Systematic demographic analysis of the prevalence of diabetes mellitus in Africa

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Background. The prevalence and incidence of diabetes mellitus is increasing at an alarming rate worldwide, especially in Africa. It was long thought that Africans suffer mainly from communicable diseases, but data from sources such as the International Diabetes Federation show an increasing prevalence of non-communicable diseases in Africa.
Objectives. To review startling data from the International Diabetes Federation about the population of diabetics in Africa.
Methods. The data are presented as percentages of each variable, specifically the residential setting, gender and age group of populations in countries of the north, southern, west, east and central Africa sub-regions. This was done for easier comprehension and comparison than if presented as raw values. The patterns and trends in the countries of each sub-region are thereafter discussed. Variation in the prevalence of diabetes between individual countries was observed.
Results. Diabetes prevalence is significantly higher in urban than in rural areas: of the diabetic population, 55.90% are urban dwellers v. 44.10% rural. An exception is the east Africa sub-region, with 38.16% urban dwellers, as against 61. 84% rural, but the overall pattern shows urbanisation as a major factor for the increasing prevalence of diabetes in Africa. The most productive demographic of society (20 - 59 years old) were the most affected by diabetes in all African countries and sub-regions: north, 72.87%; southern, 75.57%; west, 82.49%; east, 84.06%; and central, 83.74%. These are citizens in their prime and the most useful segment of the workforce. Diabetes is not sex-sensitive in Africa, with 48.89% of diabetics male v. 51.11% female, apart from in the north and southern Africa regions (44.16% male and 55.84% female, and 43.52% male and 56.48% female, respectively). The rate of death due to diabetes is very high in Africa. The number of undiagnosed cases is huge. The economic impacts of diabetes, which include increased use of health services and loss of productivity, and consequent financial burden, are severe.
Conclusion. Given the rising global prevalence of diabetes, and projections that this will continue to increase substantially over the coming decades, we suggest measures to be taken to stem the tide of the disease, in Africa in particular and the world at large. The prevalence of diabetes can be reduced drastically with timely action on these recommendations. Intervention strategies to control diabetes need to be intensified.

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Diabetes in all its varieties inflicts high individual, societal and financial costs at every earning level. Diabetes mellitus and its complications has an enormous impact on patients, and on the economy of a country as a whole. Diabetes is classified into two major forms: diabetes insipidus and diabetes mellitus. Diabetes insipidus (DI) is an uncommon form resulting from a deficiency of the antidiuretic hormone (also known as vasopressin), or an abnormal response by the kidney to the hormone.[1] Vasopressin is secreted by the posterior pituitary gland where it is stored after production in the hypothalamus, a small gland in the brain.

Diabetes mellitus is a persistent disorder characterised by an elevated degree of blood glucose. This can be as a result of the body's failure to produce sufficient insulin (a hormone secreted in the pancreas to regulate the level of blood glucose), or the inability of the body to utilise insulin effectually, or both.[2] The two forms are not related, but both exhibit associated symptoms such as excessive thirst and frequent passage of urine. The large volume of urine produced by a DI patient is diluted, and mostly water. It is unusual to encounter DI that jeopardises a person's health.

The most prevalent type of diabetes is diabetes mellitus, which is the form that receives more news coverage. It is also the focus of the present article. Diabetes mellitus is simply referred to as diabetes for the purposes of the article.

Prevalence refers to the proportion of individuals present in a population at a given time that has a disease, while incidence refers to the proportion of new cases of a disease among a certain group of people for a particular period of time.[2]

The International Diabetes Federation (IDF)'s 2013 estimates[3] state that approximately 8.3% of adults, a population of about 382 million people, have diabetes, and they projected the number of people with diabetes to increase to above 592 million in 20 years' time. However, there are an estimated 180 million undiagnosed diabetics moving towards complications while unaware of their condition.[3]

Complications are secondary problems arising from a disease, wound or treatment (such as surgery) that make the condition more severe.[3]

Africa, in epidemiological transition, is currently faced with an exploding but neglected problem of non-communicable diseases (NCDs). A recent United Nations meeting on the global issue of NCDs highlighted their extremely disproportionate weight in low- and middle-income countries, and stressed the need to urgently tackle the menace, particularly in these countries.

In Africa, there are 33.1 million people diagnosed with diabetes, while ~29.7 million are undiagnosed. About 522 600 deaths due to diabetes occurred in Africa in 2013, 76% of which were of people under the age of 60 years.[2] Poverty, ignorance, social inequality, lack of and difficult access to quality health facilities could be responsible for the growing scourge of the disease in Africa.

