NON-COMMUNICABLE DISEASE AND DIABETES SCREENING IN COMMUNITY SETTINGS IN LOW- AND MIDDLE-INCOME COUNTRIES: A CASE STUDY IN SENEGAL, WEST AFRICA

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ABSTRACT

Sub-Saharan Africa is faced with a significant and increasing burden of non-communicable diseases such as type 2 diabetes mellitus (diabetes). In Senegal, the prevalence of diabetes has been documented to be as high as 8.1% in urban-dwelling Senegalese and is fast approaching the United States prevalence of approximately nine percent; however, insufficient resources are available for prevention efforts and disease management. As a result, many cases remain undiagnosed, leading to an increased likelihood of diabetes complications and mortality. Many of these cases remain undiagnosed or are diagnosed only after complications have developed, such as the need for amputation, kidney failure, or loss of vision, which could be potentially reduced through diabetes self-management support. In addition, factors such as limited access to adequate facilities for screening and treatment lead to a disproportionate burden of diabetes related morbidity and mortality in this context. While early detection is a necessity, ethical and logistical considerations should be explored in order to inform and deliver culturally grounded, sustainable, and accessible diabetes screening. We discuss the use of community-based health fairs for diabetes screening and present a case study of a free screening program used in Senegal, West Africa.

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I. INTRODUCTION

Low- and middle-income countries (LMICs) are experiencing a rapid increase in non-communicable diseases (NCDs),[1] such as hypertension, cancer, and diabetes,[2] as well as related risk factors, such as smoking, physical inactivity,[3] and high sugar and fatty diets.[4] In fact, NCDs are expected to exceed communicable and poverty-related diseases as the leading cause of death in LMICs by 2030.[5]

Over the next twenty-five years, sub-Saharan Africa is projected to have the highest increase in diabetes prevalence compared to global estimates.[6] type 2 diabetes mellitus, hereinafter referred to as diabetes, is of particular concern given the propensity for comorbidity with hypertension and obesity. It can also result in microvascular (small blood vessel) damage leading to retinopathy, kidney disease, and macrovascular complications, such as heart attack and stroke.[7] Proper glycemic or blood sugar control has been found to reduce the probability of these complications.[8] However, Eugene Sobngwi and colleagues, in *The Diabcare Africa study*, found that less than thirty percent of participants across six sub-Saharan African countries had normal blood sugar levels or good glycemic control.[9] Factors associated with poor glycemic control in sub-Saharan Africa include infrequent blood glucose monitoring and

1. *See* Trevor Shilton et al., *Towards a Global Framework for Capacity Building for Non-Communicable Disease Advocacy in Low- and Middle-Income Countries*, 20 GLOBAL HEALTH PROMOTION 6, 7 (2013); Michael M. Engelgau et al., *Tackling NCD in LMIC Achievements and Lessons Learned from the NHLBI—UnitedHealth Global Health Centers of Excellence Program*, 11 GLOBAL HEART 5, 5 (2016).

2. WORLD HEALTH ORG., GLOBAL STATUS REPORT ON NONCOMMUNICABLE DISEASES 2010 vii, 1, 11 (2011). *See also* Tolu Oni & Nigel Unwin, *Why the Communicable/Non-Communicable Disease Dichotomy is Problematic for Public Health Control Strategies: Implications of Multimorbidity for Health Systems in an Era of Health Transition*, 7 INT'L HEALTH 390, 392 (2015).

3. Carl Lachat et al., *Diet and Physical Activity for the Prevention of Noncommunicable Diseases in Low- and Middle-Income Countries: A Systematic Policy Review*, PLOS MED., June 2013, at 1, 2.

4. *See* Ana-Lucia Mayén et al., *Socioeconomic Determinants of Dietary Patterns in Low- and Middle-Income Countries: A Systematic Review*, 100 AM. J. CLINICAL NUTRITION 1520, 1520 (2014).

5. WORLD HEALTH ORG., *supra* note 2, at 9, 11.

6. Julia H. Goedecke et al., *Type 2 Diabetes Mellitus in African Women*, 123 DIABETES RES. & CLINICAL PRAC. 87, 88 (2017).

