Asessing Glycemic Control among a Clinic Based Sample of Diabetics in M'Bour Senegal

Abstract

Background: Sub-Saharan Africa (SSA) including Senegal is faced with a significant and increasing burden of type 2 diabetes. However, little information is available about diabetes management among Senegalese diabetics.

Purpose: The current study aims to describe the level of glycemic control among a convenience sample of diabetics who receive care at the M'Bour hospital in M'Bour Senegal.

Methods. A total of 106 type 2 diabetic patients were recruited at the hospital complex of M'Bour, Senegal. Linear regression was employed to assess the relationship between clinical and socio-demographic factors and HbHba1c.

Results: Only 24.8% of the sample had glycemic control, according to an Hba1c test. Participants who were diagnosed earlier were less likely to have diabetes control (mean=7.8 years) compared to those who were diagnosed more recently (mean=6.5 years); $p<0.05$.

Conclusions We found that glycemic control in our sample was suboptimal. Length of time with diabetes was one of the key factors related to glycemic control. Length of time with diabetes is negatively associated with glycemic control. Early diagnosis and early glycemic control are essential to long-term glycemic control screening, and early detection for diabetes is uncommon given the general lack of health insurance and most people's paying out of pocket for medical care. In the absence of universal health insurance, public health programs that provide blood sugar screenings for high risk individuals would provide preliminary indication of abnormal glucose; however, subsequent diagnostic testing and follow-up may still be cost prohibitive.

Background

Sub-Saharan Africa (SSA) is faced with a significant and increasing burden of type 2 diabetes (Bertram, Jaswal, Van Wyk, Levitt, & Hofman, 2013; Danquah et al., 2012; Kibirige, Atuhe, Sebunya, & Mwebaze, 2014). While the rate of type 2 diabetes in SSA is increasing rapidly, resources for prevention efforts, including primary prevention, early detection, and disease management among those living with diabetes, are scarce (Mbanya, Motala, Sobngwi, Assah, & Enoru, 2010). As a result, many cases remain undiagnosed, leading to an increased likelihood of diabetes complications and mortality.

Diabetes management in SSA is often suboptimal (Angamo et al, 2013). Studies in Uganda and Nigeria found that less than 29% of (Kibirige et al., 2014) and 35. 3% of diabetics in clinic-based samples had glycemic control as indiciated by hemoglobin Hba1c (<7%), (Hba1c), respectively. Sobngwi and colleagues found that in the Diabcare Africa study, less than 30% of participants across six sub-Saharan African countries had hemoglobin Hba1c below 7% (Sobngwi et al., 2012).

In Senegal, the prevalence of diabetes has been documented to be as high as 9.7% (Seck, Guéye, Tamba, & Ba, 2013) and 10.4% (Pessinaba et al., 2013) in urban dwelling Senegalese. Little information is available about glycemic control among Senegalese diabetics. The current study aims to describe the level of glycemic control among a convenience sample of diabetics who receive care at the M'Bour hospital in M'Bour Senegal and the relationship between glycemic control and socio-demographic and clinical factors.

Methods

Setting: M'Bour Senegal is approximately 42 km south of the capital, Dakar. M'Bour hospital serves an area of approximately 500,000 people and has approximately 64 inpatient beds, 29 maternity beds, and approximately 140 staff members. The hospital complex provides both ambulatory and inpatient care.

In 2010, a hospital-based diabetes patient association was formed. The association is made up of diabetics who receive care at the hospital. The association maintains a patient run executive board with support from the director of the hospital, a general internist with addition training in caring for diabetic patients, and a nurse designated to help with logistics (e.g coordinating meeting space). After a doctor-confirmed diagnosis of diabetes, participants are assigned an association membership card. The goal of the support groups is to raise awareness and funds to support effective diabetes management among diabetics in MBour.

