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An Approaching Epidemic: Exploring Diabetes Awareness & Care in Mombasa, Kenya

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SIT Study Abroad

AN APPROACHING EPIDEMIC:
EXPLORING DIABETES AWARENESS & CARE IN MOMBASA, KENYA

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ACKNOWLEDGMENTS

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ABSTRACT

The prevalence of Type II Diabetes Mellitus (T2DM) has become an increasing problem in virtually every city in the world due to lifestyle changes in recent decades that have greatly reduced healthy eating habits as well as exercise. Research has shown that T2DM is largely preventable through healthy lifestyle choices. It is crucial for every country's population to be aware of the risk factors and complications of diabetes so that they can take active steps to avoid the monumental physical and financial burden of the disease.

This study attempted to gauge diabetes awareness among patients living with diabetes and to explore barriers and solutions to both educating the public and improving diabetes management among current patients in Mombasa, Kenya. Interviews with 25 patients, 9 diabetes care providers, and a host of other professionals relating to diabetes were conducted over three weeks in April, 2010. Diabetes awareness among an educated patient sample was startlingly low. Barriers to public awareness and quality diabetes management of are numerous but feasible solutions appear to exist. To avoid the prevalence of diabetes reaching epidemic proportions, it is imperative that all citizens of Mombasa become aware of the serious health and financial risks posed by diabetes and make lifestyle changes accordingly.

INTRODUCTION

Current estimates project the prevalence of diabetes mellitus (DM) world-wide to double from 175 million in 2000 to 353 million in 2030 (Yach, 2006:62). The majority of this increase is expected to occur within urban areas of developing countries like Kenya, where 305 million people are expected to have diabetes by 2030 (Yach, 2006:62). Ten years ago it was estimated that diabetes already accounted for 5.2% of deaths worldwide (Roglic, 2005:2130). DM needs to be addressed by all countries in order to control the enormous health and financial burdens that accompany the disease. There is no debate that the best way to achieve this goal is to avoid obesity through lifestyle choices. An important step in motivating people to make the necessary lifestyle changes is education about the risk factors and health risks of obesity and diabetes.

In recent years, most people in the developed world and an increasing number of those in developing countries have heard of diabetes. The number that has even a basic understanding of the disease, especially in developing countries, is radically lower. To fully understand the findings and conclusions of this study, it is important to have a basic understanding of diabetes. The same type of basic understanding, I would argue, that people everywhere would greatly benefit from having.

All forms of diabetes negatively affect the body's ability to maintain a relatively constant level of sugar in the blood. The most important hormone involved in this process is known as insulin, which is secreted by the pancreas and facilitates the uptake of sugar from the blood into the cells of the body (Mayo, 2010). Logically, if the pancreas is not able to produce insulin or if the insulin is not able to function properly then the body is not able to maintain a constant blood sugar level, which is harmful to the body. There are many types of diabetes but two types account for around 98% of all cases (WHO, 2009).

Type 1 Diabetes Mellitus (T1DM) is an autoimmune disease in which T lymphocytes (white blood cells) attack insulin-producing pancreatic beta cells and accounts for 5-10 percent of all diabetes cases (Herold, 2002:1692). T1DM used to be referred to as insulin-dependent diabetes mellitus (IDDM) or juvenile-onset diabetes because it tends to occur in children and adolescents and requires the use of synthetic insulin (NIH, 2007). The exact cause of T1DM has yet to be identified but risk factors may be genetic or environmental. No method of preventing T1DM has been identified (NIH, 2007). The prevalence of T1DM world-wide is increasing but not nearly at the rate that type II diabetes is (NIH, 2007).

Type 2 Diabetes Mellitus (T2DM) makes up 90% of all diabetes cases worldwide (WHO, 2009). T2DM refers to an impaired sensitivity to glucose in the cells of the body. At first, the pancreas increases insulin production to compensate for the decreased effectiveness but over time loses its ability to produce enough insulin (ADA, 2006:51). The result is consistently high blood sugar. T2DM results from an interaction between a genetic predisposition and behavioral and environmental risk factors, such as obesity and is associated with old age, physical inactivity, and race/ethnicity (Tuomilehto, 2001:1343). T2DM is usually diagnosed in overweight and obese adults, but diagnosis of adolescents in increasing around the world as well (NIH,2007).

The description of diabetes thus far might deter some people from unhealthy diets and encourage healthier lifestyles. Understanding the costs and complications of the disease, however, is a much stronger incentive to take steps to avoid the disease. Both T1DM and T2DM have been consistently shown to increase the risk of developing microvascular and macrovascular complications such as stroke, nephropathy (kidney failure), myocardial infarction (heart attack), retinopathy (loss of vision), and neuropathy (nerve damage which often leads to

numbness) (EAJM, 2006:397). The reason for these harmful and restrictive complications is that long-term hyperglycemia (high blood sugar) leads to damage of the vascular endothelium (a thin layer of cells that line blood vessels) as a result of oxidative stress (Brownless, 1995:223). Encouragingly, all of these complications are reduced or avoided completely when patients are able to maintain a blood sugar level in the healthy range through a combination of diet, exercise, medications (often including insulin), and blood sugar management.

In a person without diabetes, the blood sugar level is normally regulated by the body to remain within a narrow range of 4.4 – 6.1 mmol/L (82 to 110 mg/dl) (ADA, 2006:51). For individuals with diabetes, all nine diabetes care providers I interviewed wanted their patients to maintain their blood sugar between 4 and 7 mmol/L. Three main monitoring techniques are used in diabetes management. In the first method, a patient places a drop of his or her blood onto a test trip which is coated with certain enzymes. The strip is then inserted into a glucometer, a hand held device which quickly delivers a measurement of the person's blood sugar at the time of testing. This test gives little indication of the quality of glycemic control over more than, at most, the last eight hours. The glucometer is an important tool for patients who correct their blood sugar with insulin injections. In a fasting blood sugar (FBS) test, a patient fasts for 8 hours before testing their blood sugar. This method gives a better picture of the patient's average blood sugar level. The best method for long term measurement is a laboratory test known as a Hemoglobin A1c (HbA1c). This method measures the average amount of glucose that has bound to the hemoglobin in the blood and provides a good measure of the patient's average blood sugar level over the previous three months (ADA, 2006:51).

In addition to the many harmful physical complications mentioned above, the financial burden associated with diabetes is alarmingly high. Diabetes costs in the U.S. were estimated to

be over US $100 billion (KSH 75,000 billion) in 2000 (Zimet, 2000, 31). The average obese

(BMI $\geq$ 30) American pays $1,429 (in 2008 USD) more than the average American of normal

weight (BMI < 25) (Flegal et. al, 2007:2028). These high costs are compounded in poorer

countries like Kenya, where a greater lack of awareness often leads to later diagnoses where

avoidable complications have already progressed (Davis, 1997:1435). In Mombasa, a diabetes

consultation can cost up to 1500 ksh (Dr Rishad, 4/12/10). The vast majority of patients

interviewed in this study reported the cost of medications as a major economic burden. The cost

of blood sugar testing supplies inhibits most of the patients I interviewed from testing as often as

they would like.

