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IDF Diabetes Atlas

Diabetes in the Africa region: An update

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ABSTRACT

The Africa Region (AFR), where diabetes was once rare, has witnessed a surge in the condition. Estimates for type 1 diabetes suggest that about 39,000 people suffer from the disease in 2013 with 6.4 new cases occurring per year per 100,000 people in children <14 years old. Type 2 diabetes prevalence among 20–79-year-olds is 4.9% with the majority of people with diabetes <60 years old; the highest proportion (43.2%) is in those aged 40–59 years. Figures are projected to increase with the numbers rising from 19.8 million in 2013 to 41.5 million in 2035, representing a 110% absolute increase. There is an apparent increase in diabetes prevalence with economic development in AFR with rates of 4.4% in low-income, 5.0% in lower-middle income and 7.0% in upper-middle income countries. In addition to development and increases in life-expectancy, the likely progression of people at high risk for the development of type 2 diabetes will drive the expected rise of the disease. This includes those with impaired glucose tolerance, the prevalence of which is 7.3% among 20–79-year-olds in 2013. Mortality attributable to diabetes in 2013 in AFR is expected to be over half a million with three-quarter of these deaths occurring in those <60 years old. The prevalence of undiagnosed diabetes remains unacceptably high at 50.7% and is much higher in low income (75.1%) compared to lower- and upper-middle income AFR countries (46.0%). This highlights the inadequate response of local health systems which need to provide accessible, affordable and optimal care for diabetes.

1. Introduction

The International Diabetes Federation Africa Region (AFR), comprised of countries in sub-Saharan Africa, has not been spared from the global diabetes epidemic. Indeed, diabetes has become a global public health challenge increasingly affecting the poor and posing serious threats to the economies of all countries [1–3]. AFR, where diabetes was restricted to

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Table 1 – Summary data for diabetes and impaired glucose tolerance (IGT) in 2013 and projections for 2035for the Africa Region.

	2013	2035
Adult population (20–79 years, 1000s)	407,853.47	775,491.47
Diabetes in adults (20–79 years)		
Regional prevalence (%)	4.85	5.35
Comparative prevalence (%)	5.66	6.01
Diabetes cases (1000s)	19,784.59	41,459.73
Cases undiagnosed (1000s)	12,446.47	–
IGT in adults (20–79 years)		
Regional prevalence (%)	7.28	8.51
Comparative prevalence (%)	8.27	9.33
Number of people with IGT (1000s)	29,704.91	65,988.31
Type 1 diabetes in youth (0–14 years)		
Number of children with type 1 diabetes (1000s)	39.14	–
Number of newly-diagnosed (per 100,000 per year)	6.4	–
Deaths due to diabetes in adults (20–79 years)		
Total deaths due to diabetes	522,631.45	–
% of deaths under 60	76.4	–
Health expenditure		
Health expenditure due to DM (billion USD)	4.03	–

anecdotic reports during the last century, has witnessed a surge in rates of the condition [1,4]. Although infectious diseases outnumber diabetes and other non-communicable diseases (NCDs) as the predominant cause of mortality in the region [5], these are important contributors to the disease burden [6], and are projected to overtake infectious diseases as the leading cause of death in the region within the coming two decades. According to the World Health Organisation (WHO), in 2008 the age-standardised diabetes and cardiovascular disease (CVD) related mortality among 30–70-year-olds was 382 per 100,000 people in Africa, the highest in the world and more than double that of the WHO Region with the lowest rate (Region of the Americas: 169 per 100,000) [5].

This discussion paper on diabetes in AFR describes the prevalence and distribution of diabetes and its risk factors, and examines the impact and management of the disease on the continent.

2. Methodology and estimates

The full description of the methodology and global estimates of diabetes prevalence for the International Diabetes Federation (IDF) Diabetes Atlas data has been described in detail elsewhere [7]. A list of the countries in the AFR Region is listed in the aforementioned paper.

3. Prevalence and incidence of diabetes

The common forms of diabetes include type 1 and type 2 diabetes as well as gestational diabetes. There are also less common secondary causes of diabetes including diseases of the exocrine pancreas, such as tumours or pancreatitis, endocrinopathies like Cushing's syndrome or phaeochromocytomas, drug-induced diabetes and infections, which are beyond the scope of this review. In AFR, the paucity of reliable epidemiological data on diabetes, including the absence of diabetes registries, limits the accurate estimation of the prevalence and incidence of the disease. However, there has been a recent increase in the number of studies describing the epidemiology of diabetes in the region.