7. *See* Ranjita Misra et al., *Community-Based Diabetes Screening and Risk Assessment in Rural West Virginia*, J. DIABETES RES., 2016, at 1, 1.

8. *See* Edoardo Mannucci et al., *Is Glucose Control Important for Prevention of Cardiovascular Disease in Diabetes?*, 36 DIABETES CARE S259, S262 (Supp. 2013).

9. Eugene Sobngwi et al., *Type 2 Diabetes Care Centres of Six Sub-Saharan African Countries: The Diabcare Africa Study*, 95 DIABETES RES. & CLINICAL PRAC. 30, 32 (2012).

hemoglobin A1c (HbA1c) testing,[10] poor medication adherence,[11] limited access to care, limited knowledge about care,[12] and underdeveloped—or often nonexistent—diabetes education programs.[13]

Given the paucity of infrastructure to identify and care for NCDs, many cases go undiagnosed, and those that are diagnosed are already at late stages of the conditions, leading to more severe complications and premature morbidity and mortality.[14] This is particularly true among the medically underserved.[15] Early detection and proper management of diabetes are critical in order to decrease the likelihood of complications and to reduce morbidity and mortality.[16] In the United States, community health fairs have been used as a means of early detection and diagnosis for diabetes and other common conditions, especially among limited-resource communities[17] and underserved populations that may not have access to health care regularly.[18] Community health fairs have grown in popularity in the past several decades to include millions of participants.[19]

Community health fairs in the United States have evolved over time to serve several functions. First, they serve as an opportunity for community members to receive information and screening for selected medical

10. *See* Duncan M. Matheka et al., *Pattern, Knowledge and Practice of HbA_{1c} Testing Among Diabetic Patients in a Kenyan Tertiary Referral Hospital*, 9 GLOBALIZATION & HEALTH 1, 3 (2013), http://globalizationandhealth.biomedcentral.com/articles/10.1186/1744-8603-9-55.

11. Tefera Kassahun et al., *Factors Associated with Glycemic Control Among Adult Patients with Type 2 Diabetes Mellitus: A Cross-Sectional Survey in Ethiopia*, 9 BMC RES. NOTES 1, 3–4 (2016).

12. Sobngwi et al., *supra* note 9, at 35. *See also* Matheka et al., *supra* note 10.

13. *See* Maysaa Khattab et al., *Factors Associated with Poor Glycemic Control Among Patients with Type 2 Diabetes*, 24 J. DIABETES & ITS COMPLICATIONS 84, 88 (2010).

14. *See* Sheik Islam et al., *Non-Communicable Diseases (NCDs) in Developing Countries: A Symposium Report*, GLOBALIZATION & HEALTH, Mar. 2014, at 1, 5, https://globalizationandhealth.biomedcentral.com/articles/10.1186/s12992-014-0081-9 (noting NCDs such as diabetes and hypertension are often undiagnosed in LMICs).

15. *See id.*

16. William H. Herman et al., *Early Detection and Treatment of Type 2 Diabetes Reduce Cardiovascular Morbidity and Mortality: A Simulation of the Results of the Anglo-Danish-Dutch Study of Intensive Treatment in People with Screen-Detected Diabetes in Primary Care (Addition-Europe)*, 38 DIABETES CARE 1449, 1453 (2015).

17. Misra et al., *supra* note 7, at 1, 8; Kate Murray et al., *The Reach and Rationale for Community Health Fairs*, 29 J. CANCER EDUC. 19, 22 (2014); Mabel Ezeonwu & Bobbie Berkowitz, *A Collaborative Communitywide Health Fair: The Process and Impacts on the Community*, 31 J. COMMUNITY HEALTH NURSING 118, 125 (2014); Alice Burron & Larry S. Chapman, *The Use of Health Fairs in Health Promotion*, AM. J. HEALTH PROMOTION, July/Aug. 2011, at TAHP-1, TAHP-2.