Sample: During June of 2013, a total of 106 type 2 diabetic patients were recruited at the hospital complex of M'Bour. Approximately 800 diabetes charts represented all diabetics who sought care at the hospital during the past two years. Participants were recruited through referral from the hospital's diabetes patient association. The study was announced at the monthly association meeting and then spread through word of mouth by association members. Diabetes status was confirmed through review of medical charts or M'Bour diabetes association membership card.

Participants were interviewed and clinical measures were taken in a secure office space provided by the director of the hospital. Patients with blood pressure or blood sugar readings that were considered dangerous (e.g. blood sugar over 300, and/or systolic over 200 and/or diastolic over 100 or other symptoms such as dizziness, blurred vision or severe headache) were transported directly to a physician designated to care for such individuals in our study. This physician's time was donated in-kind by the director of the hospital. This physician was an internal medicine specialist on duty for the day with designated time to evaluate study participants with elevated clinical measures.

Participant interviews consisted of clinical measures and a socio-demographic survey. Clinical measures were obtained by trained medical students. Surveys were administered by the research team in the common local language, Wolof.

The current study received approval from the institutional review board of the lead author' s institution with written approval from the local hospital. Participants received the equivalent of five USD for reimbursement for travel to the clinic.

Measures

Clinical measures

Glycemic control was measured using Hba1c Now rapid test kits (by Bayer). The Hba1c Now provides a quantitative measurement of the percentage of glycosolated hemoglobin (%HBA1C) using one drop of blood. Percent Hba1c ranged from 0 to >=13. The rapid test cartridge produced test results within five minutes. Hba1c levels greater than 13 were indicated as 13 since the test does not have the capability to read Hba1c levels above 13. Typically, an Hba1c test is upward of $10.00 when obtained from the hospital laboratory.

Blood pressure was assessed using a standard manual blood pressure cuff and estimated as systolic over diastolic in mmMg. Participants also self-reported whether they were told by a doctor if they had hypertension.

Body Max Index was determined after height and weight were measured using a scale with a height rod and waist circumference was measured in centimeters using a tape measure. Subsequently, BMI was calculated using weight in kilograms divided by height in meters squares.

Smoking was originally categorized as never, former and current. There were very few former smokers (n=6), so the variable was re-categorized as current versus non-current smoker for analyses.

Demographic measures

Demographic measures included age in years, gender (male/female), marital status (married, single, divorce, widowed), employment status (do you work outside of the home? yes or no). Education was

defined as: Have you gone to formal school (yes or no). Note that we only included attendance at primary secondary school, middle, or high school. Religious school was commonly reported for male prticipants but was not categorized under formal education for the purpose of this study.

Household socioeconomic situation was measured as follows: Which one best describes your household situation?: 1) Not enough money for basic things like food and clothes; or 2) Have money for food and clothes, but short on many other things; 3) We have most of the important things, but few luxury goods; 4) Some money for extra things such as going away for holidays and luxury goods. The majority of participants indicated that they had *Not enough money for basic things like food and clothes,* and very few had money for more than just food and clothes. In fact, only two participants selected descriptions 3 or 4. As a result, this variable was collapsed into a binary variable: *Not enough money for basics (1) versus Money for basics or more (2-4)*.

Analytic approach

Descriptive statistics including means and frequencies were used to assess sample characteristics. T-tests and chi-square tests were used to examine the relationships among glycemic control as indicated by Hba1c level, gender, and socio-demographic characteristics. Linear regression was employed to assess the relationship between all clinical and socio-demographic factors and Hba1c.

Results:

The average age of participants was 55.2. The majority of diabetics were married (83%), had no formal education (57.6%), and not enough money for basic household goods (65.8%). The majority of the sample was female (73.3%), and only 29.1% of the participants worked outside of the home. Note that work often included tasks such as selling items at the local market and providing driving or transportation services. Approximately 7% of participants reported that they currently smoke cigarettes.

