Community-Based Diabetes Programs: A Qualitative and Quantitative Study Among African American Diabetics Of New York City

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Abstract
Diabetes is a chronic disease that affects how your body process food for use as energy. Insulin, a hormone produced by the pancreas is the key factor to diabetes. The immune system attacks and destroys the insulin producing beta cells in the pancreas resulting in low levels or no insulin (type 1) or cannot use the insulin made by the pancreas leading to type 2 diabetes. As a chronic disease, diabetes prevalence rates continue to increase each year. In 2012, there were 29.1 million persons have diabetes in the US with a projection of 64 million by 2050 [2]. Diabetes is a chronic disease that greatly affects New Yorkers. Among an estimated of 987,000 New Yorkers who have diabetes, 19% of them were not unaware of their condition thus were not receiving any treatments [3]. Adults with diabetes are more likely to develop heart disease and a greater chance of having a stroke or angina [4]. Quantitative and qualitative researches were done through analysis of demographic variables as well as through evaluating the strengths and weaknesses of the different public health programs as well as the impact of these services on the overall health of African American living with diabetes. Screening programs have been found to provide healthier behavior lifestyle for diabetes intervention especially the ones targeting African American participants aged of 45 and above. Further study will focus on physicians and health professionals' perceptions on physical activity and their role to create awareness on patient's lifestyle behaviors to break barriers to care.

1. Introduction

Diabetes is one of the leading causes of death in United State (US) [1]. Diabetes is a chronic disease that affects how your body process food for use as energy. Insulin, a hormone produced by the pancreas is the key factor to diabetes. The immune system attacks and destroys the insulin producing beta cells in the pancreas resulting in low levels or none insulin (type 1 diabetes) or cannot use the insulin made by the pancreas leading to type 2 diabetes. In 2016, 1.6 million deaths were directly caused by diabetes while 2.2 million deaths were attributable to high blood glucose in 2012 [5]. In 2016, diabetes prevalence rates in Staten Island were 8.5% lower than the New York State average but still represent a high number. Indeed, diabetes is epidemic in New York City [4].

One group that is more affected by diabetes, as demonstrated by prevalence rates is the Blacks with 14.2% of prevalence compared to 11.4% among Hispanics and 8.4% among Whites adults [6]. In the US, African American community represents about 17% of the population but accounts for the group with the highest risk rates of

diabetes and poorer health status than other racial or ethnic groups [7]. These findings show a need of evidence-based programs geared towards preventing the risk of diabetes among communities as well as helping individuals who are already affected to manage better their health. Diabetes is a prevalent disease associated with high rates of mortality and morbidity [5]. Mortality from diabetes is associated with others health problems such as cardiovascular diseases, obesity, high blood pressure. Although some of these conditions can be prevented if interventions are taken earlier, biological risk factors accounted for the most health disparities in diabetes cases among black Americans [8]. With high mortality and morbidity rates, diabetes can also lead to the damage of the heart, blood vessels, eyes, kidneys and nerves [5, 9]. To reduce health disparities among African Americans, public health professionals should consider the difference in culture and provide appropriate initiatives as well as adequate access to quality health care when needed.

The overall purpose of this study is to identify risk factors that are

associated with diabetes among African American living in New York City. The first step will be to evaluate the variables associated with the risk of diabetes among Black American living in Staten Island and compare these findings with other racial groups. The second step will be to summarize the data from evidence-based public health programs associated with diabetes and related conditions. The study will also identify the strength and weaknesses of four public health programs geared towards diabetes care and management in Staten Island based on epidemiological evidence to address the specific health priorities of the population of interest. The last step would be developing a quantitative data analysis to assess which public health services are mostly used as well as the impact of these public health programs on the health of African American living with diabetes in Staten Island. For the purpose of this research, Blacks and African American will be interchangeable terms.

2. Methods
2.1. Design
The "Community-based diabetes programs: a qualitative and quantitative study among African American living with diabetes" is a quantitative and qualitative research which is designed to identify risk factors that are associated with diabetes among African American living in Staten Island, NY. This type of research is known as mixed-method research in which researchers combines elements of quantitative and quantitative research approaches [10].

The quantitative research will be done through analysis of demographic variables such as age, gender, family size, income and other variables such as diet and physical activity. This quantitative research will help evaluating the risk of diabetes among African American living in Staten Island. Potential qualitative research will help evaluating the strengths and weaknesses of the different public health programs as well as the impact of these services on the overall health of African American living with diabetes.

2.2. Study Sample
The study sample will involve African American individuals who have been diagnosed with type 2 diabetes and those who are at high risk of type 2 diabetes. The risk of diabetes type 2 should have been stated or diagnosed by a health care professional. Individuals will be categorized by age groups, economic class as well as frequency of physical activity. The control group sample will include Whites who have also been diagnosed with diabetes and are at high risk of type 2 diabetes.

The eligible participants will be living in Staten Island and other boroughs of New York City. They should have been diagnosed with diabetes by a health professional or being at risk of developing diabetes. They should identify as African American Both males and females are eligible to participate.