18. Murray et al., *supra* note 17.

19. Dong-Chul Seo, *Lessons Learned from a Black and Minority Health Fair's 15-Month Follow-up Counseling*, 103 J. NAT'L MED. ASS'N 897, 897 (2011).

conditions.[20] Second, health fairs allow the opportunity for early detection or diagnosis of some health conditions; they also provide an opportunity to identify and provide education and information on modifiable risk factors for diabetes depending on the availability of (1) properly trained health care professionals to conduct the screening, (2) properly calibrated and functioning equipment for detecting diabetes, (3) education on necessary follow up for confirmation of diagnosis, and (4) access to follow-up care.[21] Lastly, community health fairs are not subject to or guided by a specific regulatory organization that enforces screening or treatment guidelines.[22]

Are community health fairs an ethical and efficient way to identify diabetes cases early and efficiently in sub-Saharan Africa? In sub-Saharan African LMICs, can the aforementioned criteria be consistently met? The following case study of a community screening program for diabetes in Senegal, West Africa, will address these questions and suggest potential strategies for creating effective and sustainable community-based programs for diabetes screenings in LMIC settings.

II. A CASE STUDY OF DIABETES AND COMMUNITY HEALTH SCREENINGS IN SENEGAL, WEST AFRICA

Senegal is a francophone country of approximately fifteen million individuals in sub-Saharan West Africa.[23] In Senegal, the prevalence of diabetes has been documented to be as high as 8.1% in the urban-dwelling Senegalese population; however, insufficient resources are available for prevention efforts and disease management.[24] In addition, Senegal is undergoing a significant nutritional transition due to urbanization that puts its population at increased risk for developing diabetes[25] and complicates the dietary management of existing cases. Nutritional transition is characterized by

20. Burron & Chapman, *supra* note 17, at TAHP-1.

21. *See* Mark J. Kittleson & Vivien C. Carver, *The Status of Health Fairs: Perspectives from the Health Education Profession*, 13 HEALTH VALUES 11, 14 (1989); Murray et al., *supra* note 17, at 23–24; Burron & Chapman, *supra* note 17, at TAHP-3–7.

22. Donald M. Berwick, *Screening in Health Fairs: A Critical Review of Benefits, Risks, and Costs*, 254 JAMA 1492, 1492 (1985).

23. *The World Factbook: Senegal*, CENT. INTELLIGENCE AGENCY, https://www.cia.gov/library/publications/the-world-factbook/geos/sg.html (last visited Feb. 11, 2017).

24. Evan Foley & Rhonda BeLue, *Identifying Barriers and Enablers in the Dietary Management of Type 2 Diabetes in M'Bour, Senegal*, J. TRANSCULTURAL NURSING 1, 1 (2016); S.M. Seck et al., *Diabetes Burden in Urban and Rural Senegalese Populations: A Cross-Sectional Study in 2012*, 2015 INT'L J. ENDOCRINOLOGY 1, 1 (2015).

25. Barry M. Popkin, *Nutrition Transition and the Global Diabetes Epidemic*, 15 CURRENT DIABETES REPS. 1, 4–5 (2011); Zulfa Abrahams et al., *Diet and Mortality Rates in Sub-Saharan Africa: Stages in the Nutrition Transition*, BMC PUB. HEALTH, 2011, at 1, 3, http://bmcpublichealth.biomedcentral.com/articles/10.1186/1471-2458-11-801.

increases in total fat, cholesterol, sugar, and other refined carbohydrates and decreases in fiber associated with lifestyle changes related to economic development and urbanization, which creates further challenges for diabetes management.[26]

Research conducted specifically on diabetes management in Senegal showed that among a sample of 106 people living with diabetes, only 24.8% had adequate glycemic control (HbA1c less than seven percent), and glycemic control worsened the longer one was diabetic.[27] On average, men had worse glycemic control than women.[28] Furthermore, diabetes management had deleterious, long-term effects on access to health care and on those who financially support their family members' diabetic diet and purchase their medications.[29] These results further highlight the need for screening and early detection, as early detection offers the best chance for glycemic control, better diabetes-related outcomes, and potentially reduced expenditures for the person living with diabetes and his or her family.[30] Lack of health insurance and limited access to care create additional challenges to managing diabetes.