In many AFR countries, recent studies on the burden of diabetes have used the WHO STEPwise chronic disease risk factor surveillance tools (STEPS). Inconsistencies, with higher diabetes rates in some studies compared to other reports in indigenous African populations, may be related to differences in methodological approaches across studies. These may include differences in sampling strategy (for e.g. random vs. convenient sample) or methods for diagnosing diabetes (random blood samples, fasting specimens vs. oral glucose tolerance tests (OGTT)) [1].

3.1. *Type 1 diabetes*

Estimates for type 1 diabetes suggest that about 39,000 people in AFR were suffering from the disease in 2013, and that 6.4 new cases were occurring per year per 100,000 people in those <14 years old (Table 1). Epidemiology data for type 1 diabetes are scarce with studies conducted two to three decades ago reporting prevalence of 0.33 per 1000 in 5–17year-old Nigerian and 0.95 per 1000 in 7–14 year-old Sudanese children [1,2]. Furthermore, the incidence of type 1 diabetes was reported to be 10.1 per 100,000 per year in Sudan in children <15 years old. In Tanzania, the incidence was lower at 1.5 per 100,000 per year with the peak age of presentation at 15–19 years compared to 10–14 years shown in developed regions [8]. In South Africa, the peak age of onset in black Africans was at 22–23 years with an earlier peak from 14 to 17 years, whereas in Europids peak age for type 1 diabetes was 12–13 years [9].

3.2. *Type 2 diabetes*

In 2013, the prevalence of type 2 diabetes, which accounts for 90–95% of all diabetes, was relatively low at 4.9% in AFR (Table 1). Diabetes figures in AFR are projected to increase with the number of individuals with the condition rising from 19.8 million in 2013 to 41.5 million in 2035, representing a 110%

Table 2 – Characteristics of individuals with diabetes in 2013 in the Africa Region.

Among people (20–79 years) with diabetes	Proportion (%)
Age distribution in years	
20–39	38.7
40–59	42
60–79	19.2
Gender	
Men	49.5
Women	50.5
Location	
Rural	44.3
Urban	55.7
Undiagnosed diabetes by income group:	
Low-income	75.1
Middle-income	46
Among adults (20–79 years)	Crude prevalence (%)
Low-income	4.4
Lower middle-income	5.0
Upper middle-income	7.0

absolute increase. The prevalence of diabetes in AFR is not uniformly distributed with apparent increases with economic development. This ranged from 4.4% in low-income countries to 5.0% in lower-middle income and 7.0% in the upper-middle income countries (Table 2).

All AFR countries with available diabetes prevalence greater than 10% appeared to be upper-middle income economies (Table 3). In absolute terms, however, low-income countries in the region such as Ethiopia, Tanzania and the Democratic Republic of Congo, by virtue of their large populations, featured among AFR countries with the largest number of people with diabetes (i.e. exceeding 1.5 million individuals) (Table 4).

The expected increase in diabetes figures in AFR will be driven not only by development and increases in life-expectancy, but also by the likely progression of people at high risk for the development of type 2 diabetes. This comprises a sizable portion of the population and includes those with impaired glucose tolerance (IGT), the prevalence of which was 7.3% among 20–79-year-olds in 2013 (Table 1). Given the current level of development of the health system in many AFR countries, it is unlikely that the necessary interventions for the prevention of progression to diabetes for people at high risk are in place.

Table 3 – Countries and territories in the Africa Region with the highest prevalence (%) of diabetes, 2013.

Country/Territory	Prevalence (%), 2013
1. Réunion	15.4
2. Seychelles	12.1
3. Gabon	10.7
4. Zimbabwe	9.7
5. South Africa	9.3
6. Western Sahara	9.2
7. United Republic of Tanzania	9.0
8. Comoros	8.4
9. Djibouti	6.8
10. Republic of Congo	6.3

Table 4 – Countries and territories in the Africa Region with the highest number of people with diabetes (20–79 years), 2013.