People with diabetes can experience many health problems, especially if the condition is not properly managed.[4] Complications resulting from diabetes are the leading source of disability, cardiovascular disease, blindness, kidney failure and lower limb amputation.[5] Furthermore, diabetics have a higher likelihood of developing infections.[6] Developing diabetes complications can be inhibited by keeping the blood glucose, blood pressure and cholesterol levels normal.[7] Inadequate control of diabetes and its complications can result in increased medical bills, absences from work, disability and untimely death.[8]

Globally, diabetes is being diagnosed in epidemic proportions, creating a major public health burden. The countries with the highest numbers of diabetics are China, India, the USA, Brazil and Mexico.[9]

Diabetes mellitus classifications

Diabetes mellitus is classified into types. Type 1 diabetes was formerly known as juvenile-onset diabetes because it commonly develops in children or young adults, although it can start at any age. It typically results from an autoimmune reaction where the body's defence mechanism attacks the cells that produce insulin. This results in little or no insulin production. The development is usually sudden and dramatic. Those suffering from type 1 diabetes need insulin replacement to survive, and in order to regulate their blood glucose level. It accounts for less than 1 in 10 cases of diabetes. It occurrence is still unpreventable. Every day, about 200 children develop type 1 diabetes worldwide. The number of toddlers affected by type 1 diabetes is reported to be increasing at a startling rate of 3 - 5% annually.[10]

Type 2 diabetes was formerly called non-insulin-dependent diabetes or adult-onset diabetes. More than 9 out of every 10 cases of diabetes are of this type. It is indicated by insulin resistance and partly by insulin deficiency, either or both of which may exist when diabetes is diagnosed.[4] It is most common in people aged 50 and above, and rare in children, although there are indications that it is increasing among younger adults.[11]

The symptoms are typically minor or non-existent and may remain unnoticed for many years.[12] It is usually detected when a complication appears, or during a normal blood or urine glucose test, thereby making it hard to detect. There are predisposing non-modifiable factors, such as age, family health record and cultural upbringing, as well as modifiable factors, specifically obesity, physical inactivity, unhealthy diet and smoking.[2] Type 2 diabetes at the outset can typically be managed through exercise and diet.[13] However, as the condition progresses, type 2 diabetics will need drugs and/or insulin. There are many indications that changes in lifestyle to achieve a healthy body weight and sufficient physical activity can help avert the development of type 2 diabetes.[14]

Gestational diabetes mellitus (GDM) is a type of diabetes characterised by high blood-glucose levels during pregnancy in women not previously diagnosed with any form of diabetes. It manifests in 1 in 25 pregnancies globally, and is associated with complications in both mother and baby.[15] GDM frequently disappears after delivery, though it can recur in later pregnancies. Women with a history of GDM and their offspring have a greater likelihood of developing type 2 diabetes in later years. There is a tendency for a woman with a history of GDM to develop type 2 diabetes within <10 years of delivery.[16]

Other, rarer, types of diabetes also occur, for example, neonatal diabetes.[17]

Method

The present article is based on data from 2013 *IDF Diabetes Atlas*[3] on the prevalence of diabetes mellitus worldwide. Over 75% of all countries and territories in Africa lack up-to-date primary data on diabetes prevalence, according to the most recent 2016 *IDF Diabetes Atlas,*[18] which largely uses extrapolations rather than data. Extrapolated estimates are not as dependable as estimates from studies conducted in the country, hence the IDF data from 2013 are used, rather than those from 2016.

The given raw values from the IDF are presented in percentages according to gender (male/female), residential setting (rural/urban) and age groups (20 - 39, 40 - 59 and 60 - 79 years old) of the population of people with diabetes in each country and sub-region of the African continent. This was done because presentation of data in percentages enhances comprehension and comparison, and promotes quicker understanding of the trends and patterns. It is only when data are understood that necessary actions can follow.

The percentages were calculated by dividing each specific sub-population by the number of cases in that population, multiplied by 100.

The analysis provides evidence of the extent to which Africa is affected by the disease, in percentages.

The formulas were coded using Excel (Microsoft, USA) for computation. The results were verified with Maple Calculator (Maplesoft, Canada).

Results

The results in Tables 1 - 5 provide clear and easy-to-comprehend data on the prevalence of diabetes in Africa's population. We present population-based data on diabetes from the 6th edition (2013) of the *IDF Diabetes Atlas* on the prevalence of diabetes in Africa.[3] The data are shown for countries in each of the five sub-regions: north, southern, west, east and central Africa. The percentages of diabetics are analysed according to gender, age group and residential setting of patients in each country. Our aim is to bring these alarming diabetes facts into the continental spotlight. Gathering and assessing worldwide health data is a veritable means to explain and communicate health challenges, ascertain tendencies and assist decision-makers in setting priorities.

Discussion

North Africa (Table 1)

The North Africa sub-region has the highest prevalence of diabetes on the continent, and one of the highest in the world. One in 10 adults has diabetes in this sub-region. Egypt has the highest number of people with diabetes in Africa, and also the highest prevalence. This may be because the country has been a centre of world civilisation; some believe that diabetes is a disease occasioned by economic development. Egypt currently needs highly proactive intervention in treatment and prevention of diabetes.

