealthy behavioural patterns without prevention and control preparedness. Even though the prevalence of infectious diseases such as HIV/AIDS, malaria, and tuberculosis has a major effect on the economy of developing countries, diabetes seems to be the world's most threatening epidemic, which is beginning to be a problem in the developing world. Diabetes maims the sufferer slowly but surely as it damages the vital organs in the body, especially when not properly managed. The potential severity of diabetes is such that some epidemiologists predict that its economic impact and death toll will surpass the ravages of HIV and AIDS in the near future.[4] In 2005, it was estimated that Nigeria lost 400 million dollars in national income from premature deaths due to heart disease, stroke and diabetes and these losses are projected to increase such that, cumulatively, Nigeria stands to lose 8 billion dollars over the next 10 years.[2]

The prevalence of type 2 diabetes (T2DM) in Nigeria in 2011 is 4.0% (with 81% undiagnosed according to a 2012 update).[3] In absolute terms, Nigeria has the largest number of people with diabetes in Africa (about three million), and it is one of the countries with the highest mortality rate due to diabetes[3]. The prevalence of impaired glucose tolerance (IGT) which is a forerunner of T2DM is even more alarming, 6.8% in 2011.[3] Thus, Nigeria is one of the countries that face the greatest burden of diabetes. Fortunately, T2DM and its complications are preventable. Primary prevention of T2DM has been shown to be possible in susceptible individuals by healthy diet and physical activity.[5] In individuals who already suffer from diabetes, diabetes self-management education (DSME) has been shown to have positive effects on knowledge,

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*Figure 1 Diabetes camp in Ogun State, Nigeria (© WDF SIDCAIN)*

frequency, and accuracy of self monitoring of blood glucose, self-reported dietary habits, and glycaemic control. There may also be beneficial effects on lipids, physical activity, weight, and blood pressure.[6,7] Prevention of complications of diabetes is also possible by DSME since improved glycaemic control is associated with reduction in the long-term complications of diabetes.[8,9]

## Strategies for improving diabetes care

Following the Alma Ata declaration of 1978 on the appropriateness of 'primary healthcare' as the key to the provision of 'health for all by the year 2000', in August 1987, the federal government of Nigeria launched its Primary Health Care (PHC) plan, which was intended to be the cornerstone of health policy. The PHC is a very useful means of disseminating information in Nigeria as well as achieving health-related goals. Through the PHC, immunisation against deadly childhood diseases has been made possible, and information about HIV prevention is being disseminated regularly.[10] Thus the PHC can be expanded to include diabetes prevention. Many of the educational posters on diabetes in the country are written in English, focus on diabetes care, and could be found mainly in secondary and tertiary care centres. Educational posters on diabetes prevention in English, and at least the three other major languages (Hausa, Igbo, and Yoruba) should be available in all primary health centres and private hospitals across the country, as well as the secondary and tertiary care levels.

Incorporation of community health workers into the care of persons with chronic NCDs, such as asthma, hypertension, and diabetes, has been shown to be beneficial.[11–13] In Nigeria, community health workers could be trained to penetrate the community with appropriate information on diabetes awareness and prevention. Furthermore, community leaders and leaders of organised groups such as market women, drivers, etc. could help mobilise their members for diabetes awareness campaigns.

The mass media can positively change health behaviour.[14] Therefore, in addition to the above, the print and electronic media should be explored to reach out to the populace at large with special emphasis on T2DM prevention. However, the quality of the information being passed to the public should be screened by important bodies such as the Diabetes Association of Nigeria (DAN) and the Endocrinology and Metabolism Society of Nigeria. Hitherto, diabetes awareness campaigns in the print and electronic media were limited to the celebration of World Diabetes Day, but it should be a regular event if the impact is to be widely felt across the nation.[15]

The availability of the global system for mobile communication has revolutionised information dissemination in Nigeria. Studies have shown that not only are wireless messages useful in the management of chronic illnesses, they also serve as a powerful preventive and behaviour modification tool.[16–18] Thus, if the health ministry or non-governmental organisation (NGO) partner with the telecommunication companies, millions of Nigerians, especially the urban dwellers, who are more likely to indulge in unhealthy lifestyles, can be reached simultaneously with important messages on diabetes prevention. However, the majority of rural dwellers in Nigeria (who constitute about 80% of the population and of whom about 90% are illiterate) do not have access to newer information technology resources and are thus cut off from the global scene.[19] The primary healthcare system is still the most appropriate option in this setting since rural dwellers have previously shown a positive response to the services of information agents such as agricultural extension workers and rural health workers.[19]

The aforementioned strategies are useful if there is an unwavering commitment by the appropriate authorities. However, it is unfortunate that (according to the 2009 International Diabetes Federation report), there are no data to suggest a national diabetes programme in Nigeria.[3] There is a high unemployment rate in the country, where poor income, lower rate of education, and physical complications adversely affect the quality of life of patients with T2DM.[20] The management of diabetes and its complications is very expensive, and not affordable by many sufferers in developing countries such as Nigeria. For example, the current minimum wage for civil servants is US$113 (18 000.00 Nigerian Naira) per month.[21] However, haemodialysis for a patient with renal failure costs about US$400 per week, excluding the cost of medications, transportation, and laboratory investigations. While sufferers of AIDS and TB receive medications and do some laboratory tests free, there are no subsidies for diabetes care.[22] This underscores the need for aggressive preventive measures against the development of diabetes on the one hand, and its complications on the other hand.

The positive impact of diabetes education on glycaemic control and other aspects of diabetes care is well known.[6] Training in diabetes care is one aspect that virtually all of sub-Saharan Africa lacks. It has been shown that the lack of proper training of health professionals in diabetes care accounts for the high non-compliance rates and serious complications.[23] The knowledge of diabetes and hypertension care among healthcare professionals in Nigeria is poor, especially those at the primary and secondary care level.[24] The knowledge of diabetes care is expected to be worse among patients living with diabetes. The dearth of diabetes educators is a major limiting factor against education of patients in Nigeria. Thus, the clinician also doubles as the diabetes educator, and sometimes as the dietician. Fortunately, it has been shown that other healthcare givers can also educate the patient with attendant positive results.[25] This means that nurses, laboratory scientists, pharmacists, etc. can also play a valuable role in educating patients with diabetes. However, as stated earlier, there is need to train the care givers in order to ensure that appropriate and uniform information is being disseminated. At the same time,

efforts should be made to produce certified diabetes educators in the country.