Country/Territory	Prevalence (in 1000s), 2013
1. Nigeria	3921.50
2. South Africa	2646.05
3. Ethiopia	1852.23
4. United Republic of Tanzania	1706.93
5. Democratic Republic of the Congo	1594.11
6. Kenya	749.248
7. Uganda	625.045
8. Zimbabwe	600.668
9. Côte d'Ivoire	501.529
10. Cameroon	497.976

4. Risk factors for type 2 diabetes

Driven by rapid globalisation and urbanisation, with subsequent changes in diet and the adoption of sedentary lifestyles, the diabetes epidemic has expanded in line with the worldwide rise in overweight and obesity. In addition, diabetes is rising on a global level but particularly in AFR largely due to population ageing and rapid urbanisation [1,4,10–13].

A complex gene-environment interaction of non-modifiable (genetics, age, gender, ethnicity and family history) and modifiable risk factors drives the development of diabetes [2,14,15]. The significant modifiable risk factors include overweight, physical inactivity and sedentary behaviour, and dietary changes with increased total dietary fat and carbohydrate intake, and alcohol consumption [11,14,16]. In addition, intra-uterine and early childhood influences as well as psychosocial stress may also play a role [2,12,14,16].

4.1. *Non-modifiable risk factors*

4.1.1. *Age, gender and family history*

Since the risk of developing diabetes increases with age, the global ageing of the population, including in AFR, is a major driver of the global rise in diabetes [1,4,10,13]. Improvements in public health and medical care, particularly for infectious diseases, are contributing to changes in demography with increases in average life expectancy in AFR. Therefore, by 2035, the diabetes peak in AFR is expected to be in the oldest individuals [17].

Currently, the majority of individuals with diabetes in AFR were reported to be less than 60 years of age with the highest proportion (43.2%) in people aged 40–59 years. Only 18.8% of diabetic individuals were 60–79 years of age, probably because of the relatively small proportion of people in this age group in AFR. The progression of the diabetes epidemic and the increase in modifiable risk factors such as obesity and physical inactivity at early ages will likely shift the age of onset to younger individuals [1,18].

The distribution of diabetes by gender varies widely in AFR and demonstrates no apparent trend [1,18]. Some populations have a male or female preponderance while others report equal gender prevalence. Overall, diabetes was equally distributed among men and women in AFR in 2013.

A positive family history of diabetes is an established risk factor for the development of the disease. AFR studies from Sudan and South Africa have confirmed this association [1,19,20].

4.1.2. *Ethnicity*

In addition to black African populations, there are established Europid and Indian populations living in AFR. Also, in South Africa, the previously defined official population groups classified people of mixed ancestry as ''coloured''. Although recent diabetes studies among minority population groups in AFR are lacking, studies conducted over two decades ago in Tanzania and South Africa reported lower diabetes prevalence in black African than Indian communities (South Africa: 5.3% vs. 13.0%; Tanzania: 1.1% vs. 9.1/7.1%, respectively [1,18,21]. Black African populations also had lower diabetes prevalence compared to populations with mixed Egyptian ancestry in Sudan (3.4% vs. 10.4%) and the ''coloured'' population in South Africa (8.0% vs. 10.8%), respectively [1]. The prevalence in Europid populations in AFR was relatively high (6–10%) and similar to those of their European counterparts [18]. Studies conducted recently in 2008–2009 reported markedly higher age-adjusted diabetes prevalence in Cape Town in ''coloureds'' (26.3%) [22] compared to black Africans (13.1%) [19].

The lower diabetes prevalence in black Africans compared to other population groups in AFR may be related to their different susceptibility as well as to being in an earlier phase of the epidemiological transition. Notably, black African populations living abroad may be experiencing a later stage of the epidemiological transition compared to those on the African continent. Cooper and colleagues reported higher age-adjusted diabetes prevalence in black African populations living in the Caribbean (9%), USA (11%) and UK (11%) compared to Nigeria (2%) [23].

4.1.3. *Genetic susceptibility*

In African people, type 1 diabetes is associated with similar HLA susceptibility loci to Europid populations, particularly with HLADR3, HLA-DR4 and HLA-DR3/DR4 heterozygosity [1,4]. For type 2 diabetes, the only reports are those from the Africa American Diabetes Mellitus study [1,24–26]. Four major genetic loci (10q23, 4p15, 15q14 and 18p11) have been found to influence C-peptide concentrations in West Africans with type 2 diabetes.

4.1.4. *Intrauterine influences*

We have described above that urbanisation and increasing exposure to unhealthy lifestyles are driving the diabetes burden in AFR. But the continuing reality of poverty, hunger and under nutrition for many AFR people is an equally large threat. More than a third of people in AFR live below the poverty line with many women undernourished [27]. There are strong links between maternal malnutrition and the risk of diabetes in later life [12], especially in AFR countries where children may be undernourished but are increasingly exposed to unhealthy diets and over nutrition as they grow up.