The data show that there is a higher proportion of female diabetics in this sub-region than any of the others. Urban dwellers are more affected by diabetes than their rural counterparts. Exceptions are Sudan and South Sudan – this may be a result of urban-to-rural migration caused by war in the countries. The male population may also have decreased owing to deaths during the war, since they were usually the fighters and soldiers; one of the effects of war is a decline in the male population. The group with the highest percentages of people with diabetes was of those between 40 and 59 years old, followed by those between 20 and 39 years. These are the most productive years of a person's life. If this trend continues, the countries could lose their most productive citizens early. The diabetes-related death rate in Sudan is worrisome, and the country should invest more in treatment and prevention programmes. Peace must be given a chance in war-torn countries because

Table 1. Diabetes prevalence by gender, residential setting and age group in North Africa*

Country	Population 20 - 79, *n*	Diabetes cases 20 - 79, *n*	Prevalence, %	Diabetes-related death 20 - 79, *n*	Male diabetics 20 - 79, *n* (%)	Female diabetics 20 - 79, *n* (%)	Incidence of type 1 diabetes 0 - 14, %	Undiagnosed diabetics 20 - 79, *n*	Rural-dwelling diabetics 20 - 79, *n* (%)	Urban-dwelling diabetics 20 - 79, *n* (%)	Diabetics 20 - 39, *n* (%)	Diabetics 40 - 59, *n* (%)	Diabetics 60 - 79, *n* (%)	Mean diabetes-related expenditure per person with diabetes, USD
Algeria	24 722.77	1 639.55	6.63	14 430.63	817.90 (49.89)	821.64 (50.11)	8.60	819.77	290.18 (17.70)	1 349.37 (82.30)	527.91 (32.20)	720.73 (43.96)	390.90 (23.84)	312.70
Egypt	48 276.39	7 510.60	15.56	86 477.62	3 210.59 (42.63)	4 309.02 (57.37)	8.00	3 755.30	3 006.79 (40.03)	4 503.81 (59.97)	1 692.84 (22.54)	3 636.10 (48.41)	2 181.67 (29.05)	176.87
Libya	3 784.70	319.13	8.43	2 728.28	142.14 (44.54)	177.00 (55.46)	9.00	159.57	52.16 (16.34)	266.97 (83.66)	72.35 (22.67)	159.06 (49.84)	87.72 (27.49)	575.60
Morocco	20 454.88	1 491.29	7.29	9 426.53	715.12 (47.95)	(52.05) 776.17	-	745.64	411.24 (27.58)	1 080.05 (72.42)	325.83 (21.85)	825.75 (55.37)	339.70 (22.79)	260.40
South Sudan	5 265.19	391.33	7.43	7 267.86	160.29(40.96)	231.03 (59.04)	-	195.66	302.71 (77.35)	88.61 (22.65)	99.23 (25.36)	190.31 (48.63)	(26.01) 101.79	-
Sudan	18 119.53	1 402.22	7.74	25 341.86	589.41 (42.03)	812.81 (57.97)	10.10	701.11	848.04 (60.48)	554.19 (39.52)	349.94 (24.96)	709.83 (50.62)	342.45 (24.42)	169.97
Tunisia	7 430.06	685.59	9.23	5 130.35	299.15 (43.63)	386.44 (56.37)	7.30	342.80	126.69 (18.48)	558.90 (81.52)	107.72 (15.71)	375.85 (54.82)	202.02 (29.47)	346.62
North Africa sub-region	128 053.52	13 439.71	9.53	150 803.13	5 934.6 (44.16)	7 514.11 (55.84)	-	6 719.85	5 037.81 (37.48)	8 401.9 (62.52)	3 175.82 (23.63)	6 617.63 (49.24)	3 646.25 (27.13)	-

*Ranges are age range in years; *n* in 1000s.

good and accessible medical care can only be provided and guaranteed in an atmosphere of peace and safety. Education of the girl-child must also be given top priority in the sub-region.

Southern Africa (Table 2)

The prevalence of diabetes in this sub-region is highest in South Africa, Zimbabwe and Tanzania, in descending order. There are more women with diabetes than men in the sub-region, with the exceptions of Malawi and Zambia. There are more urban dwellers with diabetes than rural dwellers in the sub-region as a whole, but exceptions occur in Lesotho, Malawi, Swaziland, Tanzania and Zambia. The age distribution of diabetics in the sub-region shows that ~80% are between 40 and 59 years and 20 - 39 years old, apart from in Botswana, Namibia and South Africa. These three countries have the highest diabetes-related expenditures per person in the sub-region. This spending seems to be showing results, because they also have the lowest percentages of people with diabetes aged between 20 and 39 years. This could mean that the incidence of diabetes is decreasing in these countries. The diabetes epidemic should be seen as a major threat to productivity, and hence the economy, owing to absence from work, spending on drugs, job loss and disability.