Both individual and group education have a positive impact on blood glucose control in the short term.[26] In Nigeria, the Diabetes Association of Nigeria organises regular group sessions where patients with diabetes are educated on various aspects of diabetes care, and this has been shown to positively influence glycaemic outcomes.[27] These activities are however restricted to some tertiary and secondary centres, which care for less than half of the diabetic patients in Nigeria. There is a need to strengthen diabetes club activities, at the primary care level and in the public and private sectors, for the impact of education to be felt nationally. Besides, the education given should be culturally acceptable for it to achieve its intended goals.[6]

## Support of the World Diabetes Foundation

The above underscores the importance of the activities of the World Diabetes Foundation (WDF) in supporting improved care of people living with diabetes through the re-training of healthcare givers in Ogun and Oyo States of Nigeria. The WDF currently supports two projects (WDF 08-321 and WDF 10-515) in the southwest of the country. Through the support of the Foundation, diabetes and hypertension treatment guidelines were developed[28] to enhance protocol-driven care of people living with diabetes and were made available for healthcare givers in the project areas in Nigeria (see Figures 1 and 2). In developing the guidelines, major references were made to the T2DM Clinical Practice Guidelines for sub-Saharan Africa published by the International Diabetes Federation, Africa region. The guidelines were developed to meet the needs of the primary and secondary healthcare givers both at the urban and rural areas of the country. At the end of these projects, it is expected that there will be better diabetes and hypertension education among healthcare workers, prevention of diabetes and its complications and massive community diabetes awareness, which will be useful in implementing preventive strategies.

*Figure 2 Treatment guidelines being distributed by the WDF SIDCAIN project team*

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# Glycaemic control and glucose-lowering therapy in diabetic patients with kidney disease

B Mpondo

## Introduction

Chronic kidney disease (CKD) is a common condition that affects approximately more than 50 million people worldwide.[1] Diabetes mellitus, one of the chronic non-communicable diseases is of increasing prevalence worldwide including in developing countries where it was previously a disease of less importance.[2] This rapid increase in prevalence has been attributed to rapid population growth, ageing, urbanisation, and increasing prevalence of obesity and sedentary lifestyles.[2] The use of antiretroviral therapy for the treatment of human immunodeficiency virus (HIV) has been shown to increase the risk of diabetes by causing insulin resistance and metabolic syndrome.[3] It is estimated that by the year 2030 the number of people with diabetes mellitus worldwide will be approximately double the number in 2000.[2] Diabetes has been implicated as one of the causes of renal diseases.[4] It is estimated that in up to 45% of patients with renal failure, diabetes is the cause.[5] Studies show that 15 to 24% of patients with diabetes also have moderate to severe CKD,[6–8] although a higher prevalence of 40% was found in one stud.[9] Scientific evidence shows that patients with a combination of diabetes and CKD (especially associated with albuminuria) have higher mortality rates compared with those with diabetes alone.[10–12]

## Definition and diagnosis of CKD

Until recently, CKD resulting from diabetes has been referred to as diabetic nephropathy. Currently CKD resulting from diabetes is generally referred to as diabetic kidney disease (DKD) after review by the Diabetes and Chronic Kidney Disease Working Group of the National Kidney Foundation. Diabetic nephropathy is currently reserved for renal disease attributed to diabetes with histopathological injury from renal biopsy.[13,14] Regardless of the underlying pathology, CKD is defined as kidney damage or impaired renal function for 3 months or more.[14] Proteinuria has been shown to be an important marker of impaired renal function.[15] In patients with type 1 diabetes who are found to have proteinuria, CKD is most likely caused by diabetes because studies have shown that there is a strong correlation between proteinuria and typical histological findings on renal biopsy.[16] Microalbuminuria, however, is less associated with typical pathological lesions, but still indicates a risk of progression to CKD, especially when a patient has co-morbidities such as hypertension.[17] In type 2 diabetes, microalbuminuria is less associated with DKD,[18,19] however patients with retinopathy and microalbuminuria are strongly suggestive of DKD, with a sensitivity over 90%.[19]

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## Measurement of glycaemic control

Glycated haemoglobin ($HbA_{1c}$) is used as a measure of glycaemic control for patients with diabetes. The recommended target value for patients with diabetes is <7.0%, including those with DKD.[20] Studies have shown that there is no significant difference between the correlation of the level of $HbA_{1c}$ and the level of blood glucose between patients with CKD not requiring dialysis and those with diabetes without CKD.[21] With such evidence therefore, the same target value of $HbA_{1c}$ of <7.0% can be used in this population.[20] For patients with CKD on dialysis, however, the correlation between $HbA_{1c}$ and the level of blood glucose is unclear. Some studies suggest that $HbA_{1c}$ provides an underestimate of glycaemic control,[21,22] while others suggest that it provides an overestimation.[5,23] One of the studies suggests that continuous glucose monitoring is more effective for the evaluation of glycaemic control in patients on haemodialysis as compared to $HbA_{1c}$.[24] Alternatives as markers for glycaemic control in this group of patients may be glycated albumin (GA) or glycated fructosamine.[22] However, one study showed glycated fructosamine was not reliable in uraemic patients.[21]

## Choice of medications in diabetic patients with CKD

In patients with type 2 diabetes, tight glycaemic control has been shown to reduce the risk of microvascular complications.[9,25,26] The Diabetes Control And Complications Trial (DCCT) proved that in type 1 diabetes, tight glycaemic control reduces the risk for microvascular complications.[27] It is therefore important to attain glycaemic control to the target value as far as is possible, to avoid the complications associated with poor glycaemic control.

For patients with both diabetes and CKD however, achieving glycaemic control is not a straightforward issue. Treatment options are limited in this group of patients because with the reduced glomerular filtration

rate (GFR), there is accumulation of the drugs used or their metabolites, some of which are active.[28] There are important considerations that need to be made in choosing the correct medications to use in this patient group. Here we will review the commonly used hypoglycaemic agents to aid the right choice of medications in this patient group.

**Insulin**

Exogenous insulin is mainly eliminated by the kidneys. In patients with renal insufficiency, the degradation of exogenous insulin is impaired leading to prolongation of the half-life of insulin.[29] Several studies have shown that in patients with renal insufficiency there is decreased renal clearance of insulin with one study showing that there is 30–40% decreased clearance of short-acting insulins.[30] Because of this, there are more episodes of hypoglycaemia in patients on insulin with renal insufficiency compared with those without renal insufficiency,[31] especially when the GFR falls to <60 ml/min.[32] It has been shown that in patients with renal insufficiency, there is a reduced insulin requirement because of the decreased clearance.[33,34] In one study, however, it was found that despite decreased clearance of regular insulin there was also a reduction in its effect.[30] In a more recent study, it has been shown that reducing the dose of insulin in diabetic patients with renal insufficiency reduced the episodes of hypoglycaemia while having the same effect on glycaemic control as comparedwith those receiving standard doses.[35] Another study showed that higher weight-based insulin doses were associated with a higher risk of hypoglycaemia as compared with lower doses.[36] The American College of Physicians recommends a 25% decrease in the dose of insulin when the GFR is between 10 and 50 ml/min and a 50% decrease of the dose when the GFR is <10 ml/min.[37] Therefore in patients with renal insufficiency, insulin dose should be calculated based on the level of GFR to avoid episodes of hypoglycaemia. In all cases, an 'estimated' GFR (eGFR) can be used.

**Oral hypoglycaemic agents general conditions**

Clearance of many of the oral hypoglycaemic drugs or their metabolic products (like that of insulin) is reduced in diabetic patients with renal insufficiency. As a result of such effects, patients will be exposed to higher levels of respective drugs or their metabolites potentiating side-effects. This has been found to be serious in patients with CKD stages 3 to 5 (eGFR <60 ml/min).