      With an understanding of diabetes that includes these costs and complications individuals

would be much more likely to make the difficult choices to eat healthier and get more exercise.

Clearly the physical harm and financial burden that come with diabetes make the rapidly

growing prevalence world-wide a major cause for concern. But what does this mean for Kenya?

Practically every time I described my research project to anyone outside of the medical field I

was met with the response "Diabetes in Kenya? Is that a problem there? I wouldn't have

expected that." To which I now reply, "Remember asking me that in ten or fifteen years."

      In line with estimates of many African nations, the Kenyan ministry of health estimated

the prevalence of Kenyans living with diabetes to be 1.2 million in 2007 and predicts the

prevalence to rise to 1.5 million (4.5% of the population) by 2025 (Nation, 2007). The World

Health Organization (WHO) estimated that in 2000 the prevalence of diabetes in Kenya ranked

tenth of thirty four African countries, well behind countries like South Africa, Nigeria, and

Algeria but ahead of countries including Uganda, Madagascar, and Mozambique. Also in 2000,

the WHO rated Kenya's healthcare system 140th out of 190 countries (WHO, 2000).

It seems fair to say that that Kenya is not unlike many other African countries in terms of diabetes and the care available. Cities all across Africa, and indeed the world, are facing many of the same problems as Mombasa. The barriers to improving awareness and care examined later in this paper should therefore be considered not as problems unique to Mombasa but as widespread problems that are plaguing or will plague many cities across the continent and world.

During my time in Mombasa I focused on two important questions: (1) 'what do patients know about diabetes?' and (2) 'what can be done to improve public awareness and diabetes care?' Given the time (three weeks) and resources available, I chose to interview 25 patients at four clinics, 9 diabetes care providers, 1 diabetes clinic director, 2 laboratory technicians, 3 pharmacists, 1 Chief (an appointed official who serves one of the 2500 'locations' in Kenya) , 1 Senior Education Official, 1 teacher/administrator and 1 secondary school student. The range of professionals that I talked to is indicative of the many barriers to improvement that I found and explored. I originally chose to interview patients with diabetes instead of non-afflicted individuals in order to examine the factors associated with good glycemic control. When it became apparent that diabetes awareness among patients was so startlingly low, I did not see a need nor have the time to extend the interviews into the general public. It is obvious that the population as a whole needs to become educated about the risk factors and complications of diabetes and make lifestyle changes accordingly.

I chose to focus on diabetes in Mombasa because of my previous experiences related to diabetes in the past few years and because the problem has the potential to cripple the population and health care system if not addressed immediately. Indeed, in America we are already seeing a full third of the population classified as obese (WIN, 2010). Examining possible solutions intrigued me because of the enormous health-related, societal, and economic implications of the

challenge of diabetes. While communicable diseases like HIV have been the major challenge of the last thirty years, I believe non-communicable diseases like diabetes are going to be the major challenge of the next thirty. I chose to conduct this study in Mombasa primarily due to medical contacts made available to me by SIT Nairobi academic director, Jamal Omar.

Once it became clear that patient volume and reliable medical data were going to be much harder to come by, my goals for this project shifted from assessing the factors associated with good glycemic control to gauging diabetes awareness among patients and exploring the barriers and solutions to improving diabetes awareness and care in Mombasa.

SETTING

All interviews and research presented in this study occurred in Mombasa, Kenya during April 2010. Mombasa is an island city of 730,000, predominantly Muslims and Christians, on Kenya's East coast surrounded by the Indian Ocean. Mombasa's economy is largely connected to the Kilindini Harbor, the only large harbor in Kenya. Tourism, oil production and cement production also contribute significantly to the economy. An important factor that probably contributes negatively to exercise rates is an average daily high temperature of 84 degrees Fahrenheit and high humidity (BBC, 2010). During my time in Mombasa it was the "rainy season," yet the daily high temperature hovered around 90 degrees Fahrenheit. According to a number of professional I talked to, significantly fewer patients come in when it is raining, so the daily rains may have decreased patient volume during my research period.

Each interview occurred in one of the following areas: Old Town, Kizingo, and Kibokoni. These three affluent districts contain numerous medical clinics and hospitals of varying quality, traditional/herbal healing options, and a very high number of chemists (pharmacies). The clinics where I conducted interviews charged consultation fees ranging from 250 ksh (3.33 USD) to 1500 ksh (20 USD) per visit. Almost all of the patients I surveyed reported the costs of their consultations and medications to be a significant financial burden. Nonetheless, the sample of patients I spoke with generally represents the middle-upper class of Mombasa. It is logical to hypothesize that this portion of the population knows more about diabetes than the lower classes because of better education and access to health care. My findings on diabetes awareness, therefore, are likely a best case scenario for the population as a whole at present.

Two recent societal changes are undoubtedly contributing to the increasing prevalence of diabetes and obesity in Mombasa. Like most cities in the world, the introduction of readily available, affordable, and unhealthy cooking materials and fast food options such as frying oil and chicken and chips has occurred within the last few decades. A fundamental shift in diet across Kenya and many other countries has resulted. Traditional dishes like mashed potatoes with beans and salt have been altered to include cream and fat or replaced altogether with dishes like fried chicken and chips (Dr. Gaman, 2/8/2010). Restaurants that serve cheap, unhealthy food are ubiquitous in Mombasa. One restaurant near Mombasa Hospital serves a very large plate of pilau (spiced, fried rice with chunks of meat) for just 50 ksh (.66 USD). Bottles of sugared soda are available on every street for 30 ksh (.40 USD). Ice cream and numerous fried foods such as samosas (fried meat pies) and mandazi (donuts) are available on practically every street in the city.

The second change, the introduction of tuk-tuks, seems to be less widespread but certainly not unique to Mombasa. Tuk-tuks are cheap, dangerous, and very maneuverable three-wheeled taxis that charge a fraction of the price of their four wheeled competition. Tuk-tuks only became widespread in Mombasa four years ago and have not yet become widespread in Nairobi (Interview #16, 4/21/10). Tuk-tuks have become a staple of transportation for Mombasa residents and have significantly reduced the need to walk. This is especially worrying in light of the fact that 'walking' was practically the only form of exercise reported during this study. Multiple health care providers mentioned tuk-tuks as a major obstacle to getting people to exercise more.

METHODOLOGY

When I originally created the survey found in Appendix 1, my goal was to identify predicting factors associated with good diabetes management. From previous conversations with my advisors in Mombasa and Nairobi, I imagined that I would be able to survey a sample of around 100 patients with diabetes and conduct a brief statistical analysis on the results. When I arrived in Mombasa and went to the Aga Khan clinic for the first time, I quickly realized that this was not going to be feasible. In the United States, doctors specialize in endocrinology after medical school and can fill the majority of their schedules with cases related to diabetes. Doctors are incentivized to see a high patient volume in order to pay their bills and make a profit. Many end up seeing 25 patients with diabetes in a single day. All practices in the U.S. must keep accurate records, many of which are electronic, for insurance, liability, billing, and follow up care purposes.