West Africa (Table 3)

This sub-region generally has more men with diabetes than women, apart from in 6 of the 15 countries considered: Benin, Burkina Faso, Cape Verde, Mali, Mauritania and Senegal. Approximately 3 out of 5 diabetics in the region are urban dwellers. This could be due to the fact that West Africa is one of the most developed and populous sub-regions in Africa. In the sub-region, it is only in Burkina Faso, Guinea, Guinea Bissau, Liberia, Mali, Niger and Sierra Leone that more diabetics are found among rural dwellers.

The percentage of diabetics in West African countries in the age bracket of 60 - 79 years is small. This might be a result of untimely diabetes-related death among patients. The percentage of patients in the age bracket of 20 - 39 years is relatively high in these countries, especially in Niger. West African countries need to invest massively in diabetes treatment and prevention programmes so

Table 2. Diabetes prevalence by gender, residential setting and age group in southern Africa*

Country	Population 20 - 79, *n*	Diabetes cases 20 - 79, *n*	Prevalence, %	Diabetes-related deaths 20 - 79, *n*	Male diabetics 20 - 79, *n* (%)	Female diabetics 20 - 79, *n* (%)	Undiagnosed diabetics 20 - 79, *n*	Mean diabetes-related expenditure per person with diabetes (USD)	Rural-dwelling diabetics 20 - 79, *n* (%)	Urban-dwelling diabetics 20 - 79, *n* (%)	Diabetics 20 - 39, *n* (%)	Diabetics 40 - 59, *n* (%)	Diabetics 60 - 79, *n* (%)
Angola	8 950.75	198.89	2.22	4 457	95.62 (48.08)	103.27(51.92)	91.49	349	48.55 (24.41)	150.34 (75.59)	38.90 (19.56)	121.71 (61.19)	38.28 (19.26)
Botswana	1 110.54	31.74	2.86	1 118	10.30 (32.45)	21.45 (67.55)	14.60	678	7.21 (22.72)	24.53 (77.28)	4.65 (14.65)	14.38 (45.31)	12.72 (40.08)
Lesotho	1 056.10	41.40	3.92	2 806	19.80 (47.83)	21.61 (52.17)	19.04	230	22.78 (55.02)	18.62 (44.98)	16.77 (40.51)	15.90 (38.41)	8.73 (21.09)
Malawi	7 079.31	372.35	5.26	12 799	223.38 (60.00)	148.97 (40.00)	279.58	54	280.98 (75.46)	91.37 (24.54)	219.99 (44.90)	107.47 (59.08)	44.90 (12.06)
Mozambique	11 305.74	278.38	2.46	10 104	128.59 (46.19)	149.79 (53.81)	209.02	64	105.45 (37.88)	172.93 (62.12)	112.58 (40.44)	130.61 (46.92)	35.19 (12.64)
Namibia	1 198.96	58.54	4.88	1 386	18.14 (30.99)	40.40 (69.01)	26.93	447	14.19 (24.24)	44.35 (75.76)	12.96 (22.14)	27.14 (46.36)	18.43 (31.48)
South Africa	31 983.32	2 646.05	8.27	83 114	927.87 (35.07)	1 718.18 (64.93)	1 217.18	935	505.55 (19.11)	2 140.50 (80.89)	550.98 (20.82)	1 188.33 (44.91)	906.74 (34.27)
Swaziland	622.26	23.02	3.70	1 378	11.18 (48.57)	11.84 (51.43)	10.59	441	14.99 (65.12)	8.03 (34.88)	8.85 (38.44)	9.58 (41.62)	4.59 (19.94)
Tanzania	21 870.03	1 706.93	7.80	47 144	867.11 (50.80)	839.82 (49.20)	1 281.65	63	1031.14 (60.41)	675.79 (39.59)	739.77 (43.34)	659.15 (38.62)	308.01 (18.04)
Zambia	6 137.26	193.92	3.16	7 599	101.86 (52.53)	92.06 (47.47)	145.60	161	119.20 (61.47)	74.72 (38.53)	90.21 (46.52)	73.46 (37.88)	30.24 (15.60)
Zimbabwe	6 799.80	600.67	8.83	31 347	273.64 (45.56)	327.03 (54.44)	451.01	54	282.88 (47.09)	317.79 (52.91)	365.51 (60.85)	140.30 (23.36)	94.86 (15.79)
Southern Africa sub-region	98 114.07	6 151.89	-	203 252	2 677.49 (43.52)	3 474.40 (56.48)	3 746.69	-	2 432.92 (39.55)	3 718.97 (60.45)	2 161.17 (35.13)	2 488.03 (40.44)	1 502.69 (24.43)

*Ranges are age range in years; *n* in 1 000s.