**Sulphonylureas**

These drugs are insulin secretagogues and increase the level of endogenous insulin. Because of their effect in increasing the level of endogenous insulin, these drugs have the potential to cause significant hypoglycaemia, especially in patients with renal insufficiency.[38] These are one of the commonest prescribed group of medications in diabetic patients, with one study showing that up to 33% of the prescriptions for hypoglycaemic drugs in America were for sulphonylureas.[39] Clearance of sulphonylureas and their metabolites is dependent on renal function. Studies have shown a high prevalence of hypoglycaemic episodes in dialysis patients using sulphonylureas.[38] The risk of hypoglycaemia is reduced when shorter-acting agents are used. First-generation sulphonylureas should be avoided in CKD stages 3 to 5. Of the second-generation sulphonylureas, glipizide is recommended with no dose adjustment being necessary because its metabolites are not active and there is a lower potential for the development of hypoglycaemia.[14,40] The major metabolites of glipizide are products of aromatic hydroxylation that have no hypoglycaemic activity. Glibenclamide undergoes hepatic metabolism to two weakly active metabolites. In patients with renal insufficiency, these accumulate and increase the risk of hypoglycaemia.[38, 41-43] Another of the second-generation sulphonylureas glimepiride also undergoes hepatic metabolism into two metabolites which are excreted in urine and faeces. The major metabolite is renally excreted and has a weak hypoglycaemic effect and may accumulate in renal insufficiency, increasing the risk for hypoglycaemia.[44–46] However, low doses have been shown to be safe in CKD.[44] With this evidence, glipizide is the sulphonylurea of choice in CKD. It has been shown to have the least risk in causing hypoglycaemia compared with the other sulphonylureas.[47]

**Biguanides (metformin)**

These are insulin sensitisers. They have no effect on the level of insulin, they rather lower hepatic gluconeogenesis and increase insulin-mediated glucose uptake by insulin -sensitive peripheral tissues. Metformin is the only available drug in this group. Metformin is one of the most efficacious oral hypoglycaemic agents and is associated with favourable clinical outcomes.[48] Metformin is recommended as the drug of choice in patients with type 2 diabetes.[49] Metformin does not exhibit the high risk of hypoglycaemia associated with other drugs used to treat diabetes, it is excreted unchanged in urine. Guidelines discourage the use of metformin in patients with CKD because of its alleged potential to cause lactic acidosis.[14] However, some studies challenge this by showing that metformin has less risk of causing lactic acidosis than-previously thought. Metformin has been shown to have no effect on intracellular lactate production.[50–52] Even in patients with renal failure, the use of metformin was not associated with significant rise in lactate levels.[53–54] Diabetic patients on metformin developed significant lactic acidosis only when they had other co-morbidities such as hypotension, hypoxaemia, acute kidney injury, or other acute pathophysiological insults.[55–57] CKD has been shown to cause insulin resistance;[58] being an insulin sensitiser metformin may improve this as well. Researchers have shown that metformin is safe to be used in patients with CKD provided that dose adjustments

are made according to the level of renal function.[54] A review article on the use of metformin in patients with CKD has shown that its use is beneficial with respect to cardiovascular outcomes and metabolic parameters in patients with diabetes and CKD.[59,60] The long-time belief that metformin use in patients with CKD is highly associated with lactic acidosis may be exaggerated based on recent evidence by investigators.

Though the evidence for lactic acidosis-risk and CKD may be weak, it is generally agreed that the drug should not be used, or the dose reduced, in significant CKD. An old system was to discontinue the drug if the serum creatinine rose above 150 mmol/l, but current guidelines use the estimated GFR (eGFR). One simple system is to use metformin freely if the eGFR is >45; use with caution (and in lower doses) when the eGFR is 30–45, and not to use at all if the eGFR is <30.[61]

**Thiazolidinediones (pioglitazone)**

Thiazolidinediones enhance insulin action in insulin target tissues through binding to peroxisome proliferator-activated receptor gamma. Pharmacologically, these drugs have glycaemic efficacy proven to be equivalent to sulphonylureas and biguanides with less hypoglycaemic episodes. Thiazolidinediones are metabolised by the liver to products that have either very weak action as in rosiglitazone or moderate activity as in pioglitazone. These drugs have been shown to be effective without increasing the risk of hypoglycaemia in patients with renal insufficiency.[62–64] Some studies have suggested that the use of thiazolidinediones in diabetic patients with renal insufficiency may have renoprotective effects. Thiazolidinediones have been shown to either prevent or slow progression of DKD independent of glycaemic control.[65] Other studies have shown that the use of thiazolidinediones is associated with reduction in urinary excretion of albumin, essential for slowing progression of DKD.[66] The pharmacokinetics of thiazolidinediones has not been shown to change even when there is decreasing renal function and therefore no dose adjustment is required when they are used in treating diabetes in patients with CKD.[67] However, this group of drugs has a known side-effect of fluid retention which may be accentuated in patients with renal failure. Also, due to concerns over increased risk of cardiovascular disease, rosiglitazone has been withdrawn. Pioglitazone is thus now the only glitazone available. As mentioned, because of its hepatic metabolism, it can be safely used in all grades of CKD. However, because of lack of information, the manufacturers do not recommend its use for patients on dialysis. Additionally, there have been recent concerns over a possible association with bladder cancer, and pioglitazone should not be used in those with a previous diagnosis of bladder neoplasms, or with unexplained haematuria.

**Incretin-based insulin secretagogues**

This is the new group of drugs for the treatment of type 2 diabetes. It has been developed following improved understanding of the incretin effect in the pathophysiology of type 2 diabetes. In this group, we have glucagon-like peptide 1 receptor analogues and selective dipeptidyl peptidase 4 inhibitor is approved for use.

Exenatide is the glucagon-like peptide 1 receptor analogue. Pharmacologically, it has only modest glycaemic efficacy, but also has the advantage of causing weight loss, unlike most of the other glycaemic agents.[68] Exenatide is cleared primarily by the kidneys. Studies have shown that renal clearance of exenatide is significantly reduced in patients with CKD stages 4 to 5. Several case reports show that the use of exenatide is associated with acute kidney injury or progression of CKD.[69,70] Its use is therefore not recommended in patients with CKD stages 4 and 5.[20] The other available incretin mimetic, liragrutide, is fully metabolized elsewhere in the body and the kidneys are not a major organ in its elimination.[71] When used in single dosing, it has not been shown to cause any effect in patients with CKD stages 4 to 5;[70] however, there is not enough data on long-term use, hence it is not recommended when eGFR is <60 ml/min.[20]

The dipeptidyl peptidase (DPP-4) inhibitors work by decreasing the breakdown of endogenous incretin hormones, as a result improving postprandial and fasting blood glucose levels. This group includes drugs like sitagliptin, saxagliptin, vildagliptin, and linagliptin. They have been shown to be safe in the management of hyperglycaemia in patients with CKD.[72–74] However, with the exception of linagliptin, the rest require a downward dose adjustment with declining renal function.[20,73]

**Alpha-glucosidase inhibitors**

Other oral agents include alpha-glucosidase inhibitors (acarbose and miglitol). These act by inhibiting intestinal breakdown of oligosaccharides delaying digestion of ingested carbohydrates. Acarbose is metabolised nearly exclusively in the gastrointestinal tract (GIT) with only about 2% being systemically absorbed. Miglitol on the other hand is largely absorbed systemically and excreted unchanged in urine. There is not enough data to support the use of these drugs in patients with CKD, and their use is not recommended in patients with CKD stages 4 to 5.[20,47]

**Meglitinides**

Meglitinides are insulin secretagogues which act by binding to adenosine triphosphate (ATP) dependent potassium channels in beta cells in the pancreas. They have a potentially lower risk of hypoglycaemia than standard sulphonylureas in patients with CKD, but still need to be used with care.