Intrauterine growth retardation and subsequent low birth weight therefore likely predispose individuals to metabolic disorders during adulthood. The high prevalence of stunting (20–40% in children <5 years old [4]) and malnutrition in AFR may considerably increase the development of diabetes [18]. Additionally, stunting is associated with a two- to seven-fold risk for overweight [4].

4.2. *Modifiable risk factors*

4.2.1. *Urbanisation*

In AFR studies, diabetes is more prevalent in urban compared to rural areas [1,28,29] with a two-to-fivefold increased risk for diabetes associated with urban residence [1]. The higher diabetes prevalence in urban compared to rural settings is attributable to nutritional and lifestyle changes [18]. Studies have found higher rates of diabetes risk factors, especially obesity, in urban compared to rural areas in AFR [1,4].

AFR is currently experiencing one of the most rapid increases in urbanisation and changes in lifestyle behaviours [30]. The continent is undergoing urbanisation faster than other Regions with the urban population currently growing at an average annual rate of 4.5% [31,32]. The estimated explosion of the urban population in AFR to 697million by 2035[31]is likely to lead to a marked increase in the rates of diabetes and its risk factors. Already, driven by globalisation and urbanisation, the rural–urban gap for diabetes seems to be narrowing in AFR. A surprisingly high prevalence of dysglycaemia and obesity has been reported in rural Cameroon [33].

In 2013, of the number of people with diabetes, a high proportion [44.3%] resided in rural areas (Table 2). This may be a reflection of larger rural compared to urban populations and/or is possibly suggestive of a rapid epidemiologic transition. The widespread uptake of the modifiable risk factors and the rapid economic and social development of rural Africa are likely the key driving force in the development of diabetes in rural AFR. The change in the food environment that began in urban AFR possibly spread to rural centres more rapidly [34].

4.2.2. *Adiposity*

Overweight and obesity have been central to the expansion of the diabetes epidemic. Several studies reported the independent association of raised adiposity with diabetes in AFR [1,18,19,20].

Population-based studies in the last decade have reported a high variability in the prevalence of overweight and obesity in AFR. In men, reported obesity levels ranges from 2.0% in Ethiopia [35] to 12.2% in the Democratic Republic of Congo [36] and 13.8% in Cameroon [37]. The prevalence of obesity among women in AFR was usually much higher than in men and ranged from 10.8% in Ethiopia [35] to 34.7% in Ghana [38]. Nonetheless, despite a lower prevalence in men, their susceptibility to the health consequences of obesity seems to be greater [39]. In addition, insulin sensitivity in women may be similar to their leaner male counterparts even though their percentage of fat may be higher [39].

In addition to the contribution of rapid globalisation and urbanisation, a complex set of cultural, psychosocial and biological factors influence the maintenance of a healthy weight [34,40,41]. Particularly in AFR, where access to food remains a daily challenge, overweight and obesity is perceived to be a sign of affluence and good living, and is a deeply rooted status symbol conferring respect and influence [1,10,42]. Another important influence on the positive attitude to overweight and obesity is the association of thinness with HIV/AIDS, with overweight and obesity perceived as an absence of the disease and with being healthy [42,43].

Globally, the emergence of overweight and obesity in children has increased the likelihood of type 2 diabetes developing in the paediatric population. Even in AFR, despite the high prevalence of stunting and malnutrition, overweight and obesity has increased in children under five from 4.0% in 1990 to 8.5% in 2010 and is projected to rise to 12.7% by 2020 [44]. Although little is currently known about the prevalence of type 2 diabetes in children in AFR, rising overweight and obesity will likely contribute to the spread of the disease in this population in the region.

4.2.3. *Physical activity*

The adoption of physically inactive lifestyles in AFR is high [39] and increasing, and can be ascribed to rapid urbanisation and socio-economic transitions [18,45]. According to the WHO, insufficient physical activity, defined as less than 150 minutes of moderate physical activity per week [or equivalent], was present in about a quarter of men and a third of women in AFR [46]. High levels of physical inactivity increase the risk of developing diabetes [18]. Studies from Cameroon [47] and Kenya [48], conducted in large samples and using objective measures of physical activity, have found higher physical activity levels to be inversely related to abnormal glucose tolerance.