Table 3. Diabetes prevalence by gender, residential setting and age group in West Africa*

Country	Population 20 - 79, *n*	Diabetes cases 20 - 79, *n*	Prevalence, %	Diabetes-related death 20 - 79, *n*	Male diabetics 20 - 79, *n* (%)	Female diabetics 20 - 79, *n* (%)	Undiagnosed diabetics 20 - 79, *n*	Mean diabetes-related expenditure per person with diabetes (USD)	Rural-dwelling diabetics 20 - 79, *n* (%)	Urban-dwelling diabetics 20 - 79, *n* (%)	Diabetics 20 - 39, *n* (%)	Diabetics 40 - 59, *n* (%)	Diabetics 60 - 79, *n* (%)
Benin	4 778.10	65.63	1.37	1 221	31.96 (48.70)	33.67 (51.30)	49.28	66	26.53 (40.42)	39.11 (59.58)	25.82 (39.34)	28.33 (43.17)	11.48 (17.49)
Burkina Faso	7 345.10	237.92	3.24	6 265	116.40 (48.92)	121.53 (51.08)	178.65	67	172.36 (72.44)	65.56 (27.56)	109.83 (46.16)	92.17 (38.91)	35.52 (14.93)
Cape Verde	289.36	15.85	5.48	157	7.88 (49.72)	7.97 (50.28)	7.29	228	3.46 (21.83)	12.39 (78.17)	5.26 (33.19)	7.80 (49.21)	2.79 (17.60)
Côte d'Ivoire	9 667.49	501.53	5.19	11 884	269.83(53.80)	231.70(46.20)	230.70	133	154.96 (30.90)	346.57 (69.10)	170.66 (34.03)	231.54 (46.17)	99.34 (19.81)
Gambia	800.25	12.40	1.55	205	6.80 (54.84)	5.60 (45.16)	9.31	50	3.71 (29.92)	8.69 (70.08)	3.61 (29.11)	7.26 (58.55)	1.53 (12.34)
Ghana	13 125.24	440.00	3.35	8 529	223.21(50.73)	216.80 (49.27)	330.38	123	206.05 (46.83)	233.95 (53.17)	165.00 (37.5)	199.49 (45.34)	75.51 (17.16)
Guinea	5 488.95	215.84	3.93	3 965	120.06 (55.62)	95.77 (44.38)	162.06	50	132.38 (61.33)	83.46 (38.67)	90.93 (42.13)	77.46 (35.89)	47.45 (21.98)
Guinea Bissau	813.51	27.24	3.35	660	14.04 (51.54)	13.20 (48.46)	20.45	64	14.92 (54.77)	12.32 (45.23)	10.84 (39.79)	11.33 (41.59)	5.07 (18.61)
Liberia	1 998.56	67.09	3.36	1 375	34.76 (51.81)	32.33 (48.19)	50.37	95	34.24 (51.04)	32.85 (48.96)	25.94 (38.66)	29.63 (44.16)	11.52 (17.17)
Mali	6 418.73	81.98	1.28	1 972	39.37 (48.02)	42.62 (51.98)	61.56	84	41.54 (50.67)	47.44 (49.33)	30.30 (36.96)	30.88 (37.66)	20.80 (25.37)
Mauritania	1 915.19	87.61	4.57	1 288	40.61 (46.35)	47.00 (53.65)	65.78	96	39.10 (44.63)	48.50 (55.37)	38.25 (43.66)	38.61 (44.07)	10.75 (12.27)
Niger	7 058.85	306.43	4.34	5 555	178.77 (58.34)	127.66(41.66)	230.08	35	221.25 (72.20)	85.17 (27.80)	201.88 (65.88)	87.83 (28.66)	16.71 (5.45)
Nigeria	78 628.36	3 921.50	4.99	105 091	1997.77 (50.94)	1923.73 (49.06)	1 803.89	137	1 276.70 (32.56)	2 644.80 (67.44)	1 407.69 (35.90)	1 808.06 (46.05)	707.81 (18.04)
Senegal	6 432.60	208.59	3.24	3 474	102.27 (49.03)	106.32(50.97)	156.62	116	120.27 (57.66)	88.33 (42.34)	88.75 (42.55)	84.78 (40.64)	35.77 (16.81)
Sierra Leone	2914.75	96.15	3.30	3 094	49.30 (51.27)	(48.73) 46.85	72.19	118	57.87 (60.19)	38.28 (39.81)	40.64 (42.27)	40.25 (41.86)	15.25 (15.86)
Togo	3 234.46	130.15	4.02	2 516	86.86 (66.74)	43.28 (33.26)	97.72	74	62.09 (47.71)	68.05 (52.29)	54.36 (41.77)	48.98 (37.63)	26.80 (20.59)
West Africa sub-region	150 909.5	6 415.91	-	157 251	3 319.89 (51.74)	3 096.03(48.26)	-	-	2 567.43 (39.97)	3 855.47 (60.03)	2 469.76 (38.48)	2 824.4 (44.01)	1 124.1 (17.51)

*Ranges are age range in years; *n* in 1 000s.

as to stem the tide of the disease. The impact of negligence on their part will be felt considerably in the workforce, between ages 20 and 59 years. An unhealthy workforce represents an unhealthy nation. Productivity will be affected if urgent steps are not taken.