A. Health and Health Care in Senegal

According to the World Health Organization (WHO), the current life expectancy at birth in Senegal is sixty-five years for men and sixty-nine years for women.[31] The 2015 maternal mortality rate per 100,000 births in Senegal was 315[32] compared to 14 in the United States,[33] and the neonatal mortality rate per 1,000 live births was 20.8 in Senegal[34] and 3.6 in the United States.[35] Infectious diseases are still the highest causes of deaths in Senegal.[36] Lower respiratory infections were the leading causes of death in 2012, accounting for

26. William K. Bosu, *An Overview of the Nutrition Transition in West Africa: Implications for Non-Communicable Diseases*, 74 PROC. NUTRITION SOC'Y 466, 469 (2014).

27. Rhonda BeLue et al., *Glycemic Control in a Clinic-Based Sample of Diabetics in M'Bour Senegal*, 43 HEALTH EDUC. & BEHAV. 112S, 114S (2016).

28. *Id.*

29. Foley & BeLue, *supra* note 24, at 1, 4.

30. *Diabetes Symptoms*, AM. DIABETES ASS'N, http://www.diabetes.org/diabetes-basics/symptoms/?loc=db-slabnav (last visited Feb. 12, 2017).

31. WORLD HEALTH ORG., SENEGAL: WHO STATISTICAL PROFILE, http://www.who.int/gho/countries/sen.pdf?ua=1 (last updated January 2015).

32. *Id.*

33. *Maternal Mortality Ratio (Modeled Estimate, Per 100,000 Live Births)*, WORLD BANK, http://data.worldbank.org/indicator/SH.STA.MMRT?locations=US&view=chart (last visited Mar. 12, 2017) (filter results by "United States" and "Mortality Rate, Maternal").

34. WORLD HEALTH ORG., *supra* note 31.

35. *Mortality Rate, Neonatal (Per 1,000 Live Births)*, WORLD BANK, http://data.worldbank.org/indicator/SH.DYN.NMRT?locations=US (last visited Mar. 12, 2017) (filter results by "United States" and "Mortality Rate, Neonatal").

36. WORLD HEALTH ORG., *supra* note 31.

16.1% of deaths, followed by malaria (eight percent) and diarrheal disease (six percent).[37] Deaths due to human immunodeficiency virus (HIV) were eleven per 100,000 people,[38] one of the lowest in sub-Saharan Africa.[39] Senegal also has fewer deaths from tuberculosis than many other African countries.[40] In 2014, NCDs such as cardiovascular disease, cancer, and diabetes were estimated to account for thirty-four percent of total deaths.[41]

The national health care system in Senegal is divided into three levels: regional hospitals, district health centers, and health posts.[42] The country has sixty health centers, twenty developed hospitals, and private clinics.[43] There is one hospital for every 500,000 residents compared to the 150,000 recommended by the WHO.[44] There are huge disparities in health care access and quality for those living in urban versus rural areas.[45] In rural areas, health care is divided into health centers, health posts, and health points. Health centers usually have one or two doctors and fifteen to twenty health staff, while the health posts have no doctors working but have four to five health workers.[46] Below health posts are hundreds of health points: one- or two-room structures that consist of one to two community health workers and a midwife.[47] Unpaid volunteer health workers assist community health workers in health posts or health points with vaccination campaigns.[48] For over eighty percent of the Senegalese population, these poorly equipped health posts are the only accessible health facility.[49] As of 2008, there were 600 doctors and 3,300 nurses and midwives in Senegal, and approximately fifty percent of these health professionals, as well as seven of the twenty hospitals, are located

37. *Id.*

38. *Id.*

39. *AIDSinfo*, UNAIDS, http://aidsinfo.unaids.org (last visited Mar. 25, 2017).

40. *See generally Estimated Tuberculosis (TB) Cases and Deaths, 1990—2015*, WORLD HEALTH ORG., http://gamapserver.who.int/gho/interactive_charts/tb/cases/atlas.html (last visited Feb. 10, 2017).