In this group, repaglinide undergoes hepatic metabolism resulting in inactive bi-products with a small risk of hypoglycaemia in patients with CKD.[75,76] Another drug in the group nateglinide is mainly metabolised in the liver to weakly active metabolites, of which about 80% are excreted in urine and 20% in faeces; about 15% of

the drug is excreted unchanged in urine. With impaired renal function, there is accumulation of the drug and its active metabolites which may increase the risk of hypoglycaemia.[77,78] Nateglinide therefore should be used cautiously in patients with CKD. Studies have shown that repaglinide accumulation only occurs in severe renal dysfunction, but this is not associated with increased risk of hypoglycaemia.[75,76] Based on this evidence, it is recommended that both of these drugs be started at lower doses (0.5 mg for repaglinide and 60 mg for nateglinide, each with meals) in CKD.

## Conclusions

Management of patients with diabetes and CKD is a challenging task because multiple factors in each condition may affect the other. Diabetes is a leading cause of CKD and a major source of morbidity and mortality in patients with established CKD. Loss of kidney function conspires to change glycaemic regulation in ways that can both worsen and improve blood glucose control. Despite the unique nature of diabetes in patients with CKD, there currently are no specific guidelines to direct glycaemic therapy in these patients. In summary, the majority of drugs available to treat hyperglycaemia, and especially first-generation sulfonylureas and alpha glucosidase inhibitors, are affected by kidney function and therefore should be either avoided or used in reduced doses for patients with CKD. The use of metformin is controversial because recent evidence shows it may not be as toxic as initially thought, but should be avoided when CDK is significant. Thiazolidinediones do not require dose adjustments for kidney disease and may have an independent beneficial impact on the progression of DKD, though only pioglitazone is now available, and other side-effects restrict its use. Overall, insulin remains the safest glucose-lowering treatment, when CDK in diabetes is associated with markedly low eGFR.

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# Choosing an insulin regime: a developing country perspective

S Kalra and Y Gupta

Insulin is a frequently prescribed drug in diabetes practice. Considered the most effective glucose-lowering intervention, insulin replacement therapy is a key component of effective diabetes management, irrespective of the stage of the condition.[1] Used as monotherapy, in combination with oral anti-diabetic drugs, and with incretin-based therapy, insulin is the most potent glycemia-lowering therapy available.[1]

Insulin is available in a range of preparations and delivery devices, and can be used to craft a variety of combinations and regimes.[2] All these regimes are backed by evidence in the form of randomised controlled trials and observational studies. Published reports often suggest conflicting ways of choosing regimes for insulin initiation and intensification. Well-written reviews do try to provide guidance for decision-making,[3,4] but this is complicated further by differing opinions of various international guidelines.[5–8] Widely used guidelines originate from the developed world,[5,9,10] and are appropriate for the clinical scenario of the country of origin. Understandably, they do not take into account the bio-psychosocial realities of developing countries, so markedly different from those seen in developed nations. We review the diabetes scenario in the developing world, and try to address the issue of appropriate choice of insulin regimes in this context.

## The developed world – diabetes as a chronic disease

The developed world tends to view diabetes as a chronic disease. Practitioners in optimally resourced healthcare settings may assume that persons with diabetes are screened and diagnosed in the natural course of the condition, and report dutifully for follow-up at regular intervals. This, too, is correct, in the vast majority of their cases. It is also perceived, by authors of various guidelines, that persons with diabetes will present themselves for intensification of therapy if current treatment fails to control glycated haemoglobin ($HbA_{1c}$).[9] This may be correct in many instances. The American Association of Clinical Endocrinologists guidelines, for example, reinforce the validity of this assumption when they classify persons seeking anti-diabetic therapy in to three categories, based upon their initial $HbA_{1c}$. The mid-range $HbA_{1c}$ of 7.5% to 9.0% is perhaps thought to be the glycaemic status of the average person presenting for treatment in the United States.[9]

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## The developing world: diabetes as an acute or chronic disease

Most of the world's population, however, live in developing countries. So too, do 80% of the world's people with diabetes. Most of the countries in the Top Ten list of persons living with diabetes are middle- and low-income nations.[11] It stands to reason, therefore, that the choice of insulin regime should take socioeconomic and healthcare issues of these people into consideration

For the developing world, diabetes is not only a chronic condition, but an acute disease as well, which can be life threatening. The high incidence of hospitalisations and mortality reported from resource-challenged countries bears testimony to this fact.[11] Complications such as diabetic ketoacidosis and infections including foot infections, tuberculosis, and human immunodeficiency virus (HIV) are not uncommon.[12,13] Healthcare providers in developing countries often encounter the acute face of diabetes, replete with multiple infections and metabolic co-morbidities. For such health professionals, the term 'complications' conjures visions of septicaemias and trauma. This is in contrast to his or her colleague in the developed world, for whom 'complicated conditions' imply chronic abnormalities such as retinopathy, nephropathy, and cardiovascular disease.

The exhortation of Western guidelines, therefore, to adopt less aggressive glycaemic targets in the 'presence of co-morbid conditions' may confuse developing country practitioners.[10] Most infectious or non-infectious acute complications would require an aggressive glycaemic control strategy, using intensive insulin regimes, for the short-term, to control confounding factors. Alleviation of the acute complication, as well as correction of glucotoxicity and lipotoxicity, may allow de-escalation of the prescribed insulin regime. The change in intensiveness of insulin regimes can be measured both in terms of number of doses per day, and total units per day. In other words, the presence of acute metabolic or infectious morbidity may influence the choice of insulin regime in developing countries, in a manner not described fully in Western guidelines.

## Pattern of diabetes care-seeking behaviour is not uniform

Kalra et al describe four distinct patterns of diabetes care, based upon healthcare-seeking behaviour as a function of time.[14] The classic picture of gradual up-gradation is seen in patients who need, and are prescribed, gradual intensification of therapy as their disease progresses. This pattern follows suggestions made by guidelines, and reflects not only optimal diabetes care, but also optimal diabetes care-seeking behaviour on the part of patients.

The second scenario is seen in patients who present with acute co-morbidity, or severe hyperglycaemia, receive initial intensive therapy, and then experience a reduction in requirement of drugs, due to correction of glucotoxicity, lipotoxicity, and other factors. Such clinical cases are common in the developing world.