The number of diabetes cases in Nigeria alone (3 921 500) is higher than the sum of cases in all other West African countries together (2 494 410). This means that 61.12% of diabetes cases in West Africa are in Nigeria.

Nigeria needs to be very timely about her intervention, because the number of diabetics between the ages of 20 and 39 years, 1 407 690, is also higher than the totality of diabetics in that same age bracket in other West African countries, at 1 062 070. Likewise for the age bracket 40 - 59 years, diabetics in Nigeria alone number 1 808 060, while 1 016 340 is the total number of diabetics in the same age bracket in the other West Africa countries. These are citizens in their prime, although it should also be noted that Nigeria is a very large country, and as such the number of diabetics will be large.

The number of diabetes-related deaths in Nigeria alone (105 091) doubles that of the totality of other West African countries (52 160). However, the adult population of Nigeria alone is larger than that of the totality of other West African countries.

East Africa (Table 4)

The male population of diabetics is larger in this sub-region than the female, except in the Comoros and Seychelles, where there are more female diabetics. There are more rural-dwelling diabetics than urban, except in Djibouti, the Seychelles and Somalia. This is the only sub-region in the continent with higher rural dwellers than urban settlers.

The percentage of diabetics aged 20 - 39 years is the highest, while that

of those aged 60 - 79 is the lowest, in the sub-region. This shows clearly that the region has not invested enough in medical care and preventive measures. This highlights the need for better prevention and education. Many patients may have died from diabetes in their most productive years, or as they reached the age bracket of 60 - 79 years. There is also a threat to the human resource capability in the region, because >80% of the diabetics are in the productive population. In the Seychelles, however, massive investment seems to be paying off, because the country has just 10% of diabetics in age bracket 20 - 39 years, and the highest percentage in the age bracket 60 - 79 years.

Central Africa (Table 5)

As in many of the sub-regions, urban dwellers with diabetes are more numerous than rural in this sub-region. Percentages of rural settlers with diabetes in Burundi and Rwanda were higher than those of urban settlers probably due to urban-rural migration occasioned by war. Gabon has the highest prevalence of diabetes in the sub-region. There are more male diabetics than female in most countries in the region, except in Gabon and São Tomé and Príncipe. The age distribution of diabetics in the sub-region shows that more than 80% of them were between 20 and 39 years old or 40 and 59, with the exception of Gabon, which has a good percentage of diabetics in the age bracket 60 - 79 years. This might be due to the country's high expenditure per person with diabetes. The investment seems to be yielding good results, because only a small percentage of all citizens in the age bracket 20 - 39 years are diabetic. Other countries should also take such action to confront the challenge posed by non-communicable and non-infectious diseases.

Recommendations

The following are our suggestions for the treatment and prevention of diabetes.

Health information gathering, processing and dissemination

There is a need for regular nationwide surveys and data-gathering on the health status of the citizenry of each country. The collected data should be processed, analysed and disseminated through appropriate means to all stakeholders. Representation of the data in an easy-to-understand way such as percentages, which are simple, straightforward and ensure uniform sampling, as we have done in this review, is necessary for positive action, rather than merely gathering data on the number of diabetics as a whole. The paucity of reliable data on the continent's health status is worrisome, and should be tackled by the various health ministries and statistical bureaus of countries on the continent.

Table 4. Diabetes prevalence by gender, residential setting and age group in East Africa*