41. *Noncommunicable Diseases (NCD) Country Profiles*, WORLD HEALTH ORG., http://www.who.int/nmh/countries/sen_en.pdf?ua=1 (last visited Feb. 10, 2017).

42. INST. FOR TRANSP. & DEV. POL'Y, REPORT ON CURRENT SITUATION IN THE HEALTH SECTOR OF SENEGAL AND POSSIBLE ROLES FOR NON-MOTORISED TRANSPORT INTERVENTIONS 6 (2014), https://www.itdp.org/wp-content/uploads/2014/07/ITDP-Transport-and-Health-Care-Senegal.pdf.

43. OXFORD BUS. GRP., THE REPORT: SENEGAL 2008 152 (2008).

44. *Id.*

45. *Id.*

46. INST. FOR TRANSP. & DEV. POL'Y, *supra* note 42, at 7.

47. *Id.*; OXFORD BUS. GRP., *supra* note 43.

48. INST. FOR TRANSP. & DEV. POL'Y, *supra* note 42, at 8.

49. *Id.* at 9.

in Dakar.[50] However, fifty-seven percent of the population lives in rural areas, hence there is a strong need to have more of these personnel in rural areas.[51]

Besides access to health services, the cost of treatment is also a major barrier for a large proportion of the population.[52] Minimal services are provided at the health points at affordable prices.[53] "Antenatal care[,] family planning,. . .and vaccinations all cost less than [one dollar]" and are easily affordable.[54] However, hospital stays at health posts can cost as much as fifty dollars per day, caesareans can cost one hundred dollars, and dialysis can cost as much as twenty-five dollars per week.[55] Eighty-nine percent of a household's health expenditure is out-of-pocket,[56] yet, in 2014, the Senegalese government spent 4.7% of the country's gross domestic product on health care.[57] The average annual per capita income is $760, and many people live on less than one dollar per day.[58] Additionally, only 15.2% of Senegalese people have health insurance.[59]

Limited access to care and lack of health insurance highlight the need for opportunities for early identification of diabetes and assistance with diabetes management. Thus, this case study highlights a program conducted by a bi-national, non-profit organization for diabetes screening in Senegal.

B. An Illustration of a Community-Based Health Fair for Diabetes and Other Conditions in Senegal, West Africa

Weer Africa ("healthy Africa" in Wolof, a language commonly spoken in Senegal)[60] is a non-profit organization that provides "culturally-centered leadership development, programming, timely information and research support on best practices related to high quality [NCD] prevention [and] management, and healthcare quality improvement in the global south."[61] Weer

50. Angela Scillia, *Senegal: Ray of Hope as Transmission Rates Slow*, COURIER ACP-EU, Sept.–Oct. 2001, at 16, 16; OXFORD BUS. GRP., *supra* note 43.

51. *Senegal*, WORLD HEALTH ORG., http://www.who.int/leishmaniasis/resources/SENEGAL.pdf (last visited Feb. 11, 2017).

52. *Id.*; OXFORD BUS. GRP., *supra* note 43, at 153.

53. OXFORD BUS. GRP., *supra* note 43.

54. *Id.* at 153.

55. *Id.*

56. Aurélia Lépine & Alexis Le Nestour, *The Determinants of Health Care Utilisation in Rural Senegal*, 22 J. AFR. ECON. 163, 163 (2012).

57. *Country Profile: Senegal*, WORLD HEALTH ORG., http://www.who.int/countries/sen/en/ (last visited Feb. 11, 2017).

58. OXFORD BUS. GRP., *supra* note 43, at 153.

59. Lépine & Le Nestour, *supra* note 56, at 163–64.

60. *Wolof*, ABOUT WORLD LANGUAGES, http://aboutworldlanguages.com/wolof (last visited Feb. 9, 2017).

61. *About Us*, WEER AFR., http://www.weerafrica.org/charity-organization-about-us (last visited Feb. 9, 2017).