4.2.4. *Diet and alcohol*

Processed foods have become easily available in AFR as a result of foreign direct investment from transnational food companies [18,49]. Consequently, there has been a shift away from traditional diets towards the higher fat and more refined carbohydrate Western diet [50], particularly in urban areas. Intake of unhealthy diets that are richer in high-fat, high-energy foods contributes directly to increased energy imbalances, and subsequent obesity and diabetes. Nonetheless, in some settings, rural to urban migration is accompanied by access to more varied diets and greater consumption of fresh fruit and vegetables [45].

Other evolving dietary patterns affected by globalisation, acculturation and urbanisation include alcohol consumption. Currently, the prevalence of non-drinkers is higher in AFR compared to Europe (men: 32% vs. 8%, women: 45% vs. 14%, respectively) [51]. Alcohol consumption has been reported to moderately increase the risk of type 2 diabetes but remains to be studied in greater depth in AFR [18]. However, a few studies have reported a link: in rural South Africa, alcohol use was independently related to diabetes [20] and in Kenya, frequent alcohol intake in men was associated with glucose intolerance [48]. Therefore, rising levels of consumption may likely contribute to higher diabetes prevalence.

4.3. *Emerging risk factors*

4.3.1. *Psychosocial stress*

Many studies have found an association between depression and diabetes [52,53]. Analyses of the World Health Survey data found diabetes to be associated with a twofold increase in the prevalence of an episode of depressive symptoms globally [54]. There is also growing evidence that other forms of psychosocial stress contribute to the development of diabetes [52]. In addition to these studies, a South African study reported the association of psychosocial stress with diabetes in women but not men [19]. Nonetheless, longitudinal studies, particularly in AFR, are required to determine the role of psychosocial stress in the development of diabetes.

5. Impact of HIV/AIDS and tuberculosis on diabetes

Two of the most common infectious diseases seen in Africa, tuberculosis (TB) and HIV/AIDS, not only co-exist but interact with diabetes, with one exacerbating the other [1,4,6,29,31,32]. Diabetes increases the risk of developing TB three-fold [29,31] and it seems that TB may predispose a person to diabetes [31]. Rising diabetes prevalence may hamper TB control efforts by increasing the number of susceptible individuals in endemic areas. The co-morbid presentation of diabetes and TB is associated with poorer outcomes [6,31].

HIV/AIDS and antiretroviral therapy (ART) are associated with an increased risk of developing diabetes [1,4,29,55]. Factors contributing to the development of diabetes in HIV disease include inflammation and viral factors, among other influences, while ART causes insulin resistance and decreased insulin secretion [56]. The implementation of ART programmes, key to the management of the HIV/AIDS epidemic, is likely to lead to a rise in individuals with adverse metabolic consequences [31]. Considering the high burden of TB and HIV/AIDS in AFR, the impact of these co-morbidities is likely to be great.

6. Morbidity and mortality

Hyperglycaemia and diabetes contribute significantly to morbidity and premature mortality worldwide [13]. In AFR, diabetes is responsible for a considerable amount of morbidity, mainly attributable to micro-vascular complications [1,4,10,18,28,31,57] and due to poor glycaemic and blood pressure (BP) control [18]. The prevalence varies widely across the continent which is likely due to the heterogeneity of the populations studied in terms of the type and duration of diabetes, glycaemic control, and accompanying risk factors such as hypertension or smoking, among other variables [10,18]. A systematic review found that the prevalence of diabetic retinopathy in diabetes clinic-based studies ranged from 7.0 to 62.4% [58]. Owing to the frequent delayed diagnosis of diabetes, retinopathy is present in 21–25% of patients with type 2 diabetes at initial diagnosis [1]. Type 1 and type 2 patients with long-standing diabetes (>10 years) who attended a diabetes clinic in South Africa had retinopathy rates of 53.2 and 64.5%, respectively [59]. In the same study, persistent proteinuria was present in 23.4 and 25.0% of type 1 and type 2 diabetic patients, respectively. In AFR, neuropathy affected 6–47% of diabetic individuals [10].

In contrast, macro-vascular complications are low compared to other regions, probably because of the lower rates of traditional risk factors, except for hypertension, or the shorter disease duration [4]. Ischaemic heart disease affects 5–8% of diabetic patients [1,4], while up to 5% of diabetic patients present with stroke symptoms at diagnosis [18]. The prevalence of peripheral vascular disease ranges from 4 to 28% depending on the method of detection used [1,4].