Country	Population 20 - 79, *n*	Diabetes cases 20 - 79, *n*	Prevalence, %	Diabetes-related death 20 - 79, *n*	Male diabetics 20 - 79, *n* (%)	Female diabetics 20 - 79, *n* (%)	Mean diabetes-related expenditure per person with diabetes (USD)	Rural-dwelling diabetics 20 - 79, *n* (%)	Urban-dwelling diabetics 20 - 79, *n* (%)	Diabetics 20 - 39, *n* (%)	Diabetics 40 - 59, *n* (%)	Diabetics 60 - 79, *n* (%)
Comoros	351.11	23.74	6.76	284	11.69 (49.24)	12.05 (50.76)	68	14.17 (59.69)	9.57 (40.31)	4.87 (20.51)	13.98 (58.89)	4.90 (20.64)
Djibouti	485.24	28.75	5.92	533	14.62 (50.85)	14.13 (49.15)	161	3.70 (12.87)	25.05 (87.13)	9.97 (34.68)	13.45 (46.78)	5.33 (18.54)
Eritrea	2 955.25	130.93	4.43	1720	67.29 (51.39)	63.64 (48.61)	24	73.89 (56.43)	57.04 (43.57)	65.51 (50.03)	49.16 (37.55)	16.26 (12.42)
Ethiopia	42 487.79	1 852.23	4.36	34 262	991.67 (53.54)	860.56 (46.46)	29	1 176.20 (63.50)	676.04 (36.50)	818.47 (44.19)	731.81 (39.51)	301.96 (16.30)
Kenya	20 908.23	749.25	3.58	20 350	(57.20) 428.59	(42.80) 320.66	61	(63.91) 478.82	(36.09) 270.43	(32.19) 241.21	(50.46) 378.07	(17.35) 129.97
Madagascar	10 571.13	352.21	3.33	5 298	(50.97) 179.52	(49.03) 172.69	31	(66.19) 233.12	(33.81) 119.09	(41.92) 147.65	(42.44) 149.48	(15.64) 55.08
Seychelles	63.52	7.75	12.20	88	(43.36) 3.63	(56.64) 4.12	511	(29.55) 2.29	(70.45) 5.46	(10.45) 0.81	(56.00) 4.34	(33.42) 2.59
Somalia	4 364.80	244.05	5.59	5 234	(51.48) 125.64	(48.52) 118.41	21	(37.00) 90.31	(63.00) 153.74	(42.85) 104.58	(41.32) 100.83	(15.83) 38.64
Uganda	15 106.73	625.05	4.14	21 461	(53.65) 335.35	(46.35) 289.69	79	(65.56) 409.77	(34.44) 215.27	(48.86) 305.43	(37.56) 234.77	(13.57) 84.84
East Africa	97 293.8	4 013.96	-	89 230	(53.76) 2 158	(46.24) 1855.96	-	(61.84) 2 482.27	(38.16) 1 532.69	(42.31) 1 698.5	(41.75) 1 675.89	(15.94) 639.57

*Ranges are age range in years; *n* in 1 000s.

Education

Health education should be a major priority for African countries. The need for massive education on diabetes and its medical, social and economic impact cannot be overemphasised. School curricula from the primary to the tertiary level should include considerable information about communicable and most importantly, NCDs. Education is the most important bridge to the future and a powerful instrument of empowerment, and its base needs to be broadened, and its quality improved. Proper health education should be the centrepiece of the strategy for any development.

Public awareness and correct orientation

Public enlightenment on diabetes is very necessary. Timely awareness and understanding of diabetes symptoms, its attendant complications and predisposing factors such as obesity, especially abdominal obesity, a sedentary lifestyle, poor eating habits, physical inactivity, family history, alcohol consumption and smoking can help in preventing people from becoming victims.

Strong commitments are needed to raise awareness about diabetes in Africa. The misconception held by many that diabetes is prevalent only among the affluent should be debunked in its entirety. This will also help to prevent stigmatisation of diabetics. All the media of public orientation such as mass media, social networks, public lectures and announcements should be used to spread the message about diabetes. Prompt detection can prevent or hinder chronic health complications of people with diabetes.

Nutrition and physical activity (exercise)

Knowledge comes with responsibility. 'A fork can dig a grave' when it comes to diabetes and other NCDs. Attention should be given to healthy eating by all Africans. Strategies to promote accessibility and availability of food, fruits and vegetables year round should be formulated. Government should provide

Table 5. Diabetes prevalence by gender, residential setting and age group in central Africa*