Africa was founded in 2010 in response to Senegal's NCD epidemic.[62] Its goal is "to develop human and financial resources to support the prevention and treatment of [NCDs] and [to improve] health care quality by working closely with . . .local partners."[63] Weer Africa's philosophy is "that sustainable and useful programming and products work best when grounded in the local culture and created in partnership with local stakeholders."[64] Additionally, it is a registered, non-governmental organization in both the United States and Senegal.[65] Board members consist of Senegalese persons living in the United States and in Senegal and Americans living in the United States. One of Weer Africa's primary activities is community-based diabetes screening.[66] These free community-based screenings in Senegal are generally referred to as *Consultation Gratuite* in French, or a "Free Consultation."[67]

C. The Weer Africa Model of Community-Based Screenings

Weer Africa employs a grassroots, community-engaged model of community screening. First, *Consultations Gratuite* are done in response to a request from an interested community.[68] Second, Weer Africa works with a local community planning committee. Approximately six months in advance, Weer Africa helps a local community develop this local planning committee to manage the *Consultations Gratuite*. The functions of the planning committee are to set a date for the screening, identify a location for the consultation, obtain the proper approvals for use of space, inform and invite the relevant community and local officials to attend the screening, advertise the event, staff the event (e.g. provide security and manage participant flow), identify strategies for ongoing health promotion events, review screening-day outcomes, and identify potential follow-up events or strategies.[69] The planning

62. *Projects*, WEER AFR., http://www.weerafrica.org/charity-organization-projects (last visited Feb. 9, 2017).

63. *About Us*, *supra* note 61.

64. *Id.*

65. *See Weer Africa*, CROSSROADS GLOBAL HAND, https://www.globalhand.org/en/search/organisation/organisation/44708?search (last visited Feb. 6, 2017).

66. *About Us*, *supra* note 61.

67. *See* LINGUEE, http://www.linguee.com/english-french/translation/free+consultation.html (English-to-French translation of "free consultation") (last visited Feb. 6, 2017). The author and her colleagues use this language when conducting health screenings in Senegal, West Africa.

68. Rhonda BeLue is the acting director of the Pan University Network for Global Health. She has also been leading short-term study abroad trips to Senegal, West Africa, for undergraduate and medical students since 2013. In addition, she collaborates with stakeholders and community members in Senegal to conduct outreach and research activities as a part of a Fulbright award related to non-communicable disease. One of the main outreach activities is the Free Community Screening or Consultation (*Consultation Grauites* in French). The information within this section comes from the work she has personally done in Senegal.

69. *See generally Projects*, *supra* note 62.

committee is usually composed of approximately ten individuals including several well-respected community leaders, a local health care provider, and stakeholders who cope with a NCD.[70]

The Weer Africa staff identifies and assembles local health care providers who are fluent in the local language, health status, socioeconomic status, and cultural norms surrounding diabetes screening and health-seeking behaviors. Weer Africa uses a local provider model, as opposed to a medical mission model with foreign physicians, to increase the probability of sustainability and receipt of culturally appropriate care.[71] The organization also provides all needed medical supplies. Weer Africa conducts a public diabetes and NCD education and awareness session for consultation participants.[72] Finally, it also tracks the demographics and screening results for all participants.[73]

As an illustration of these efforts, in the summer of 2016, Weer Africa worked with several communities to host consultations in four communities in Senegal, namely (1) Sangalkam, a small town near the Lac Retba area outside the capitol; (2) Kaffrine, a rural village in the Kaffrine region (the peanut basin or peanut-producing region); (3) Kaolack, the main city in the Kaolack region bordering The Gambia; and (4) Thiadiaye, in the Thiès region of Senegal, bordering the western coast.[74] Of the four sites, Kaffrine is the furthest from a health care facility, which is approximately a two-hour drive away.

Consultations included the following services: diabetes screening via blood glucose tests and screening or treatment for other conditions that are often comorbid with diabetes. These included a blood pressure check via ambulatory blood pressure monitor, eye screenings with donated glasses (free of charge to patients), dentistry (extractions), general medical consultations, and general advice related to screening results.[75] A total of thirty physicians and nurses staffed each consultation.[76] Physician specialties included general practitioners, gynecologists, pharmacists, emergency department doctors, nutritionists, endocrinologists, ophthalmologists, dermatologists, urologists,

70. *Id.*

71. *Id.*

72. *Senegal 2016*: *Weer Africa*, MED. MISSIONS, http://medicalmissions.org/missions/senegal-2016 (last visited Feb. 5, 2017).