I expected something similar in Mombasa but I found something very different. Many providers of diabetes care are general practitioners who run a diabetes clinic one morning or afternoon a week. Others, like Dr. Rishad, have specialized in another field (nephrology in his case) but see a handful of patients with diabetes each day. Medical records are rarely easily accessible and were never electronic in the settings where I conducted interviews. I quickly realized that collecting accurate diagnostic information such as blood pressure, weight at diagnosis, and HbA1c, was not going to be feasible given the time and resources allotted to me.

Despite this challenge, it became apparent on my first day that patients living with diabetes new very little about the disease. I quickly modified the survey to contain questions about the cause of diabetes, source of patient knowledge, immediate reason for diagnosis, and care seeking behavior. These additional questions are listed under Appendix 2. Using this new

survey, I interviewed 10 patients at Dr. Rishad's Aga Khan Clinic, 4 patients at his Mombasa

Hospital Clinic, 8 patients at Dr. Lema's Mombasa Hospital clinic, 2 patients at Dr. Bachani's

Memon Clinic, and 1 patient at the SIT Mombasa office over the course of three weeks. In

addition to the survey, I asked some of the patients about educating the population and ways to

reduce the incidence of the disease.

In order to identify and address as many of the barriers to educating the population as

possible, I began to interview a range of other people with jobs relating to diabetes. When one

person would mention a seemingly legitimate barrier to educating the public, I sought out

someone in that field to better understand the issue. For example, Dr. Lema mentioned that he

believed education about diet and diabetes in schools was the best solution so I went and

interviewed an official at the Ministry of Education and a teacher/administrator at a secondary

school. Dr. Ashraf told me that many patients got frustrated with conventional medicine and

transitioned to alternative medicine so I went to an herbal medicine clinic and interviewed an

alternative medicine provider. In total I interviewed 6 medical doctors, 2 clinical officers, 1

herbal/alternative clinician, 2 laboratory technicians, 3 pharmacists, 1 diabetes clinic director, 1

chief, 1 senior education officer, 1 teacher/administrator, and 1 secondary school student. In each

case, I prepared a list of specific questions and got permission from the individual to use the

information they provided in my report.

The majority of patients I interviewed spoke English well enough that no translation help

was needed. In the five cases where help was required, I was assisted by (3) Dr. Rishad's

secretary, (1) a staff member at Dr. Lema's clinic, (1) another patient in the waiting room, and

(1) a patient's daughter. I do not see the language barrier as a significant limitation to this study.

RESULTS & DISCUSSION

A. SURVEY RESULTS & ANALYSIS

I. DEMOGRAPHIC INFORMATION

	Total	Men	Women
Sample Size	25	12	13
Average Age	52	52	52
BMI	31.2	28.6	33.9
Average Visits / Year	17	10	22
Average Years Since Diagnosis	5.5	4.9	6.2

Table 1. Demographic Information of the Twenty-Six Patients Interviewed.

The sample tended to be well educated, living in urban areas within Mombasa, and practicing either Islam or Christianity. All but four of the respondents had completed at least secondary school. Economic status was not specially discussed but based on the consultation fees of the private practices where interviews were conducted it is safe to say that this sample was average to well above average financially. I expected that this portion of the population would be the most informed about diabetes based on access to health care, education level, and wealth. One patient even characterized type II diabetes as "a disease of the rich" (Interview #24, 4/28/10). We can therefore take the following results regarding awareness, testing habits, and care-seeking behavior as a best case scenario for Mombasa.

II. GENERAL DIABETES AWARENESS

The first step in convincing someone to make difficult lifestyle changes to avoid diabetes is convincing them that diabetes is avoidable. All people need to understand than type II diabetes is extremely preventable via lifestyle choices. People with normal BMIs (BMI<25) are much less

likely to develop type II diabetes than those who are overweight (BMI≥25) or obese (BMI≥30) (Knowler et. al, 2002:393). I asked 25 of the patients I interviewed what caused diabetes. Eleven said they had no idea whatsoever. Some interesting secondary comments came from this group. One patient said that "only God can know that" (Interview #6, 4/13/20). Two said that "[they] couldn't know that because [they] were not doctors" (Interviews # 14 & #22). One patient told me that "like HIV, I believe the Europeans may have made diabetes so that they could sell their drugs" (Interview #23, 4/29/10).

Nine patients mentioned genetics or inheritance as the primary cause of diabetes. This issue is discussed in the next section. Two patients mentioned "stress" as the primary cause, one of which told me how this explanation accounted for the high rates of obesity in rural villages. He said that rural villagers have at least ten children, which is very stressful, and then naturally get diabetes. It is important to keep in mind that the people responding to this question have had diabetes for an average of five and half years and visit a doctor for care an average of seventeen times per year.

Only four out of the twenty five mentioned weight or lifestyle as a contributing factor to developing diabetes. This is probably the most concerning result of this study. Among a group of generally well educated, financially stable, people *who already have diabetes and see a provider* only 4 out of 25 mentioned lifestyle habits as a cause of diabetes. Two of these had attended nursing school. So among patients with no medical training, only 2 or 23 knew anything about the link between poor diet and exercise and developing diabetes.

III. AWARENESS OF COMPLICATIONS

There is no question that people who spend more time and effort trying to maintain a constant and healthy blood sugar level if they knew of the terrible long term complications of diabetes: vision loss, kidney failure, heart problems, numbness of the hands and feet, delayed wound healing, and more (EAJM, 2006:397). When asked "what are some of the long term complications of diabetes?" most responses included one to three of these proven complications. Five patients said that they didn't know of any complications of the disease. One patient said that "if you get diabetes, it means you already have TB and your joints are going to be destroyed" (Interview #16, 4/21/10). Educating patients about the many complications of diabetes is an important step in motivating them to control their blood sugars.

IV. GLYCEMIC CONTROL AWARENESS

According the American Diabetes Association (ADA), the range of blood sugar that patients should aim for is between 4 and 7 mmol/L (ADA, 2006). Encouragingly, almost all of the patients who responded to this question gave ranges within 1 mmol/L of this range. Four said they had no idea and two gave very high target ranges: 6-10 mmol/L and 7-10 mmol.L, respectively. It is important that all patients know the range the ideal range to avoid short term symptoms and long term complications.

V. BLOOD SUGAR MONITORING

Location	Responses	Frequency of Testing	Responses
Hospital/Clinic	5	During Visits	3
Home	13	At least Once per Day	7
Chemist	1	Weekly	4
Doesn't Check	1	Monthly	5

Table 2. Location and Frequency of Blood Sugar Testing in the Sample Group

Frequent blood sugar testing is a critical component of good diabetes management. Ideally, patients using insulin should check their blood sugar at least before each meal if not more frequently. Frequent testing can help patients avoid symptoms of both high and low blood sugar. If a patient is taking insulin, for example, a low blood sugar level would indicate to them that they should reduce the amount of insulin they are injecting. Not one patient described testing in this fashion. Most patients who test at home said they would test more frequently if the strips weren't so expensive. I visited three pharmacies and found that on average a package of 50 one-time-use strips cost 1,879 ksh. If patients were to test their sugar twice a day, this cost would become a monthly expense that few patients could afford. Many patients seem to check their blood sugar with a glucometer once a week or less. This is not a great way to monitor blood sugar because it only gives the patient a short term picture of their control. A number of patients said they only tested when they felt the symptoms of high blood sugar which may mean that they are often have blood sugar levels which are well above the desired range but not yet producing symptoms. One patient reported not being able to afford to test ever (Interview #17, 4/10).