Table 1 displays sample characteristics by gender and glycemic control status where Hba1c <= 7 indicates adequate control and >7 indicates poor control. Men were more likely to be employed compared to women (42.v% versus 24.7% respectively; $p<0.05$). While only 24.8% of the sample had glycemic control according to their Hba1c level, females were more likely to have glycemic control (32.5%) compared to the average, whereas only one man had glycemic control (3.6%; $p=0.0024$). Women had an average Hba1c of 9.0(sd=2.6), whereas men had an average Hba1c of 11.0 (sd=2.8); p=<0.05. Men also had been diagnosed with diabetes for longer than women with the mean time since diagnosis of 8.7(sd=5.8) versus 7.0 (sd=4.8) years respectively ($p<0.05$). Participants who were diagnosed earlier were less likely to have diabetes control (mean=7.8 years) compared to those who were diagnosed more recenly (mean=6.5 years) $p<0.05$.

Diabetics with glycemic control actually had a slightly higher systolic blood pressure (mean=149.0) and were more likely to report having hypertension (37.5%) compared to those without glycemic control (mean= 137.6) and 18.75% respectively. Men and women did not differ by blood pressure or HTN status. Women (mean=26.7(sd=5.0)) also had a slightly higher BMI compared to men (mean=24.2(sd=4.2);P=0.02).

Table 2 displays the results of the linear regression model that assessed the relationship between Hba1c and socio-demographic and clinical variables. As age increases, Hba1c decreases on average 0.06 points. In other words, for every one unit increase in age, participants experienced a 0.06 unit increase in Hba1c, on average. For every year longer one has diabetes, Hba1c increases by 0.12 points. Men had an average Hba1c 1.5 points higher than women. Hba1c is negatively associated with systolic blood pressure and positively associated with diastolic blood pressure.

Discussion

Similar to other studies in SSA (Kibirige et al., 2014; Sobngwi et al., 2012), our current study found that glycemic control in our sample was suboptimal. Also in the current study, we found that women are more likely to have lower Hba1c on average; however, we are unable to make inference about gender differences in actual glycemic control because only one man had achieved glycemic control. Cultural, gender-based differences in diabetes management behaviors (e.g. diet, food preparation and medication adherence) warrant further exploration (McGill et al., 2013; Yuan, Huang, Liao, Lin, & Wang, 2014).

Similar to other studies, our study found that the longer participants in our sample had diabetes, the worse their glycemic control (Khattab, Khader, Al-Khawaldeh, & Ajlouni, 2010). Up to 65% of the population in Senegal remains uninsured and there is a high rate of out of pocket household spending on health care, mainly on pharmeceuticals (HCGP 2014), programs that provide community blood sugar screenings for high risk individuals may provide early indication of abnormal glucose. However, subsequent diagnostic testing and follow-up may still be cost prohibitive. Several insurance initiatives, such as community insurance plans (Mladovsky et al 2014) and Plan Sesame, a plan launched in 2006 intending to offer Senegalese age 60 (Parmar et al., 2014), have not been fully implemented, especially among the poor.

A large majority of participants indicated that they do not have enough money for basic items such as food and clothing. Food insecurity has been found to negatively affect glycemic control. In studies conducted in both Kenya (Cheng et al., 2013) and the U.S. (Berkowitz, Baggett, Wexler, Huskey, & Wee, 2013), diabetic patients who reported food insecurity had poor glycemic control, possibly because energy dense foods (e.g. rice) that negatively affect blood sugar are less expensive than less energy dense foods (e.g. lean meats and vegetables). Future studies on the role of diet and management of type 2 diabetes in the context of a food insecure population is warranted.

This study is not without limitations. First, a convenience sample was used; therefore, this sample may not be a fully accurate representation of all diabetics receiving care at the MBour medical complex. Also,

the Hba1c Now rapid test only reads Hba1c measures up to 13, whereas many of our participants (n=12) had Hba1c levels above 13. Of note is that only 9 patient in our sample had ever had an Hba1c test in the past; this lack of testing is likely due to cost of the test paired with financial insecurity, far short of the International Diabetics Foundations (IDF) guidelines of two to four times per year depending on how well a patient's diabetes is controlled (Consensus Committee, 2007). In addition, we only had one reading of blood pressure, and our hypertension measure was self-reported.