73. *See id.*

74. *Id.* The author conducted these community consultations and screening events in Senegal during the summer of 2016.

75. *See generally Senegal 2016*: *Weer Africa*, *supra* note 71.

76. The author conducted these community consultations and screening events in Senegal during the summer of 2016. Clinical notes were given to each participant and after each part of the screening (e.g. blood pressure assessment), the provider wrote down the results. All results were recorded and tallied in an excel file. Patients also received a copy. The data was then imported into and analyzed using a statistical software package. The information in this section comes from this data and is on file with the author.

pharmacists, and a dentist. Participants self-reported age, gender, and whether a health care provider had informed them that they had diabetes or hypertension.

A total of 1,593 community members participated across the four communities: 449 in Sangalkam, 240 in Kaolack, 420 in Kaffrine, and 484 in Thiadiaye. Approximately four percent of the participants reported that they had diabetes, and twenty-five percent reported that they had hypertension. Among those who reported that they did not have diabetes, fifteen percent had a blood sugar reading greater than 200 (indicative of potentially elevated blood sugar). Among those who reported that they did not have hypertension, thirty percent had blood pressure readings over 140/90 (indicative of potentially elevated blood pressure). These increased levels of blood sugar and blood pressure warrant a follow-up visit with a health care provider post-screening. In addition, providers performed over 100 dental extractions, performed over 1,000 eye exams, wrote over 500 prescriptions, and made over 600 preliminary diagnoses of conditions related to skin disorders and infections, tooth abscess, gynecological infections and complications, eye injury, eye infection, eye disorder (e.g. cataracts), and uncorrected myopia and hyperopia. Three hundred pairs of donated glasses were distributed, and they alleviated some of these conditions. The majority of these diagnoses required additional follow up post-screening.

D. Challenges Faced During and After the Consultation Gratuite

Multiple challenges and ethical considerations arose during these consultations:

1. The gold standard for diagnosing diabetes or detecting the amount of glycosylated hemoglobin in one's blood is the HbA1c test.[77] A HbA1c rapid test, or one that can be administered on-site at a consultation event, can cost over ten times the dollar amount compared to a blood glucose test (approximately ten dollars versus one dollar per test) and is, therefore, cost-prohibitive in the context of a large public screening.[78]

   While the current literature shows that blood glucose test strips are effective screening tools in low-resource settings,[79] several

77. Enzo Bonora & Jaakko Tuomilehto, *The Pros and Cons of Diagnosing Diabetes with A1C*, 34 DIABETES CARE S184, S184 (2011).

78. *Id.* at S189; Caroline West et al., *Developing a Screening Algorithm for Type II Diabetes Mellitus in the Resource-Limited Setting of Rural Tanzania*, 351 AM. J. MED. SCI. 408, 413–14 (2016).

79. West et al., *supra* note 78, at 414; Jon B. Rasmussen et al., *Random Blood Glucose May Be Used to Assess Long-Term Glycaemic Control Among Patients with Type 2 Diabetes Mellitus in a Rural African Clinical Setting*, 19 TROPICAL MED. & INT'L HEALTH 1515, 1515–18 (2014).

scenarios can occur where cases of diabetes still go undiagnosed. Blood sugar, as detected by a glucose test strip, fluctuates throughout the day and can reach the normal threshold (or below) even among those with diabetes.[80] The HbA1c test, however, is a definitive diagnostic and does not rely on daily blood sugar fluctuations, but rather represents an approximate three-month average of blood sugar control.[81] Therefore, one barrier to community-based blood sugar screenings is missed cases of diabetes where blood sugar is currently normal, but the participant is actually diabetic. In all cases, follow up for elevated blood sugar is warranted.