VI. DIET

The foods reported as being dietary staples did not vary significantly across the sample. The traditional Swahili diet includes rice, ugali, chipati, beans, fish, chicken, vegetables, fruits, etc. All of these answers were very common. Many patients said they had switched away from white flour products like white rice and white bread for the brown flour alternatives. Like any society, it is hard to imagine adults changing their diet after eating the same foods for their entire lives. The tendency to keep the same diet may be magnified in a place like Mombasa, where the standard diet is very narrow and few alternatives are both available and affordable. Patients need to be encouraged to reduce their portion sizes and use techniques to minimize the number of carbohydrates they are consuming. An easy technique mentioned by one patient is to let rice soak for an hour or so and remove the excess starch before cooking (Interview #10 4/10).

VII. POST-DIAGNOSIS NUTRITIONAL COUNSELING

Almost every patient reported receiving advice about limiting portions, avoiding sugary and starchy foods, and opting for brown flour products over white flour products. Exceptions to this trend included several patients who said they had never been counseled on the topic. One 80 year-old gentleman, who was diagnosed in 1968, said that he had no idea which types of food to avoid or reduce (Interview #14, 4/10). Despite listing sugary and starchy foods, many patients were not able to mention many actual examples of these types of foods. Between nutritional counseling and posters or pamphlets illustrating actual examples of these types of foods patients could become better informed. One recently diagnosed patient said that he wanted nutritional counseling but had not received any from his doctor and did not know where to look (Interview #2, 4/12/20).

VIII. EXERCISE

Fourteen patients described walking as their only form of exercise. Two added swimming. The remainder said that they didn't get any exercise anymore. A culture of physical activity needs to be promoted on the population level. This issue is addressed in Discussion Section C.

IX. FAMILY HISTORY

It was very common for patients to have a family member afflicted with diabetes. Thirteen patients responded that they had a relative with diabetes while ten responded that they were the first in their family. There is no doubt that genetics plays a role in diabetes. The data from these responses alone, however, can tell us nothing concrete. It could be that patients with diabetes tend to come from families who can afford and choose to eat large portions of unhealthy foods and get very little exercise. Interestingly, three patients without a family history of diabetes reported that their spouse also had the disease. Nonetheless, the frequency of multiple members of the same family getting diabetes is contributing to the notion that diabetes caused by genetics. This is a very dangerous idea which is discussed in depth in the Discussion Section B.

X. MEDICATIONS & AFFORDABILITY

Patients reported a wide range of mediations including several types of insulin (lantas, humalog, etc.) and tablets (diamacrin, metformin, glucophage etc.). Only one patient reported an adverse effect of a medication. Medication availability is not an issue in Mombasa. Medication affordability, however, was described as a major economic burden by practically every patient. Three respondents said that their costs are not an issue at the moment because of employer

insurance policies but that they didn't know if they could afford the medications when they retired. Two patients said that they bought their medications from India at a much better price than is available in Mombasa.

B. BARRIERS TO IMPROVING DIABETES AWARENESS AT THE POPULATION LEVEL

I. PRIMORDIAL EDUCATION

The term 'primordial education' refers to teaching a subject starting on the first day a child attends school. When I first met with Dr. Lema, he told me that primordial education was the best chance we have at combating the current trends in obesity and diabetes (Dr. Lema, 4/14/10). While his conviction was strong, Dr. Lema didn't seem to know much about what, if anything was being taught to primary and secondary school students about diet, nutrition, and the complications of obesity. Looking for more information, Charles Nyaribo, a Senior Education Officer at the Ministry of Education reported that both private and public schools teach the same basic curriculum, which is designed by the Kenya Institute of Education (SIE) (Mr. Nyaribo, 4/22/10). He mentioned that students learned about health in a class called "home science" but referred me to a teacher at the Coast Girls Secondary School for more specific information.

Mrs. Thirika is the acting head of the Creative Arts department at Coast Girls. As for primary education, Mrs. Thirika informed me that "science and crafts used to be taught but has been removed from the curriculum," leaving no education related to diet or exercise at the primary school level. During the first day of Form I (9th grade), students choose one of four classes to take for the next four years: Home Science, Computer, Business, or Agriculture. After the completion of Form II, students have the option to transfer classes but *do not* have the option to transfer into Home Science. Currently, 40% of the Form I class at Coast Girls is enrolled in

Home Science (Mrs. Thirika, 4/23/10). Mrs. Thirika referred to the students who choose Home Science as "the lucky ones."

Home Science teaches child care, home management, consumer education, clothing & textiles, health, and food and nutrition. Students in Forms I and II attend Home Science three times per week while students in Forms III and IV attend it four. Two lessons per year are taught on "Nutritional Deficiency Disorders," during which the girls learn about hypertension, goiters, marasmus (a severe protein-energy malnutrition), and diabetes. Aside from occasional lectures on topics like HIV and TB, the information taught in Home Science is the only information about health or nutrition that students receive during their entire educations. I interviewed a secondary school student who had opted for Computer class in his secondary school and could not recall ever learning a thing about health or nutrition aside from a pamphlet distributed by a visiting head of school, which few students read (Mr. Khan, 4/22/10). Mrs. Thirika emphasized the importance of educating students about diabetes so that they would be able to go "go back and teach their relatives." She also said that "the majority of students have a relative at home with diabetes" (Mrs. Thirika, 4/23/10).

Besides the obvious problem that the majority of students are not even enrolled in Home Science, many schools are cutting the course because of the expenses that come with it. Principles are arguing that the class is not affordable because of the high costs of supplies, which include cooking devices, utensils, materials, sewing machines, kitchens, fabric, etc. Students are already required to bring their own cooking supplies from home, but during examinations the schools must buy the supplies to standardize the exam (Mrs. Thirika, 4/23/10).

Outside of diet and health education, a Physical Education (P.E.) program is in place teaches students gymnastics, games, swimming, etc. Currently each class spends only forty minutes per week in P.E. (Mrs. Thirika, 4/23/10).

II. An "It's Genetic" Mentality

Why asked "what do you think causes diabetes?" nine of the twenty-five patients responded "it's genetic" or "it's inherited." It is well established that genetics can predispose certain people to obesity and diabetes (Weber, 2008:65). It is equally well established that lifestyle characteristics like diet and exercise also play a major role in determining who gets diabetes. Numerous "lifestyle intervention studies" have shown that diabetes can be prevented through changes in behaviors even among those containing strong genetic predispositions (Knowler, 2003:393).

An "it's genetic" mentality is appealing to people because it removes any responsibility they might feel to eat well and exercise. One patient with a BMI of 53.8 (morbidly obese) told me that "they say it's caused by lifestyle and too much weight, but I think it's genetic" (Interview #13, 4/10). This patient's sisters, brothers, and mother all had diabetes. Chances are that they were also all obese. Very few patients seem to realize that just because everyone in a family is obese and has diabetes, we do not have any more reason to believe that the disease is genetic than we do to believe that it is caused by obesity (Dr. Rishad 4/27/10). Unfortunately, choosing the "it's genetic" mentality often leads patients to ignore advice about changing lifestyle habits and leads them down the painful road of diabetic complications.