Although diabetes-related mortality in AFR is unacceptably high with rates of 8–41% of all-cause mortality, poor documentation of underlying cause of death in vital statistics lead to significant uncertainty in estimates for the region [18]. In 2013, mortality attributable to diabetes is expected to be over half a million with three-quarter of these deaths occurring in those <60 years old (Table 1). Mortality in the region is primarily due to acute metabolic complications and infections [18,28]. These include diabetic ketoacidosis caused by insulin deficiency or delayed diagnosis, and hyperosmolar non-ketotic coma [18]. However, a changing pattern has been reported in some studies, with findings similar to that reported in Western literature i.e. the emergence of chronic complications as a major cause of mortality. In a 20-year outcome study of type 1 diabetic patients in South Africa, the most frequent cause of mortality was renal failure accounting for >40% of all deaths [60].

7. Economic and socio-economic burden of diabetes

The majority (76.4%) of diabetes mortality in the region occurred in people younger than 60 years old compared to the global proportion of 49% [13]. The high burden of diabetes in the working age population has a critical impact on the health of the workforce with far-reaching economic repercussions [49]. In addition to undermining productivity and adversely affecting national economies, the socioeconomic costs of diabetes are devastating as the region simultaneously grapples with poverty-related diseases and poor healthcare facilities. In addition to compromised quality and duration of life in people with diabetes, the loss of wage-earners can drive families into poverty.

Exacerbating the situation is the need for prolonged and expensive treatment associated with diabetes complications, the cost of which is often borne by the patient and depletes family resources [1,10,29,61]. Insulin, for example, is a relatively expensive drug that is unaffordable to the poor, particularly in resource-limited settings and often not available on an uninterrupted basis [29,61].

In 2000, diabetes was responsible for a total economic loss of 25.5 billion international dollars, that is, 3633 dollars per patient with diabetes [62]. Costs included direct costs related to healthcare for diabetes and indirect costs associated with loss of productivity caused by the disease.

8. Diabetes management

8.1. *Healthcare expenditure and treatment of diabetes*

The healthcare expenditure on diabetes in AFR in 2013 was 4.0 billion USD (Table 1) representing less than 1% of the total global healthcare expenditure allocated to diabetes. Spending on diabetes care in the region is woefully inadequate given the substantial projected rise in cases and the overwhelming burden of premature mortality.

About 90% of health ministries in Africa have a dedicated unit or department responsible for NCDs with 61% funded for treatment and control [63]. However, only 26% had an operational diabetes programme highlighting that most AFR countries were ill-prepared to tackle the management of this disease. Notably, Diabcare Africa study found that diabetes care was sub-optimal with less than half (47%) of diabetic patients having had HbA_{1C} measurements conducted in the previous year [64]. Furthermore, the same study found that blood glucose treatment targets were achieved only in 29% of those who had an HbA_{1C} measurement.

8.2. *Detection of undiagnosed diabetes*

The prevalence of undiagnosed diabetes in AFR in 2013 remained unacceptably high at 50.7% (Table 2). These levels were much higher in low income (75.1%) compared to lower- and upper-middle income AFR countries (46.0%). The high proportion of unknown diabetes reflects poorly on local health systems; strained economic resources and ill-equipped healthcare systems are mainly responsible for the inadequate detection and management of diabetes. The condition is usually only diagnosed once patients are overtly symptomatic or present with complications [18].

The high proportion of undiagnosed diabetes demonstrates the inadequate response in AFR to this growing threat, which will compound the continuing health burden. Early diagnosis and treatment of diabetes is essential to mitigate the serious and fatal consequences associated with the development of complications [1].