2. A one-time blood pressure reading cannot be used to arrive at a diagnosis;[82] however, a follow up to confirm (or refute) the elevated value found at the screening is necessary.
3. Follow up for all elevated or suspicious screening results are likely cost-prohibitive and may also be geographically prohibitive because traveling to a health care facility is not affordable or transportation is not readily accessible.
4. Many participants required medications or came to the consultation seeking specific medications that Weer Africa was not able to provide.[83] Again, a medical follow up at a health care facility was required.
5. Health advice for primary or secondary prevention of diabetes and hypertension offered at the consultations may also require additional financial resources, such as funds related to the purchase of certain foods and outlets for physical activity.
6. Literacy and numeracy were a challenge among many of the elderly participants and those in the most rural consultation sites.[84] Some participants relied on children or grandchildren to confirm written instructions and suggested follow up.[85]

80. Barry H. Ginsberg, *Factors Affecting Blood Glucose Monitoring: Sources of Errors in Measurement*, 3 J. DIABETES SCI. & TECH. 903, 905 (2009).

81. WORLD HEALTH ORG., *Use of Glycated Haemoglobin (HbA1c) in the Diagnosis of Diabetes Mellitus: Abbreviated Report of a WHO Consultation* 6 (2011), http://www.who.int/diabetes/publications/report-hba1c_2011.pdf?ua=1/.

82. *Id.* at 9.

83. BeLue et al., *supra* note 27, at 115S.

84. UNESCO INST. FOR STAT., UIS FACT SHEET: 50TH ANNIVERSARY OF INTERNATIONAL LITERACY DAY: LITERACY RATES ARE ON THE RISE BUT MILLIONS REMAIN ILLITERATE 7 fig. 5 (Sept. 2016).

85. *See* Rhonda BeLue et al., *A Cultural Lens to Understanding Daily Experiences with Type 2 Diabetes Self-Management Among Clinic Patients in M'Bour, Senegal*, 33 INT'L Q. COMMUNITY HEALTH EDUC. 329, 334, 339–40 (2013).

7. Some participants arrived at the consultations in need of urgent medical care that was not within the scope of the *Consultation Gratuite*.[86] Efforts were made to stabilize such participants and instruct family members on how to get the person the immediate health care facility-based medical attention needed.

E. Successes of the Consultation Gratuite

While there are multiple challenges and concerns related to *Consultation Gratuite* events, several positive outcomes also occurred:

1. The local communities developed an increased awareness of the NCDs, and the planning committees became vehicles for addressing the ongoing health care needs of the local community.
2. Participants received health education and medical advice.
3. Some participants received medical attention, and their health concerns were completely resolved at the consultation: for example, tooth extractions performed for abscessed teeth and glasses given for vision correction.[87]
4. Participants who had elevated blood pressure or blood sugar were provided basic health education that could be implemented without additional financial resources: for example, participants were given basic dietary instructions, such as how to reduce salt and sugar in their diets without having to purchase additional or different household food items.
5. Participants whose health issues could not be resolved at the consultation were given a plan and the next steps for treating their condition, including what type of care is likely needed. They were also referred to specific local health care resources and the local planning committee for assistance.

III. CONCLUSION

There is a growing need for early detection of NCDs such as diabetes in LMIC settings. Individuals in these settings face a disproportionate burden and suffer worse outcomes compared to those in high-income countries due to the current lack of programming, resources, access to care, insurance, and infrastructure. In LMICs, where health insurance is uncommon and health care access is often cost-prohibitive, community screenings can be potentially useful. However, the utility of free, community-based screenings in low- and middle-income settings requires further thought and investigation. Questions

86. BeLue et al., *supra* note 27, at 113S.

87. The author conducted these community consultations and screening events in Senegal during the summer of 2016.

include whether screenings should be conducted if follow-up cannot be guaranteed for all participants; what personnel and equipment are necessary for conducting community screenings; and whether community health screenings should be regulated by a professional society or health care legislation in LMICs. Furthermore, since the Weer Africa screening model is not common, other future research questions arise: what resources and opportunities exist for replicating and improving the Weer Africa approach; and what are the legal ramifications of giving potentially incorrect medical advice or the participant misinterpreting medical advice, in a setting where resources are limited, and literacy and numeracy are uncommon?