It is also possible that the limited diabetes awareness of providers is contributing to the "it's genetic" mentality. According to Dr. Okanga, a former branch chairman of the Kenya

Diabetes Association, most doctors only learn about diabetes for a semester or two in medical

school and then pick up bits of information during their internships. He thinks it is likely that

many doctors providing diabetes care are unsure about the etiology of the disease themselves and

may be giving patients the easily accepted answer that the disease is genetic (Dr. Okanga,

4/28/10).

III. GOVERNMENT PRIORITIES

The rates of non-communicable diseases like diabetes are increasing all over the world.

Developing countries like Kenya are facing a "double burden" of both non-communicable and

communicable diseases that they must deal with (Boutayeb, 2001:191). Right now the Kenyan

government is more concerned with combating HIV, malaria and tuberculosis than with diabetes

because the former are thought of as the main medical problems in the country. Bakari

Mohammed, Chief of Old Town, told me that health-related talks do occur at the bimonthly

Chief's Barazas but that they are almost always related to TB, malaria, and clean drinking water.

He was very vague on the frequency of talks related to nutrition or diabetes, but did say that they

do exist "because diabetes is a very big problem for [their] people" (B. Mohammed, 4/23/10).

It's very hard to say that the money spent on HIV, malaria, and TB education would be better

spent on diabetes. It is fair to say that health care costs over the few decades could be radically

reduced if more money was spent on nutrition education now.

IV. GOVERNMENT FUNCTIONING

Like all sectors of the government, the health sector is prone to abuse and misuse of

resources. Several people I interviewed expressed their pessimism about the government being

able to achieve anything to benefit the health of the population. One woman who spends most of her time helping sick people in her community told me that the government corruption she's witnessed makes her "wish she was never born" (N. Mohammed, 4/20/10). Dr. Okanga told me about a serious mismanagement of the funds given to the Kenyan Diabetes Association by the International Diabetes Foundation (IDF) in 2008 (Dr. Okanga, 4/28/10). He described the corruption as crippling to the progress the KDA was making with their education outreach programs.

V. FUNDING FOR PUBLIC EDUCATION

Like any country, but particularly developing ones, funding for anything is hard to come by. Often times when a health-related issue can lead to profits for a corporation, that corporation will invest in educating the population on the topic through things like pamphlets and TV commercials. While drug companies do have an incentive to educate patients about drugs that can help to control diabetes there is no incentive for those companies to encourage lifestyle changes that could help people avoid diabetes in the first place (Dr. Ashraf, 4/16/10). Organizations seeking private funding must compete with the same prevalent and highly publicized diseases which are absorbing much of the government funding.

C. SOLUTIONS TO IMPROVING DIABETES AWARENESS AT THE POPULATION LEVEL

I. ORGANIZED OUTREACH PROGRAMS

Diabetes Kenya (formerly the Kenyan Diabetes Association) and the World Diabetes Federation are playing important roles in educating the population and identifying individuals with diabetes. Diabetes Kenya's strategy involves establishing diabetes clinics in locations all

over Kenya including places like Lamu, Melindi, and Kilifi. Diabetes Educators at these clinics

train others in the surrounding areas to go back to their communities and conduct talks about

diabetes at mosques, churches, and schools and look for people experiencing the symptoms of

diabetes. Dr. Okanga said that the system was working very well before IDF funds were poorly

managed in 2008. After a rough patch with limited funding, the project now seems to be

improving the situation once again (Dr. Okanga, 4/28/10). This type of widespread outreach has

the potential to prevent people from getting diabetes and to help those with diabetes get care as

soon as possible.

The World Diabetes Foundation and the Diabetes Information and Management centre

conducted the Diabetes Education Program (WDF04-085) from 2005-2009 hoping to "improve

the understanding of diabetes among health care staff and create public awareness on prevention,

control and risk factors" (WDF, 2009). The program created 45 main clinics at district hospitals,

109 mini-clinics at dispensaries and educated 682 doctors, 2.091 nurses, 813 paramedics, 380

dieticians, and 4,023 lay educators. The program also screened 118,767 people across the

country and found that 12,627 (over 10%) had diabetes, 1,834 of which were unaware they had

diabetes. One-day educational meetings were held within religious and corporate settings,

educating a total of 661,638 people.

The WDF is now involved in two additional projects launched in 2008 and 2009 targeting

diabetic foot care (WDF07-302) and Diabetes Care in the slums of Nairobi (WDF08-399),

respectively (WDF, 2009). The results of the initial program show what an important and

effective role an international organization like the WDF can play in a developing country like

Kenya. As encouraging as these results are, it must also be kept in mind that Kenya is a country

of 39 million people (CIA, 2010). Educating 660 thousand people, therefore, is a small but important first step towards the goal of near complete population awareness.

II. PRIMORDIAL EDUCATION

Graduating every student from secondary school with a solid understanding of basic nutrition, diet, exercise, the risks of obesity and the signs and symptoms of diabetes is a realistic and important goal. Requiring students to take and adequately funding the Home Science class would be one way to reach this goal. Because increasing government funding is such a difficult task, other solutions need to be explored. School-wide lectures regarding communicable disease like HIV are already commonplace. Mrs. Thirika saw no reason why diabetes-related lectures of the same kind could not be utilized. She also thought that diabetes education could easily be added to current topics addressed by each school's Guidance and Counseling Committee. In addition to the long term benefits of primordial education, students are able to pass on the things they learn to their families and friends who may have diabetes or be in a high-risk group.

The longer a person with diabetes remains undiagnosed the worse their prognosis is becomes. Knowing the symptoms of diabetes is important for making diagnoses as early as possible. Towards the middle of my research period I began asking patients about how they were diagnosed. One woman told me that she had been urinating frequently and was very thirsty so she went to get checked for diabetes. When I asked her how she had known that those were signs of diabetes she told me that she had learned about diabetes in secondary 25 years ago. She is now 38 years old. Knowing the signs of diabetes probably sped her recovery and significantly increased her life expectancy.

In 2009, The Ministry of Health in the United Arab Emirates (UAE) has launched a three year campaign to educate students, parents, and teachers about diabetes by holding frequent workshops held at primary and secondary schools in UAE (DN, 2010). Obviously more funding for this type of endeavor is available in the UAE that in Kenya at the moment. Nonetheless, this campaign could serve as an excellent model for Kenya.

II. DIABETES CAMPS

"Diabetes Camps" are days where free head-to-toe checkups are provided at certain hospitals in Mombasa. Alice Halwenge, the director of the Mombasa Hospital Diabetes Clinic, said that the hospital runs two camps per year and that hundreds of people come to each. At these camps, patients have their blood sugar checked and receive free counseling on diet and exercise from nurses. Chief Mohammed also mentioned the camps as one of the major ways that people in his district become educated about diabetes (B. Mohammed, 4/23/10). Increasing the frequency of diabetes camps is a desirable goal that is contingent on funding available to the participating hospitals

.