A third situation, known as the 'yo-yo' or 'see-saw' pattern, describes patients who present with high glucose levels, respond to therapy, and then discontinue it for a period of time, for various reasons, before returning to the physician with uncontrolled hyperglycaemia. This situation implies inadequate patient and community education related to diabetes.

A fourth pattern known as the linear pattern, describes a situation where the patient continues to be prescribed almost the same drugs, irrespective of glycaemic levels or other co-morbid developments, over a long period of time. This indicates lack of pro-activism on the part of the diabetes care provider.

'Doctor shopping' may also occur during the course of the condition. It is not uncommon to have patients request deintensification of insulin regimes, after having been cured of significant acute illness with intensive glucose-lowering strategies. An understanding of these patterns helps choose an appropriate regime of insulin. Paraphrasing this statement, healthcare-seeking behaviours of the person with diabetes, and the stage of natural history of diabetes at which he or she presents, influence the choice of an insulin regime. Adherence and persistence to prescribed insulin regimes are also influenced by the nature of diabetes care being followed by the majority of the community.

## Human resources are limited

Prescribing insulin is not a simple or quick task. While writing a prescription of tablets or of insulin takes perhaps the same amount of time and energy, the pre-prescription and post-prescription work involved in insulin therapy is significant. To be effective and safe, an insulin prescription should be accompanied by an explanation of why it is necessary, motivation to accept it, demonstration of insulin technique, education regarding hypoglycaemia and its management, information about self-monitoring, and empowerment related to self-adjustment of dosage.[15] Carried out diligently and carefully, this consumes a disproportionate amount of both time and energy. Many healthcare practices are unable to afford the human resources required for this.[16] It thus becomes imperative to choose simple insulin regimes, preparations, and devices, which require less time to explain, and which are easier to use for the person with diabetes.

While circumstances will vary for each individual patient, they will also change for each healthcare setting. Appropriate choices should be made to ensure cost-effectiveness in each situation. In particular, the availability and cost of qualified, trained manpower, the ability to prevent iatrogenic hypoglycaemia by detailed education, and the cost of managing hypoglycaemia if it occurs, should be weighed against the advantages of achieving glycaemic control with intensive regimes.

## Choosing a regime

Insulin regimes are traditionally classified as basal (conventional insulin such as neutral protamine Hagedorn [NPH] or analogues like insulin glargine, detemir, and degludec), premixed (conventional insulin combinations such as 30/70 – 30% regular insulin, 70% NPH insulin; or analogue combinations such as 25/75 – 25% lispro, 75% protaminated lispro; 30/70 – 30% aspart, 70% protaminated aspart; 50/50 – 50% lispro, and 50% protaminated lispro; 50/50 – 50% aspart, 50% protaminated aspart), and basal-bolus or intensive (multiple-component insulin regimen consisting of basal insulin given once daily, usually at bedtime and prandial insulin (regular insulin; or a rapid-acting analogue such as aspart, lispro, and glulisine) given three times, one each before breakfast, lunch, and supper). However, with newer evidence supporting the use of once-daily premixed insulin, classification can also be done in terms of number of doses per day (once daily, twice daily, and so on). Novel thrice-daily regimes such as prandial insulin thrice daily; premixed-prandial-premixed; and prandial-prandial-premixed are also used in specific clinical situations.[17]

In Tables 1 and 2, we offer a pragmatic way of choosing an initial insulin regime, based upon a few simple clinical, biochemical, and practical factors. The insulin regime is a dynamic choice, which can be changed as per need. Correction of acute toxicity allows one to downgrade the regime, i.e. reduce the number of injections, while inability to achieve glycaemic targets without significant hypoglycaemia suggests a need to intensify the regime.

Clinical factors strongly influence the choice of initial regime. Presence of significant illness such as trauma, fracture, planned elective surgery, acute infection, or necessity for steroid therapy, should encourage use of intensive regimes. These may be de-intensified once control of glycemia, and of the comorbid state, is achieved.

Persons with concomitant illness which puts them at high risk of hypoglycaemia should preferably receive premixed or basal insulin. The safest insulin currently available, with respect to hypoglycaemia, is insulin degludec.[18]

| Clinical factor/choice of regime | Basal[1] | Premixed[2] | Intensive[3] |
|---|---|---|---|
| Fasting hyperglycaemia alone | ++ | + | ++ |
| Postprandial hyperglycaemia alone | – | + | ++ |
| Both fasting and postprandial hyperglycaemia | – | ++ | ++ |
| High $HbA_{1c}$ at presentation (>8.5%) | – | ++ | ++ |
| Low $HbA_{1c}$ at presentation (<8.5%) | + | ++ | – |
| Acute comorbidity requiring euglycaemia for management, e.g. infection, trauma | – | + | ++ |
| High risk of hypoglycaemia | + | + | – |

**Notes:**
1. Basal insulin includes conventional insulin (e.g. NPH) or analogues (e.g. glargine, detemir, and insulin degludec).
2. Premixed insulin includes conventional insulin combinations such as 30/70 – 30% regular insulin,70% NPH insulin; 50/50 – 50% regular insulin, 50% NPH insulin; or analogue combinations such as 25/75 – 25% lispro, 75% protaminated lispro; 30/70 – 30% aspart, 70% protaminated aspart; 50/50 – 50% lispro, 50% protaminated lispro; 50/50 – 50% aspart, 50% protaminated aspart.
3. Intensive insulin means a multiple-component insulin regimen consisting of basal insulin given once daily (usually at bedtime) and prandial insulin (regular or an analogue such as aspart, lispro, and glulisine) given three times a day – one each before breakfast, lunch, and supper.

*Table 1 Pragmatic way of choosing an initial insulin regime on the basis of clinical factors*

| Clinical factor/choice of regime | Basal[1] | Premixed[2] | Intensive[3] |
|---|---|---|---|
| Inability to have regular meals | + | + | – |
| Inability to self-monitor | + | + | – |
| Inability to self-adjust doses | + | + | – |
| Inability to remain in regular touch with diabetes care team | + | + | – |
| Inability to self-inject | + | + | – |
| Psycho-social factors | + | + | – |
| Poor family support and acceptance | + | + | – |
| Low personal acceptance of insulin | + | + | – |

**Notes:**
1: Basal insulin includes conventional insulin (e.g. NPH) or analogues (e.g. glargine, detemir, and insulin degludec).
2: Premixed insulin includes conventional insulin combinations such as 30/70 – 30% regular insulin,70% NPH insulin; 50/50– 50% regular insulin, 50% NPH insulin; or analogue combinations such as 25/75 – 25% lispro, 75% protaminated lispro; 30/70 – 30% aspart, 70% protaminated aspart; 50/50 – 50% lispro, and 50% protaminated lispro; 50/50– 50% aspart, and 50% protaminated aspart.
3: Intensive insulin means a multiple-component insulin regimen consisting of basal insulin given once daily (usually at bedtime) and prandial insulin (regular or an analogue such as aspart, lispro, and glulisine) given three times a day – one each before breakfast, lunch and supper.