Each participant was asked if he or she was on diabetes and/or antihypertensive medication (e.g. metformin, insulin, beta-blocker, etc). While nearly all participants reported that they were prescribed medication, the large majority (over 80%) also reported that they were not consistently or currently on the medication due to costs or lack of availability. We chose not to use this information given that we could not determine whether the medicine was being taken.

Word of mouth led to many diabetic participants arriving to the study fasting for significant periods of time and with symptoms of unstable blood sugar (e.g. dizziness). Petty cash funds provided by the research staff were used to purchase small snacks in these cases. Almost 15% of the sample had symptoms or alarm values such as blood sugar or blood pressure readings that required follow-up with the on-call study doctor. Two participants were subsequently admitted for inpatient treatment. In research contexts where participants may have untreated or inadequately diabetes and may show up for recruitment with acute symptoms, having direct access to immediate follow-up as opposed to just referral to sevices is necessary.

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Table 1: Sample characteristics by gender and glycemic control

Variable N=106	Mean(sd) or %	Men	Women	Glycemic Control 24.8%	No Glycemic Control 75.2%
Age	55.2(11.6)	57.4(12.8)	54.4(11.1)	57.2(11.7)	54.5(11.0)
Household situation Not enough money for basics	65.8%	60.7%	67.1%	65.8%	61.1%
Work Status* Work for money	29.1%	42.3%*	24.7%*	29.0%	37.5%
Education No formal schooling	57.6%	54.2%	61. 3%	58.3.%	56.8%
Marital status % Yes	83.8%	85.7%	83.1%	84.8%	86.2%
Smoking	6.7%	10.7%*	5.3%*	6.4%	7.7%
Hba1c*	9.5(2.7)	10.9(2.1)*	9.0(2.7)*	6.0(0.5) *	10.5(2.1)*
Waist Circumference(cm) All Male Female	92.4(13.0)	92.7(12.8)	92.1(13.1)	87.2(12.0) 80.00^ 89.7(15.7)	93.0(15.7) 92.2(12.8) 91.4(12.3)
BMI	26.2(4.9)	24.2(4.2) *	26.7(5.0)*	27.0(6.5)	25.9(4.3)
Time since DM diagnosis in years	7.5(5.6)	8.7(5.8)	7.0(4.8)	6.5(4.3) *	7.8(5.3)*
Systolic Blood pressure	139.7(13.7)	144.7(22.6)	138.1(22.7)	*149.0(21.8)	137.6(21.6) *
Diastolic Blood pressure	83.4 (13.8)	86.1(11.9)	82.2(14.2)	82.0(12.2)	86.3(17.7)
Hypertension	24.5%	25.0%	22.0%	37.5%**	18.8%**
Glycemic Control	24.8%	3.6%*	32.5%*	--	--

*P<0.05

^Only one man had proper glycemic control.

Table 2 Linear regression model describing the relationship between Hba1c and clinical and socio-demographic variables

N=106 Variables	*B*	SE	P-value
Age	-0.06	0.02	**0.01**
Waist Circumference	0.04	0.01	0.10
BMI	-0.10	0.07	0.18
Gender Males Female (ref)	 1.5	0.64	**0.02**
Duration	0.14	0.05	**0.03**
Education No Yes (ref)	0.11	0.55	0.76
Marital Status No Yes (ref)	-0.108	0.67	0.87
Work Status No (ref) Yes	0.07	0.06	0.90
Household Situation Not enough Enough (ref)	-0.701	0.56	0.29
Smoke No Yes(ref)	-0.25	1.0	0.82
Systolic BP	**-0.05**	**0.01**	**0.03**
Diastolic BP	**0.07**	**0.02**	**0.03**
HTN No yes(ref)	0.76	0.94	0.41