The detection of undiagnosed diabetes requires an appropriate biochemical test that is reliable, high performance, convenient and low-cost [65]. Oral glucose tolerance tests (OGTT) are cumbersome and inconvenient. HbA_{1C} tests, while convenient as these can be performed in the non-fasting state, and much less time consuming, are expensive [12,66]. Also, the discordant diagnosis of diabetes with HbA_{1C} and the glucose criteria used are of concern [12]. Numerous studies have demonstrated a lower prevalence of undiagnosed diabetes using HbA_{1C} compared to OGTT criteria. This may be related to several factors that influence the HbA_{1c} result such as anaemia, haemoglobinopathies, pregnancy and uraemia [67]. The HbA_{1C} criteria have high specificity (>90%) but lower and great variability in sensitivity in diagnosing diabetes when compared to OGTT. The sensitivity ranges from 17% in Australians to 78% in Asian Indians for $HbA_{1C} \geq 6.5\%$. The use of alternative HbA_{1C} cut-points as well as ethnic-specific cut-points has been proposed [12]. Additionally, the wide adoption of HbA_{1C} as a diagnostic criterion would inevitably result in different prevalence estimates to that found with OGTT. The use of different methodologies to diagnose diabetes would therefore impact considerably on the ability to compare inter- and intra-population differences or changes in dysglycaemia [12]. Both OGTT andHbA_{1C} tests require skilled healthcare personnel and laboratory facilities for sample analyses, a major challenge in resource-constrained AFR countries [65].

The gold standard for diagnosing diabetes, advocated by the WHO, is the OGTT [67]. However, in light of the practical difficulties associated with testing, a pragmatic and cost-effective solution may be to initially identify high-risk individuals through questionnaires or non-laboratory risk scoring systems [68]. This may be accompanied by point-of-care capillary glucose testing to aid detection of individuals requiring further biochemical evaluation. Nonetheless, the introduction of diabetes screening programmes in already overburdened AFR healthcare systems which are delivering sub-optimal care is not a priority before providing care to those already diagnosed. Additional resources would be required or, more likely, a redirection of existing resources from other activities [68].

8.3. *Perspectives*

The UN High-level meeting on NCDs in New York in September 2011 raised international awareness on the magnitude, and socioeconomic and developmental impacts of diabetes and other NCDs [69]. These conditions were positioned resolutely as a development, and not only a health, issue [70]. Therefore, governments in AFR need to recognise their primary role and responsibility to respond to the challenges of diabetes.

However, national policies for the control of diabetes are absent in most AFR countries. Also, primary healthcare systems have not adapted to cope with the new additional challenges and many lack the most basic equipment [71]. There needs to be a sustained response and political commitment to the prevention, detection and control of diabetes. The IDF Africa Action Plan advocated harnessing political will for governments to develop national action plans for the adequate delivery of diabetes care and to promote community awareness of the disease as well as introduce school and workplace health programmes, among other initiatives [72].

The rising number of individuals with diabetes has important implications for healthcare provision of care for people with diabetes [73]. AFR countries with already burdened healthcare budgets cannot afford to ignore the opportunity to address this major problem. Limited resources must be prioritised efficiently using cost-effective strategies. The emphasis on early treatment and prevention of diabetes is an excellent, cost-saving economic investment as well as an established way to improve outcomes [15,74]. Programmes must be developed for health systems in AFR which align with this evidence.

Feasible and cost-effective interventions in people with diabetes that improve health include tight glucose and BP control, and foot care for individuals with a high risk of ulcers [46]. BP control in people with diabetes is very effective in reducing micro- and macrovascular complications. In resource-poor regions, measures for BP control are estimated to be one of the most feasible and cost-effective interventions for people with diabetes [46].

It is estimated that about 80% of type 2 diabetes can be delayed or prevented through early management and lifestyle modification [75,76]. Therefore, equally important for successful management, is the need for health education and increased public awareness of diabetes and its risk factors [73]. Poor patient and provider education are among the challenges to achieving optimal diabetes care in AFR [18].

9. Conclusions

The prevalence of diabetes in AFR is rising and of particular concern is the high burden of undiagnosed diabetes. There is considerable variance in the prevalence of diabetes and its risk factors among AFR countries as well as by urban-rural location and sub-populations which is likely a reflection of the varying pace at which communities are developing. The challenges of diabetes in AFR include the need to stem the rising burden of type 2 diabetes, exacerbated by urbanisation and obesity, and to provide accessible, affordable and optimal care for the management of the disease [61]. This is compounded by the weakest health systems and workforces as well as the lowest per capita income globally [49,55]. Nonetheless, if the battle against diabetes is to succeed, it must be a public health priority on the continent. Further research is required to build the evidence base, design and implement an optimal strategy for early diagnosis and treatment, and to identify appropriate population-based prevention programmes. A concerted effort is required to change the course of the rising diabetes burden in AFR; the price of inaction will otherwise be devastating.

Conflict of interest

The authors have no conflicts to disclose.

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