*Table 2 Pragmatic way of choosing an initial insulin regime on basis of practical factors*

Biochemical factors also inform the choice of treatment. Fasting glycaemia is best controlled by basal insulin, and postprandial by premixed or intensive regimes. The presence of both fasting and postprandial hyperglycaemia implies the need for premixed or intensive regimes. The excursion between postprandial and fasting glucose values can be used to estimate the need for such insulin. Another formula suggests measuring the ratio of fasting glucose (in mmol/l) to $HbA_{1c}$: a ratio>1.3 implies the necessity for basal insulin.[19]

The above listed biological factors, however, may have to be modulated according to practical and psychosocial factors. The ability to take regular meals, self-inject, adjust doses, and consult the diabetes care team may change the prescription of insulin. Psychosocial issues including personal and family attitudes may also influence choice of management. Premixed insulin is characterised by efficacy, along with safety and convenience. Relative glycaemic excursions after each meal can help decide the timing of administration of premixed insulin, if it is prescribed in a once-daily dose.

Diabetes care professionals working in developing countries are familiar with unwelcome situations such as limited supply of insulin, or inadequate facilities for self-monitoring of blood glucose, or inability of patients to return for regular follow-up because of sociopolitical or geographical reasons. In these cases, the primary aim of aggressive glycaemic control for most infectious or non-infectious acute complications should remain the same. The approach or strategy for achieving such an aim, however, may be modified as per local factors. The dosage of oral anti-diabetic agents (OADs) should be optimised, and insulin added as per availability and need. Basal insulin for example, NPH, can be prescribed once daily to control elevated fasting glucose levels, and twice daily to manage generalised hyperglycaemia. Regular insulin may be added where inappropriate postprandial excursions are present even after OAD optimisation. Where glucose monitoring at multiple time points is not feasible, we suggest monitoring therapy with fasting blood glucose and keeping it as a primary target for control. Once fasting euglycaemia has been achieved, dosage of prandial insulin can be adjusted by testing paired blood glucose values. For example: to decide the need for, and dose of, regular insulin before breakfast, a blood sample before breakfast and 2 hours after breakfast can be taken. If the excursion is unacceptable, regular insulin can be added and titrated appropriately. The decisions for lunch- and supper-time insulin can be similarly taken.

## Conclusions

This developing world perspective should be read in conjunction with existing guidelines on diabetes management. This viewpoint adds to, rather than negates, the collective evidence discussed in various guidelines.

It suggests a fresh way of approaching a common clinical situation, i.e. the choice of an insulin regime. This should help not only practitioners in the developing world, but in advanced countries as well. It highlights the need to consider severity of diabetes, presence of acute infectious and non-infectious comorbidity, and availability of resources, while choosing appropriate insulin therapy. Blanket recommendations by various guideline-issuing authorities may not be entirely appropriate. Adequate use should be made of all available insulin regimes, to ensure appropriate control for all.

It is hoped that this perspective may allow readers to practice 'glocal' diabetology, i.e. following global guidelines, in concordance with local pragmatism.

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# Prevalence of peripheral neuropathy in the contralateral limb of unilateral diabetic amputees

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## Abstract

Sensory and motor defects are known to contribute to foot ulceration in diabetes. It is suspected that the contralateral limb in diabetes patients after unilateral amputation is at risk of peripheral neuropathy, but there is little knowledge on the extent of the problem This study determined the prevalence of peripheral neuropathy in the contralateral limb and examined the demographic characteristics of the study population. There were 32 diabetic unilateral amputees studied, 72% of whom were male. Mean (±SD) age was 60±14 years (range 40–90 years).

Using the Michigan Neuropathy Screening Instrument (MNSI), the mean (±SD) overall peripheral neuropathy score was 1.0±0.3 indicating mild peripheral neuropathy in the majority of patients. There were 94% with Grade 1 and 6% with Grade 2 changes.

We conclude that peripheral neuropathy does exist in the contralateral limb of diabetic unilateral amputees. Most patients lose protective sensation, thereby putting them at risk of foot ulcers, and possible future amputation.


## Introduction

Diabetes mellitus is a metabolic disease that is brought about by either insufficient production of insulin or the inability of the body to respond to insulin. Diabetes is a major cause of lower limb amputation in many regions in the world.[1] In sub-Saharan Africa, fast uncontrolled urbanisation and changes in standards of living are largely responsible for the rising epidemic of type 2 diabetes, and the observed increase presents a substantial public health and socio-economic burden in the face of limited resources.[2] Foot ulcers are a common complication of diabetes, and a frequent cause of hospital admission in diabetic patients.

Neuropathy is a term for any disorder of peripheral nerves and a well-known complication of diabetes, which is a major risk factor for foot ulceration.[3]

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Lower limb amputations are commonly performed because of peripheral vascular disease (PVD), often related to diabetes. Following amputation, diabetic patients are at high risk of further amputation in the contralateral limb – in one study this happened to 50% in 2-years post-amputation.[4] Rates of amputation vary both between and within countries, due to socio-economic factors, the organisational environment, and clinicians' decision-making.[1] The most common aetiology for amputations in North America is PVD.[5] In a study that was conducted in Kenyatta National Hospital, researchers found that out of 77 lower limb amputations done on 74 patients PVD accounted for the majority of lower limb amputations (55%) with one-third of these patients due to diabetes-related gangrene.[1,6] People with diabetic foot complications in African communities often present to hospital only after the onset of gangrene or during a stage of sepsis that might be intractable to conventional supportive treatment.[7]

Diabetic peripheral neuropathy is an important complication and contributes to the morbidity of diabetes. Evidence indicates early detection of peripheral neuropathy results in fewer foot ulcers and amputations.[8] This study was aimed at identifying to what extent peripheral neuropathy is present in diabetic patients with a unilateral amputation.

## Patients and methods

This was a clinical cross-sectional study of first-time unilateral diabetic amputees who were operated on at Kilimanjaro Christian Medical Centre (KCMC) between November 2009 and January 2012. Only diabetic unilateral subjects with no other major medical conditions were part of the study. Subjects that were amputated due to trauma, tumours, and other medical conditions were not included in the study. Out of 122 patients that were amputated in KCMC during the study period, 32 diabetic patients took part in the study.

Data collection was done by use of questionnaires, and clinical examination by a physiotherapist for soft touch, nocioception and tendon reflexes, which is part of the Michigan Neuropathy Screening Instrument (MNSI).[9] A peripheral neuropathy grading scale was adapted from the National Cancer Institute Common Terminology Criteria for Adverse Events (NCI CTCAE) version 3.0[10]

was used to grade the neuropathy. Muscle strength was examined using the Medical Research Council (MRC) scale (Oxford scale).[11]

Data analysis and results interpretation was done with the assistance of a statistician and computer software – the Statistical Package for Social Sciences (SPSS).

## Results

**1. Demography**. Thirty-two (32) diabetic amputees took part in the study; 23 (72%) being male. Their age ranged between 40 and 90 years. Mean (±SD) age was 60±14 years. Slightly more than half of patients (53%, n=17) were aged 40 to 59 years. Of the 32 amputees, most (87%) were married, the rest were single. The majority (87%) of the study participants were attending the hospital diabetic clinic.