III. CHIEF'S BARAZAS

Chief's barazas were mentioned in three interviews as a way to educate the public so I went to talk with a Chief in Old Town. A baraza is a large gathering where a district's population meets at a local school or mosque (B. Mohammed, 4/23/10). Most districts conduct around twenty-four barazas each year. These gatherings often include health-related lectures but it seems that currently the majority are about TB, malaria, and clean drinking water. Adding lectures about nutrition and diabetes to this slate seems like a relatively cheap and feasible way to educate

the population. Mr. Mohammed supported the idea in light of the increasing burden of diabetes in his community. Finding an engaging speaker to lecture on these topics is a potential problem (B. Mohammed, 4/23/10).

IV. WAITING ROOM EDUCATION

Most of the medical clinics I visited in Mombasa functioned on a first come, first serve basis. This often meant many patients waiting idly over an hour to see a doctor. This would be a great time to educate patients about nutrition and diabetes. I was advised not to visit Coast General Hospital because of protocol issues, but several patients told me about diabetes educators who lecture in the waiting areas there. One Clinic I went to is planning to install a television in the waiting room that will show educational videos on repeat (Dr. Bachani, 4/21/10). Keeping in mind the high start up cost of buying a television and video player, this method seems like a great way to get information to patients while they are not busy.

V. EDUCATING ALL PATIENTS

Physicians in all specialties should be comfortable and knowledgeable enough to talk to any of their patients about basic nutrition, the risks of obesity, and signs and symptoms of diabetes. Whether seeing a patient for hypertension or a knee replacement, if a doctor encounters an obese patient they should at least encourage that patient to lose weight and investigate the signs of diabetes.

VI. WORLD DIABETES DAY

World Diabetes Day occurs two weeks after Diabetes Awareness Month (November) concludes, on December 14th. Since 2004, the World Diabetes Foundation (WDF) has organized the Global Diabetes Walk. Last year's walk included over 305,000 participants in 343 registered walks in 52 countries including Kenya. Mombasa was a host city for one of these organized walks. This is a great event because it is highly publicized and brings together the diabetes community in a city for a day where information and knowledge about management and prevention can be shared (WDF, 2009).

VII. PROMOTING PHYSICAL ACTIVITY

A landmark study by Knowler et al. randomly assigned 3,234 individuals at high risk for developing diabetes to one of three interventions: lifestyle changes, the drug metformin, and information about diet and exercise alone (Knowler et. al, 2002:393). "Lifestyle changes" usually meant getting 30 minute of exercise (usually walking) 5 days a week and decreasing calorie consumption. The study found that those in the lifestyle intervention group reduced their risk of getting type II diabetes by 58 percent, while those in the metofromin group reduced their chances by 31 percent (Knowler et al, 2002:393). Thirty minutes of walking per day may have once been the norm in Mombasa, but since the introduction of cheap and available transportation including matatus and tuk-tuks, it certainly not any more.

The best way to increase the physical activity of a population is to develop healthy exercise habits among children that can be sustained throughout life. Increasing the amount of P.E. in schools is a critical first step to achieving this goal. The standard forty minutes of PE per school week is insufficient by any measure (Mrs. Thirika, 4/23/10). Enjoyment of physical

activity is becoming increasingly important as less and less exercise is required on a daily basis. Additional efforts need to be made to encourage adults to get exercise each day. The most realistic forms of exercise in Mombasa are walking and swimming. Although the traditional Muslim dress could be a problem for some women, I saw many Muslim women walking and running in burkas on my own morning jogs. In the U.S. the National Football League (NFL) has launched a widespread campaign called Pay 60: the NFL movement for an active generation. This initiative encourages communities to facilitate children playing actively for at least an hour a day (NFL, 2010). Again, funding would be much harder to garner in Kenya, but the method of prevention is a good one.

D. BARRIERS TO IMPROVING DIABETES MANAGEMENT

There is no question that prevention through lifestyle choices is the best way to combat the burgeoning problem of diabetes in Mombasa. For those who have or will soon have diabetes, it is very important that quality medical care be available to help patients manage their diabetes in order to the avoid symptoms and complications of the disease. There are a surprising number of barriers to improving diabetes management in Mombasa, many of which I have not seen during my experience in the United States.

I. PATIENT COMMITMENT

Glycemic control and the resulting symptoms and complications are largely products of an individual's effort to manage their diabetes. Patient commitment to the management of diabetes appears to be a very serious problem in Mombasa. Practically every doctor I interviewed commented on this problem. Dr. Ashraf said that one of his biggest challenges

within diabetes care is convincing patients to follow up (Dr. Ashraf, 4/16/10). Dr. Lema told me

that "patients with decent or good control don't come in for appointments" (Dr. Lema, 4/14/10).

Mrs. Halwenge told me that "many patients will not come in unless they've had recent

symptoms" (Mrs. Halwenge, 4/14/10).

In response to these comments, I began asking the patients I interviewed why they came

in for diabetes care. It was not uncommon for a patient to respond that they came only when they

experienced symptoms. While the average number of visits per year displayed in table 1 is not

bad, this average is somewhat deceiving because a handful of very committed patients increased

the overall average significantly. Alarmingly, it seems that the weather can be a major factor in

patients' decisions to visit the clinic. Many diabetes clinics are only open one day per week. If it

happens to be raining that day, many patients will choose not to visit the clinic that week (Mrs.

Halwenge, 4/14/10).

It would make sense that commitment to diabetes management would be strongly linked

to an understanding of the benefits of good control and of the possible long term complications

of the disease. This is certainly an area for future study which could be important in garnering

outside funding for diabetes education at the population level.

II. QUALITY OF CARE PROVIDED

There is a great deal of room for improvement in the diabetes care provided in Mombasa.

Diabetes education for doctors in Kenya is often limited to a semester or two in Medical School

without much focus on the etiology of the disease (Dr. Okanga, 4/28/10). Clinical Officers

receive limited training about diabetes that is largely limited to memorizing the symptoms and

treatments of the disease (Dr. Collins, 4/16/10). Alternative medicine providers are usually

trained for one year by their employer and learn little more than the company's supplement and dosing recommendations for diabetes (M. Njoki, 4/19/10).

The product of this limited training is that many providers are not in a position to appropriately counsel patients about diabetes management. As mentioned earlier, the HbA1C is the best method to monitor a patient's average blood sugar control. When I interviewed Dr. Ali, a Clinical Officer, he was not familiar with the HbA1c or any other method of blood sugar monitoring besides the glucometer. This is a major cause for concern. If providers are not familiar with these basic testing methods then their patients have little chance of becoming educated. Providers with very limited training may be contributing to the perception that diabetes is solely a genetic disorder because of their lack of understanding (Dr. Okanaga, 4/28/10). This lack of understanding may also be leading some providers to use prescription medications as their only form of care because they are not in a position to educate.

Another major problem among providers is their unwillingness to encourage lifestyle changes (Dr. Ashraf, 4/16/10). They often feel that patients will not be able to make lifestyle changes, rendering their efforts useless. Financially speaking, doctors profit from patients returning for care often. It is possible that some doctors recognize this incentive and would rather see a patient monthly to renew their prescriptions than to help that patient avoid diabetes in the first place through lifestyle changes (Dr. Ashraf, 4/16/10).