2.3. Data Collection
Annuals counts of diagnosed cases of diabetes from different age groups will be collected from 2009-2019. Quantitative data will be collected from various databases sources such as Behavioral Risk Factor Surveillance System, National Center for Health Statistics, the National Health and Nutrition Examination Survey, the Center of Disease Control and Prevention, the United States Diabetes Surveillance System and the New York State Department of Health. The qualitative data will be collected using interviews that will explore the views, experiences and beliefs of the participants. The interviews may be structured and semi-structured.

I will also be using the New York City Department of Health and Mental Hygiene databases to evaluate the different public health programs available for African American communities living with diabetes or at higher risk of developing diabetes.

2.4. Measures
Quantitative measures will include data from the database sources such as National Center for Health Statistics and the United States Diabetes Surveillance System. The analysis of association between demographics variables will also be done to find potential association between these variables and the risk of diabetes among African American individuals.

Qualitative measures will include interview or survey questions to which the participants will respond. These measures will help evaluating which programs have the greatest impact on the health of the participants.

3. Analytic Plan
The study sample will involve African American individuals who have been diagnosed with type 2 diabetes and those who are at high risk of type 2 diabetes. The control group sample will include Whites who have also been diagnosed with diabetes and are at high risk of type 2 diabetes. Individuals will be categorized by age into the young adults (18-35 years), middle-aged adults (36-55 years), and older adults (age older than 55 years) [11]. The individuals will also be regrouped into different economic class by income as well as the frequency of physical activity per week.

3.1. Quantitative
Inferential statistics will be generated to analyze the association between variables. For a sample population of 5,000 participants, four research questions will be generated to study the effects of these associations. The primary question will involve two categorical variables with an independent variable as "sex" and the dependent "diabetes". The secondary question will involve two continuous variable "age" and BMI the third question will involve another categorical variable "physical activity" with "A1C level". The four questions will associate age, with the dependent variable "diabetes". A Pearson's correlation test will be generated to find the relationship between two continuous variables while a chi square test will be used to see if there is a relationship between two categorical variables. For a continuous and categorical variable, a two independent samples t-test will be generated. A p value $p < 0.05$ will represent a significant difference between the predicted and observed events. For missing data, I will be excluding them during the analysis.

3.2. Qualitative

The study sample will involve African American individuals and Whites who have been diagnosed with diabetes and those who are at high risk of diabetes. Qualitative measures will include interview or survey questions to which the participants will respond. Qualitative measures will help evaluating the impact of public health programs on the participants' overall health and well-being [12].

With interviews and survey answers from participants, a SWOT analysis will be conducted. A SWOT analysis will help provide a clear, easy-to-read map of the internal and external factors that may help or harm a project [12]. ATLTAS it will be used to help analyzing the qualitative data.

4. Results

4.1. Qualitative Analysis

The sample population involves individuals based on their age groups, sex difference and race/ethnicity (Table 1). The sample populations include 16% Black with a control group which included 59% White, 6% Asian and 19% Hispanic populations (Fig 1). The study group was Black African Americans, and the other groups represented the control group.

YEAR	2009	2010	2011	2012	2013	2014	2015
TOTAL	6,520	8,495	7715	6.046	5,323	6,721	5,583
	8.2(7.4-9.0)	36.9(35.6-38.3)	10.5(9.6-11.3)	9.7(8.7-10.8)	19.7(17.9-21.6)	9.8(8.8-10.89)	11.5.(9.8.-13.3)
Age in years							
18-44	2.1(1.2-3)	2.2(1.5-3)	2.5(1.8-3.1)	2.2(1.8-3.3)	3.1(1.6-3.1)	3.7(1.2-4.1)	2.4(2.1-5.6)
45-64	12.1(10.2-13.1)	12(10.4-13.7)	12.3(11-13.6)	12.5(11.4-14)	13(11.7-14.7)	13.1(10.4-13.7)	11.7(10.1-13.1)
65+	20.2(17.3-21.5)	21.1(18.9-23.3)	19.5(17.8-21.2)	22.5(19.9-25.1)	22.7(20.1-25)	22.5(18.9-24)	20.7(17.8-21)
Sex							
Men	9.8(7.5-11)	10.1(7.8-12.2)	9.8(8.7-10.9)	10.6(9.3-12.)	10.1(7.8-12.2)	10.1(7.8-12.2)	9.1(8.4-9.9)
Women	8.7(7.5-12)	9.9(7.9-13.1)	8(7.2-8.8)	10.3(9.2-11.4)	8.8(7.4-10.1)	10.9(9.8-12.1)	8.5(7.5-9.5)
Race/ ethnicity							
White, non-Hispanic	7.0(6.8-8.3)	7.8(7.1-8.6)	7.9(7.2-8.6)	9.3(8.4-10.2)	7.9(7-8.8)	7.9(7.1-8.6)	7.3(6.6-8.1)
Black, non-Hispanic	13.1(10.1-18)	14(10.7-17.3)	13.8(11.2-16.5)	14(10.7-17.3)	11.9(8.5-15.4)	16.2(13.1-19.4)	13.4(12.2-14.6)
Asian, non-Hispanic	5(2.2-9)	5.6(1.9-9.4)	8.1(4.6-11.6)	11.2(4.6-19.8)	13.2(5.6-20.8)	13.7(8.6-18.8)	10.3(8.6-12.4)
Hispanic	9(6.9-12)	8.9(6.4-11.5)	8.4(6.4-10.3)	10.8(8.3-13.3)	11.2(8.4-14.1)	12.3(10-14.6)	11.9(10.3-13.7)