**2. Knowledge of peripheral neuropathy**. Patients were asked if they knew what peripheral neuropathy was. About three-quarters of the patients (72%, n=23) said they knew about neuropathy. Almost all of these said they heard about it at the Diabetic Clinic of Kilimanjaro Christian Medical Centre (KCMC).

**3. Knowledge of risk factors of diabetes**. None of the respondents gave a history of past or current cigarette smoking. Four out of 32 participants (12%) admitted to taking alcohol – three out of the four drank once per week and one twice per week. Regarding the duration of taking alcohol, three said 20 years and only one said 5 years. The amount taken was 2 litres of beer per occasion for three respondents and 1 litre of beer for the other.

**4. Remedial action and precautions**. Respondents were asked whether they were doing physical exercise. Only 13 (41%) said they were exercising. When asked if they were on treatment, only one (3%) was not under medication. For those taking medication, 16 (52%) were on insulin and 15 (48%) on oral agents. All respondents said they had never been taught on appropriate footwear for diabetic patients.

**5. Peripheral neuropathy grading**. Regarding motor function, most patients (78%, n=25) were in Grade 1 (mild grade, asymptomatic) neuropathy and the remaining 7 (22%) were Grade 0 (normal). On the sensory grade, 30 (94%) were in Grade 1 (loss of deep tendon flexes or paresthesia) while the remaining 2 (6%) were in Grade 2 (sensory alteration or paresthesia). As regards painful neuropathy, most (72%, n=23) were in Grade 1 (mild pain) followed by 6 (19%) in Grade 2 (moderate pain); the fewest were Grade 0 (normal) with 3 (9%) patients. The mean (±SD) overall peripheral neuropathy score was 1.0±0.3, indicating mild peripheral neuropathy in the majority of patients. The mean overall peripheral neuropathy score showed that 91% scored Grade 1. Of the rest, 2 (6%) were Grade 0 and only one was Grade 2 (see Figure 1).

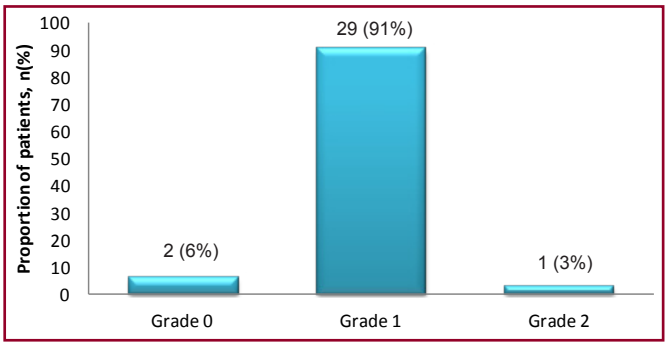


*Figure 1 Average grade of peripheral neuropathy (n=32)*

**6. Associations of neuropathy with treatment.** The grade of pain, sensory, and motor function were not significantly related to the type of medication taken ($p>0.05$). The proportion with painful neuropathy was higher for Grade 0 for patients on oral agents than on insulin agents (13% vs 6%) and higher for Grade 2 patients on insulin than on oral hypoglycaemia (31% vs 6%). The association was not statistically significant with a p-value of 0.207.

## Discussion

Diabetes mellitus has been the leading common cause of amputation at the KCMC for the last few years. The current results are contrary to what has been published before by other researchers on the common cause of amputations in sub-Saharan Africa, where tumours and trauma have been reported to be the leading causes.[11] Peripheral neuropathy is one of the complications associated with diabetes and it can affect both sensory and motor nerves. Patients are often not screened for neuropathy when they come to attend the diabetic clinic. This could be due to the non-existence of a diabetic foot clinic or podiatrist in KCMC. This may be why our subjects responded that they had never been educated or told of the appropriate footwear for diabetic patients.

It was found that patients drinking alcohol or taking physical exercise did not differ significantly in the prevalence of neuropathy compared with those who did not drink or undertake exercise. These results are not consistent to those published previously from the western world. One of the possible explanations for this variation could be related to differences in sample size involved in other studies, since in this study only 32 diabetic amputees were involved.

The motor power of most of the subjects was not affected as the majority tested normally according to the MRC muscle grading scale.[11] Only elderly (those above 80 years) subjects had decreased muscle power, and this may not necessarily be related to neuropathy and could be due to ageing. Sensory nerves appeared to be the most affected as nearly all subjects had lost protective sensation, which could put them at risk of getting injured without noticing, potentially leading to infections or ulcers if not attended to. There were 94% of the subjects with Grade 1 and 6% with Grade 2 changes. Most (72%) were associated with some degree of neuropathic pain.

In conclusion, peripheral neuropathy does exist in the contralateral limb of diabetic patients with unilateral amputation. Most patients lose the protective sensation and this puts them at risk of ulceration, which could lead to amputation of the contralateral limb. Larger studies from elsewhere in Africa may be helpful.There is also an urgent need for foot-related education being made available to all diabetic patients. Patient care for diabetic amputees should include all members of the rehabilitation team.

**Acknowledgement**
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# Problems associated with treatment compliance among type 2 diabetic patients at a tertiary health institution in Nigeria

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## Abstract

This study analyses the problems associated with compliance to treatment among type 2 diabetic patients attending the out-patient clinic in Federal Medical Centre, Owerri, Imo State, Nigeria. It also determines the extent to which patients comply with medications and understand blood sugar control. Data were collected using pre-tested questionnaires from 30 randomly selected subjects. An analysis was done using Statistical Package for Social Sciences (SPSS). Results showed that 30% of the respondents were aged between 40 and 50 years, 63% were married, and 37% had secondary education. Those with a duration of diabetes of more than 5 years totalled 30%. 43% reported on understanding of good glycaemic control, while 33% defaulted in taking medications. Also, 37% agreed that medications should be stopped when they are feeling well, while 40% agreed that compliance was associated with fear of hypoglycaemia. It is important to explore the precursors to treatment adherence behaviour and to carry out interventions that can change negative attitudes toward treatment compliance and promote medical knowledge, which may help improve compliance in the treatment of type 2 diabetes.


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## Introduction

Type 2 diabetes poses a major global health threat and is increasingly common in Asian and African countries.[1] There are about 1.7 million people living with diabetes in Nigeria, and this figure is projected to reach 4.8 million by the year 2030.[1,2] Diabetes and its complications impose significant economic consequences on individuals, families, health systems, and countries. Other risk factors, such as hypertension frequently co-exist with diabetes, and may further increase morbidity and mortality.[3] Diabetes and its complications remain major causes of such morbidity and mortality worldwide,[4] and poor glycaemic control also adversely affects outcome.[5]

Poor adherence to medication is known to be common in type 2 diabetic patients, with adherence rates varying from 30 to 90%.[6] This is likely to lead to an increased complication risk due to poor glycaemic control.[5] This may adversely affect quality of life (QOL),[7] and alhough the relation between glycaemic control and QOL is controversial,[8,9] there are suggestions that adherence to drug treatment and QOL are linked.[10]

Low compliance in type 2 diabetes can be affected by various factors, including socio-economic status, low education levels, and ethnic origin.[11,12]

Psychological factors are also linked with regimen adherence. Appropriate health beliefs, such as perceived seriousness of diabetes, vulnerability to complications, and efficacy of treatment can predict better adherence. Problems such as anxiety, depression, and fear of hypoglycaemia have also been linked with worse diabetes management in both the young and adults with diabetes.[13] Family and social factors may also affect treatment adherence positively if there is good patient support.[14] Support provided by nurses has also been shown to promote adherence to diet and medications. Another study has shown that having regular, frequent contact with patients on the telephone promoted regimen adherence and achieved improvement in glycemic control.[15]

Many patients with type 2 diabetes do not believe that their condition may adversely affect their future health and life expectancy.[16] Improving patient education and treatment compliance is highly important.[17] This study was therefore designed to assess the current status of treatment compliance in a group of type 2 diabetic patients.