III. IDEAS ABOUT LOSING WEIGHT

Historically, a high weight has been considered a sign of affluence and success in much of Kenya (Kerns, 2006). While this trend may be slowly changing, partially due to western influence, it remains a serious problem for diabetes management. When told to lose weight,

many people are concerned about what their friends will think of them (Dr. Lema, 4/14/10).

From informal discussions I've had it also seems that very few Kenyans understand the

association between BMI and life expectancy. A 2009 study found that BMI was a strong

predictor of overall mortality both above and below the optimum range of 22·5–25. They found

that at 30–35, median survival is reduced by 2–4 years and at 40–45 it is reduced by 8–10 years

(Lancet, 2009:1083). One man who told me about his struggles to *gain* weight was shocked

when I told him that thinner individuals tend to live longer than overweight and obese people.

IV. MANAGEMENT COSTS

Few people without diabetes understand how expensive good diabetes management is. At

the locations where I conducted interviews, consultation fees ranged from 250 ksh to 1500 ksh

per visit. The cost of medications is a major burden for virtually all patients paying out of pocket.

One woman told me that she spends 6000 ksh on diabetes medications each month (Interview #8,

4/13/10). The monthly fee for the herbal supplements given to patients with diabetes at the

Kamirithu Herbal Clinic is 3500 ksh (M. Njoki, 4/19/10). At the three pharmacies I visited the

average price for a hand held glucometer was 3,608 ksh and the average cost of a package of 50

testing strips was 1,879 ksh. It seems that the majority of patients cannot afford to have a

glucometer at home and therefore only check their blood sugar at their clinic or at a chemist. At

the laboratory I visited at the Memon clinic, which had the least expensive consultation fee of the

clinics I visited, it cost 150 ksh to test using a hand held glucometer and 700 ksh for an HbA1c.

These costs are a major barrier to patients controlling their blood sugar. One patient at the

Memon clinic told me that she stopped taking medications and never tests her blood sugar

because she cannot afford to do so (Interview #12, 4/10).

V. ALTERNATIVE MEDICINE

It is very hard to make general comments about the role of alternative medicine in diabetes care. There are a number of herbal and alternative medicine options for diabetes care in Mombasa. It is difficult to comment on the quality of care provided because studies measuring the efficacy of these treatments, which can differ greatly between providers, are extremely limited. According to Dr. Ashraf, many patients get frustrated with the slow progress they are making with conventional care and look for a quick fix through alternative medicine. Misinformation given to patients by families and friends about the effectiveness of these treatments also seems to be a contributing factor (Dr. Ashraf, 4/16/10).

Mercy Njoki, an alternative medicine provider at the Kamirithu Clinic, said that patients often come for supplements after they don't get well via conventional care. The providers working at the many clinics owned by Kamirithu are trained for one year at the company headquarters in Nairobi. All patients with diabetes who come to Karmirithu are given a supplement called "Kisukari." Ms. Njoki knew nothing about Kisukari besides that it was the supplement given for diabetes. According to Ms. Njoki, the supplements are used until the patient's blood sugar is back into a range of 3.5-6mmol/L, which usually takes between 6 and 12 months. Interestingly, if a patient can't get back into the normal range, they are advised to go to a conventional office and get insulin (Ms. Njoki, 4/19/10

E. SOLUTIONS TO IMPROVING DIABETES MANAGEMENT

I. IMPROVING DIABETES AWARENESS

Literally every professional I interviewed felt that education was the best way to curb the trend in diabetes. For individuals already afflicted with the disease, education is still vitally

important both to help with food choices and to motivate patients to manage their diabetes as well as they can. As described at length in Discussion Sections B and C above, the barriers and feasible solutions to educating the public are numerous and complex. At the patient level, it is imperative that providers be able to raise the awareness of their patients, who will in turn be able to spread the word to others in their communities.

II. MEDICAL EDUCATION

Medical education of all types of providers must include a thorough understanding of the etiology of diabetes and the current evidence that illustrates the importance of lifestyle choices in preventing the disease. Memorizing the symptoms and treatments for diabetes is insufficient knowledge if empowering patients is the goal. All providers must be in a position to educate their patients and answer their questions about diabetes managing. I would predict that as the rates of diabetes continue their upward climb, medical schools will increase their focus on diabetes out of necessity.

III. EDUCATING CURRENT PROVIDERS

While education at the medical school level is very important for long term care, educating current providers is very important for care in the near future. The Kenya Medical Association (KMA) has introduced a Continuing Professional Development (CPD) program that is analogous to America's Continuing Medical Education (CME) system. Doctors are required to earn a certain number of points by doing things like attending conferences abroad or weekly lectures in Kenya in order to renew their licenses (Dr. Rishad, 4/26/10). Currently there are very few diabetes-specific lectures partially due to the government's primary medical concerns:

malaria and tuberculosis. Increasing the attention to diabetes could be an important way to

increase knowledge among providers in the coming years.

CONCLUSION

The prevalence of type II diabetes has been rapidly increasing across the globe in recent years. Lifestyle changes over the last decade have led to a diet of decreasing nutritional value and greatly reduced amounts of exercise. As a result, diabetes has transitioned from being a disease of the rich to a disease of the masses. Every person interviewed in this study reported that diabetes is a major problem for the population of Mombasa.

Preventative measures are the only way to keep the prevalence of diabetes in Mombasa from reaching epidemic proportions. The first step in prevention is educating people about the lifestyle choices that can prevent obesity, diabetes, and the harmful and financially draining complications associated with each. Alarmingly, only four of the twenty five patients interviewed in this study knew of the relationship between obesity and diabetes. Eleven had no idea what caused diabetes and nine thought diabetes was a strictly genetic disorder. This result is very bad sign for the near future of diabetes in Mombasa. If people don't understand that they can avoid the monumental physical and financial costs of diabetes through diet and exercise they are very unlikely to make difficult but important lifestyle changes.

Many barriers to raising diabetes awareness at the population exist. A severe lack of primary and secondary education, a prevalent "it's genetic" mentality, other important health burdens receiving the majority of government funding, and the government's inability to use funding efficiently and effectively are all major challenges. National and international organizations like Diabetes Kenya and the World Diabetes Foundation have begun efforts to educate the population within the last five years. An increased and sustained effort is undoubtedly required but may prove difficult to fund. Other ways to significantly increase public

awareness include primordial education, diabetes camps, chief's barazas, waiting room education, and the promotion of physical activity.

For those already living with diabetes, as well as the many who will become afflicted in the near future, several important barriers to maximizing diabetes management exist. These barriers include a lack of patient commitment (largely a product of not understanding the possible complications of poor management), the quality of diabetes care provided, negative ideas about losing weight among patients, and high the high costs of care and blood sugar testing supplies. To manage diabetes effectively, patients must be empowered through education about the multi facetted approach to managing the disease. For this to happen, it is imperative that a thorough understanding of diabetes is fostered among all current and future providers of medical care in Kenya.