Country	Population 20 - 79, *n*	Diabetes cases 20 - 79, *n*	Prevalence, %	Diabetes-related death 20 - 79, n	Male diabetics 20 - 79, *n* (%)	Female diabetics 20 - 79, *n* (%)	Undiagnosed diabetics 20 - 79, *n*	Mean diabetes-related expenditure per person with diabetes (USD)	Rural-dwelling diabetics 20 - 79, *n* (%)	Urban-dwelling diabetics 20 - 79, *n* (%)	Diabetics 20 - 39, *n* (%)	Diabetics 40 - 59, n (%)	Diabetics 60 - 79, *n* (%)
Burundi	4 557.48	178.26	3.91	4 829	96.06 (53.89)	82.19 (46.11)	133.84	41	132.53 (74.35)	45.72 (25.65)	85.59 (48.01)	70.01 (39.27)	22.65 (12.71)
Cameroon	10 199.41	497.98	4.88	13 822	251.66 (50.54)	246.32 (49.46)	229.07	116	151.87 (30.50)	346.10 (69.50)	187.92 (37.74)	216.16 (43.41)	93.90 (18.86)
Central African Republic	2 255.59	126.48	5.61	3 934	64.27 (50.81)	62.21 (49.19)	94.97	30	45.59 (36.05)	80.89 (63.95)	55.84 (44.15)	49.20 (38.90)	21.44 (16.95)
Chad	5 169.88	231.29	4.47	6 926	122.24 (52.85)	109.05 (47.15)	173.66	64	131.79 (56.98)	99.49 (43.02)	109.92 (47.52)	88.80 (38.39)	32.57 (14.08)
DRC	29 663.00	1 594.11	5.37	33 280	824.61 (51.73)	769.50 (48.27)	1 196.94	34	643.55 (40.37)	950.56 (59.63)	696.25 (43.68)	654.10 (41.03)	243.76 (15.29)
Rep. of Congo	2 091.03	114.57	5.48	2 549	57.81 (50.46)	56.77 (49.54)	52.70	146	24.70 (21.56)	89.88 (78.44)	41.13 (39.50)	52.30 (45.65)	21.14 (18.45)
Equatorial Guinea	384.40	19.16	4.98	437	10.22 (53.34)	8.94 (46.66)	8.81	2009	8.25 (43.06)	10.91 (56.94)	5.37 (28.03)	10.87 (56.73)	2.91 (15.19)
Gabon	843.40	76.59	9.08	1 594	28.09 (36.68)	48.50 (63.32)	35.23	528	2.28 (2.98)	74.31 (97.02)	14.08 (18.38)	31.37 (40.96)	31.14 (40.66)
Rwanda	5 339.84	234.00	4.38	5 464	120.01 (51.29)	113.99 (48.71)	175.70	109	140.53 (60.06)	93.47 (39.94)	113.14 (48.35)	90.68 (38.75)	30.18 (12.90)
São Tomé and Príncipe	92.43	4.79	5.19	62	2.30 (48.02)	2.50 (51.98)	2.21	192	1.05 (21.92)	3.74 (78.08)	1.90 (39.66)	2.11 (44.05)	0.79 (16.49)
Central Africa sub-region	60 596.46	3 077.23	-	72 897	1 577.26 (51.26)	1 499.97 (48.74)	-	-	1 282.15 (41.67)	1 795.08 (58.33)	1 311.14 (42.61)	1 265.61 (41.13)	500.48 (16.26)

Rep. = Republic; DRC = Democratic Republic of Congo.
*Ranges are age range in years; *n* in 1 000s.

sports and recreational centres and facilities such as gymnasiums in strategic places. Schools at all levels should have practical sporting arenas and facilities to inculcate the habit of regular exercise in students.

Medical tests, medication, medical care and medical personnel

Regular comprehensive medical tests such as blood glucose level tests, blood pressure tests and urine analysis should be a health priority of all and sundry. Self-testing kits for some of these, such as the digital glucometer and sphygmomanometer, should be made available at a subsidised rate. Initiatives to improve the accessibility and availability of affordable essential healthcare facilities, medicines and injections such as insulin are needed to address the diabetes epidemic. Continuous training of medical personnel such as endocrinologists and nutritionists is necessary to control diabetes.

Government policy

African governments should increase their allocation of funds and investments to healthcare systems. They must facilitate efficient public health arrangements, community service projects and health and social strategy preparation. Governments should roll out plans for the prevention and management of diabetes in their countries, sub-regions and the continent at large. The healthcare models in place for dealing with communicable diseases such as HIV, tuberculosis and lately the Ebola virus on the continent can potentially be adopted as a framework to deal with the diabetes epidemic. The scourge can also be largely prevented and controlled at the government level through collective and co-operative action by the African Union (AU) member states. Appropriate political will, which is not given to undue over-politicisation of medical and health matters of human development, is essential. Investing in intensive diabetes prevention and treatment programmes now will have tremendous payoffs for the future of the continent.

Public-private partnership

Non-governmental organisations, philanthropists and blue-chip companies can strategically partner with governments and their agencies through advocacy and campaigning as part of their corporate social responsibility to nip the diabetes menace in the bud. They can also help to subsidise prices of medications and the sponsorship of medical training.

Conclusion

We have provided general information about and insight into the prevalence of diabetes in Africa in a tabular, easy-to-understand format in percentages. The most productive demographic of society (20 - 59 years old) is the most affected. Urban dwellers are more prone to diabetes than rural. Diabetes is not gender-sensitive in Africa. We have recommended concerted initiatives and efforts required to address the growing diabetes epidemic, particularly in Africa and the world at large.

Living with diabetes is a serious challenge, hence people with diabetes deserve all the support they need to enjoy life to the fullest.

The fact that Africa currently has the highest predicted rate of increasing diabetes incidence in the world is a poignant reminder that diabetes prevention and control should be on the top of the AU and member states' health agendas. The diabetes epidemic could be retarded or stopped in the very near future by making the right choices today.

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