## Patients and methods

The study was carried out at the Federal Medical Centre (FMC), Owerri in Imo State, south-eastern Nigeria. It is a tertiary healthcare provider in the area which offers comprehensive medical services to individuals and maintains their clinical information in a paper-based medical records system. The patients are mainly civil servants, students, and traders, as well as military and paramilitary personnel from different areas in the state.

The target population consisted of outpatients with type 2 diabetes. According to the medical records at the FMC, as at 2008, the total population of patients with type 2 diabetes was approximately 302. This figure is not representative of all people with diabetes in Imo State because people with diabetes were attending other hospitals and clinics in the state. Out of this, 30 patients were randomly selected according to the following inclusion criteria:

- Diagnosed with type 2 diabetes at least 1 year ago.
- Between the ages of 40 and 80 years.
- Regular with appointment schedules at the diabetic clinic.
- Undergoing medical treatment for diabetes.

A well-structured pre-tested questionnaire was used to collect information on the problems associated with compliance to treatment among type 2 diabetic patients. It used open-ended questions so as to allow respondents to supply appropriate answers. The questionnaires were administered and then collected as soon as they were completed.

## Results

There were equal males and females, i.e. 15 (50%) of each. There were nine (30%) within the age range of 40 to 50 years, and eight between 50 to 60 years. Most were married – 19 (63%). There were 15 (50%) artisans and 5 (17%) farmers. Most (27 or 90%) had some level of education and all patients were Christian. The duration of diabetes was <5 years in 21 (70%) and >5 years in 9 (30%). Glibenclamide was used by 16 (54%), metformin 7 (23%), and insulin 7 (23%).

Table 1 shows the responses of the patients to the ten main questions asked regarding knowledge of diabetes and the factors influencing compliance with prescribed medication. The responses are in the form of numbers (with % levels) of patients who strongly agreed, agreed, disagreed, or strongly disagreed with the questions asked.

## Discussion

This study has shown that several factors can affect treatment compliance in type 2 diabetes. Most patients understood the value of blood glucose control, although what exactly were good glucose levels was more variably appreciated. There were 26% who felt that medication could be stopped if patients felt well. A large proportion (70%) believed that fear of hypoglycaemia affected compliance. All agreed that a good doctor–patient re-

| | |
|---|---|
| **1. Understanding blood glucose control** | |
| Very good | 8 (27%) |
| Fairly good | 12 (40%) |
| Good | 7 (23%) |
| Poor | 3 (10%) |
| **2. Understanding good blood glucose levels** | |
| 4–6 mmol/l | 2 (7%) |
| 7–10 mmol/l | 13 (43%) |
| 10–12 mmol/l | 4 (13%) |
| >12 mmol/l | 1 (3%) |
| Don't know | 10 (34%) |
| **3. Good control delays complications** | |
| Strongly agree | 25 (83%) |
| Agree | 5 (17%) |
| Disagree | 0 (0%) |
| Strongly disagree | 0 (0%) |
| **4. Medication can be stopped when feeling well** | |
| Strongly agree | 3 (10%) |
| Agree | 5 (16%) |
| Disagree | 11 (37%) |
| Strongly disagree | 11 (37%) |
| **5. Stopping medication will make patient sicker** | |
| Strongly agree | 10 (33%) |
| Agree | 12 (40%) |
| Disagree | 7 (23%) |
| Strongly disagree | 1 (4%) |
| **6. Fear of hypoglycaemia adversely affects compliance** | |
| Strongly agree | 12 (40%) |
| Agree | 9 (30%) |
| Disagree | 4 (13%) |
| Strongly disagree | 3 (10%) |
| Don't know | 2 (7%) |
| **7. Care from family increases compliance** | |
| Strongly agree | 18 (60%) |
| Agree | 6 (20%) |
| Disagree | 4 (13%) |
| Strongly disagree | 2 (7%) |
| **8. Good patient–doctor relationship helps compliance** | |
| Strongly agree | 26 (87%) |
| Agree | 4 (13%) |
| Disagree | 0 (0%) |
| Strongly disagree | 0 (0%) |
| **9. Proximity to home influences compliance** | |
| Strongly agree | 18 (60%) |
| Agree | 6 (20%) |
| Disagree | 4 (13%) |
| Strongly disagree | 2 (7%) |
| **10. Patient is satisfied with treatment** | |
| Strongly agree | 10 (33%) |
| Agree | 13 (43%) |
| Disagree | 7 (14%) |
| Strongly disagree | 0 (0%) |

*Table 1 Responses to questionnaire on aspects of diabetes-related knowledge and compliance*

lationship helped compliance and 80% believed that strong family support was similarly beneficial. There were 80% who thought that a good proximity to the clinic was helpful for treatment compliance. Overall, 76% were satisfied with their treatment.

Other studies have shown that fear of hypoglycaemia adversely affects compliance,[13] as well as family support,[14] and a good doctor–patient relationship.[16] Proximity to the clinic is generally beneficial, particularly with regard to blood glucose testing, as most patients could not measure their own blood glucose levels.

In conclusion, we found significant problems with treatment compliance knowledge. This is important, as type 2 diabetes is a complex disease with a high burden of complications if not properly managed. Better patient education is needed, ideally by suitably trained nurses. Oral agents, insulin, and glucose-monitoring facilities need to be made more affordable. Family and physician support are, however, cost-neutral and are powerful ways of improving patient support and compliance.

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# Guidance to Authors

AJDM
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Review articles

These are particularly welcome as we receive relatively few. They can be on any aspect of diabetes, though preferably of general interest to our readers. Review articles do not need an abstract, and should be about 1500–2500 words long. Figures and tables, etc are welcome.

Original articles

These should be research-based articles, divided in a standard way into abstract, introduction, methods, results and discussion. In length they should be no more than 2000 words with no more than three tables or figures, and 30 references.

Short reports/case reports

These should be up to 800 words long, have one table or figure only, and up to 10 references. The subdivisions of the report should be the same as for original articles, but the abstract should be very brief – usually two or three sentences.

Letters, news and notes, editorials etc.

We welcome news items, conference reports, letters to the editor, etc. We normally write editorials 'in house', but if you think you have a useful editorial to offer, we'd be glad to see it.

Illustrations

These must be supplied as jpeg, tiff or PDF files, in CMYK format with a resolution of at least 300 d.p.i.

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