Efforts at raising diabetes awareness now have the potential to save Kenya an immense amount of suffering and health-related costs over the coming decades. Every country should fear looking back in 2020 or 2030, with epidemic proportions of obesity and diabetes on their hands, and wishing they had invested more in prevention strategies. Based on the current status of diabetes awareness and care in Mombasa, it is hard to believe that this will not be the case.

RECOMMENDATIONS

A. EXPANSION OF THIS STUDY

With a longer research period I would have expanded my research in three ways. First, I would have liked to interview more patients, perhaps one hundred, across a more diverse socio-economic range than my sample provided in this study. To do this, I would have attempted to gain permission to conduct interviews at Coast General Hospital, the largest government-run hospital in Mombasa. Coast General has a large diabetes clinic where it seems that the patient volume is much higher and the financial stability of the patients is much lower than in the areas where I conducted interviews.

Next, I would have tried to further explore the role of the large organizations like the WDF and the challenges they face in a developing country like Kenya. Many issues are currently preventing the Kenyan government from functioning efficiently and effectively. International organizations may prove more effective at than government organizations at raising diabetes awareness in countries facing these types of challenges.

As I've stressed in this report, my sample group was a best case scenario of diabetes awareness and still knew extremely little about the etiology or management of the disease. Therefore my final expansion, given several months to work on the project, would have been to extend interviews into the general public to get a sense of diabetes awareness among those without the disease.

B. FUTURE STUDY

Future studies related to diabetes in Mombasa should begin by trying to gain permission to conduct interviews at Coast General in order to maximize access to patients with diabetes. It

would be very interesting to reexamine patients' understanding of the etiology of diabetes and methods of prevention in the same locations as this study in five or ten years. In the near future, it would be very interesting to examine Kenyans' opinions about the relationships between BMI, health, and life expectancy. An understanding of these relationships is critical for people to make tough lifestyle decisions like eating healthier and exercising more.

Finally, it would be interesting to look into the pharmaceutical market in Mombasa. It appears that with a low barrier to entry, high profit margins, and ever increasing demand, more and more retail and wholesale pharmacies are opening in Mombasa. With seemingly little regulation or accountability, pharmacies often offer prescription drugs without prescriptions and may be selling counterfeit products. Based on the large price discrepancies I observed and the lack of any legitimate price-comparison method it seems that patients are paying radically different prices for the same medications.

APPENDICES

APPENDIX A: ORIGINAL PATIENT SURVEY

I. Diagnostic Info:
   1. Age: _____
   2. Height: _____
   3. Weight: _____
   4. Weight when Diagnosed: _____
   5. B.P. _____
   6. Diabetes: _____
   7. A1C: _____
   8. Provider Rating: Terrible – Poor – Acceptable – Good - Excellent

II. Lifestyle
   1. Education: primary _____ secondary _____ university _____
   2. Modes of Transportation: _____
   3. Exercise: _____
   4. Idea body type: diagram
   5. Which body type will live the longest?
   6. Where do you live? Rural – urban – slums
   7. Religious Orientation? _____
   8. Are you comfortable receiving injections?

III. Diet
   1. Staple Foods: _____
   2. Importance of Price in food choices: _____
   3. Are there any foods that you were advised to stop eating or reduce quantities of after you were diagnosed with diabetes? _____
   4. Are there any foods that you have avoided since being diagnosed with diabetes?
      _____

IV. Awareness
   1. When were you diagnosed / how long have you had diabetes? _____
   2. Has anyone else in your family had diabetes? _____
   3. What are some common complications of diabetes? _____
   4. What is good glycemic control?
   5. Which foods increase your blood sugar the most? _____
   6. What are some causes of poor glycemic control? _____
   7. How happy are you with your blood glucose levels on a scale of 1 (very unhappy) to 5 (very happy)? _____

V. Healthcare
1. Are the drugs your doctor prescribes: available _____ affordable _____
2. Which type of medications do you take? _____
3. Do you think these drugs cause you any problems?
4. Have you ever failed to take your drugs?
   i. If so, why?
5. How many times per year do you see your diabetes care provider? _____
6. Type of provider seen: consultant – GP – counselor
7. How do you check your blood sugar? _____
8. How often do you check your blood sugar? _____
9. Who do you go to when you get sick? _____
10. Do you seek healthcare anywhere besides the medical office?
    _____
11. Do you use any traditional treatments in addition to the drugs your doctor prescribes and which? _____
12. What are some of the symptoms you have experienced?
    _____

APPENDIX B: ADDITIONAL SURVEY QUESTIONS

1. What causes diabetes?
2. Where have you learned about diabetes?
3. How were you originally diagnosed with diabetes?
4. How could the population become more educated about diabetes?

APPENDIX C: GLOSSARY

Autoimmune- of, relating to, or caused by antibodies or T cells that attack molecules, cells, or tissues of the organism producing them.

BG- blood glucose- the amount of glucose (sugar) present in the blood of a human or animal. Normally, in mammals the body maintains the blood glucose level at a reference range between about 3.6 and 5.8 mM (mmol/L). It is tightly regulated as a part of metabolic homeostasis.

BMI- body mass index- a measure of body fat that is the ratio of the weight of the body in kilograms to the square of its height in meters <a *body mass index* in adults of 25 to 29.9 is considered an indication of overweight, and 30 or more an indication of obesity.

Etiology- the study of causation or origination.

Glucose- a sugar that can be linked to form carbohydrates and that serves as a primary source of energy.

Glycemic Control- a medical term referring to the typical levels of blood sugar (glucose) in a person with diabetes mellitus. Much evidence suggests that many of the long-term complications of diabetes, especially the microvascular complications, result from many years of hyperglycemia (elevated levels of glucose in the blood).

HbA1C- a stable glycoprotein formed when glucose binds to hemoglobin A in the blood ; *also* : a test that measures the level of hemoglobin A1c in the blood as a means of determining the average blood sugar concentrations for the preceding two to three months.

Hyperglycemia- an excess of sugar in the blood.

Hypertension- abnormally high arterial blood pressure that is usually indicated by an adult systolic blood pressure of 140 mm Hg or greater or a diastolic blood pressure of 90 mm Hg or greater.

Macrovascular- Pertaining to the macrovasculature, the portion of the vasculature of the body comprising the larger vessels, those with an internal diameter of more than 100 microns.

Marasmus- a form of severe protein-energy malnutrition characterized by energy deficiency.

Microvascular- of, relating to, or constituting the part of the circulatory system made up of minute vessels (as venules or capillaries) that average less than 0.3 millimeters in diameter.

Nephropathy- an abnormal state of the kidney; *especially* : one associated with or secondary to some other pathological process.

Neuropathy- an abnormal and usually degenerative state of the nervous system or nerves.

Oxidative Stress- physiological stress on the body that is caused by the cumulative damage done by free radicals inadequately neutralized by antioxidants and that is held to be associated with aging.

Prevalence- the percentage of a population that is affected with a particular disease at a given time.

Retinopathy- any of various non-inflammatory disorders of the retina including some that cause blindness.

T lymphocytes- a group of white blood cells that play a central role in cell-mediated immunity.

Vascular Endothelium- the endothelium is the thin layer of cells that line the interior surface of blood vessels, forming an interface between circulating blood in the lumen and the rest of the vessel wall. Vascular refers to a relation to blood vessels.

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