Table 1: Estimated Number of Adults aged 18 years or Older with Diagnosed Diabetes, New York State 2009-2015
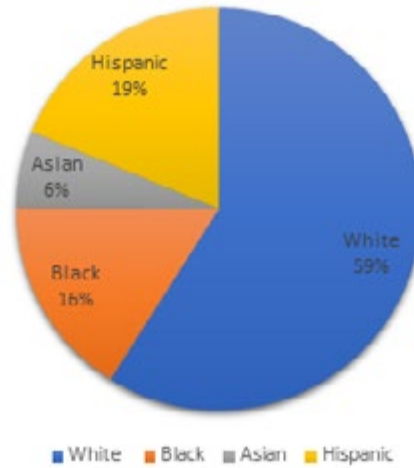
Figure 1: Diabetes Percentages Among NYC Adults by Race/Ethnicity 2009-2019

The sample population included 45.8% and females 54.2%. Using the chi-square test, at 95% confidence level, we generated a p-value of p=0.7831 and z-value of z= -0.2753. Since the p-value is 0.7831 and is higher than the alpha level at 0.05, we fail to reject the null hypothesis and did not have enough evidence at 0.05 to suggest a statistical difference in diabetes proportion between males and females.

Comparing participants' age group and the prevalence of diabetes, participants aged of 65 years or older are more likely to be diagnosed with diabetes than other age groups (Table 1). This group also shows a statistically difference with a p-value p=0.03. Since the p-value is lower than 0.05, we reject the null hypothesis. At 95% confidence level, there is a statically difference in diabetes among individuals from difference age groups.
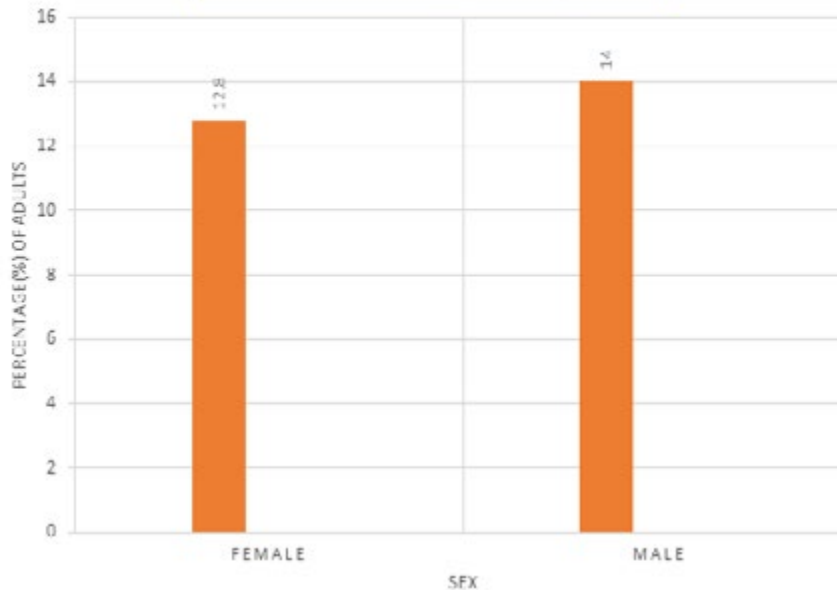

Figure 2: Diabetes Percentages Among NYC Adults by sex 2009-2019

Table 2 depicted the variation in BMI by race and age groups. Results show that African Americans (35.42%) are more likely to be overweight (BMI≥30) than non-Hispanic White (26.69%). Respondents belonging to the age groups 45– 64 (33.39%) are more likely to be overweight than the age group 18-44 (27.32%) or the 65 or older (28.31%) age group.

	BMI ≤24.9	BMI≥25–29.9	BMI≥30
RACE			
African American	29.87	34.71	35.42
Non-Hispanic White	42.36	30.96	26.69
Age (years)			
18-44	45.35	27.33	27.32
45-64	31.45	35.16	33.39
65+	33.83	37.86	28.31

Table 2: Body Mass Index by Sociodemographic Characteristics

Table 3 shows the distribution between individuals who practice physical activity for at least 20 minutes compared to those who do not participate. On average about 22.44% respondents participate at least one physical activity and tend to be less than the 29.07% respondents who do not participate in any physical activity. Table 4 shows that Queens is the boroughs of New York with the higher levels of A1C among African Americans. A t-test was performed and generated a p-value extremely small with a t-value t=-8.94 at degree of freedom 2705. Since the p-value is extremely small and is less than the alpha level of 0.05, the null hypothesis was rejected. At 95% confidence level, there is a statistically difference in A1C levels with individuals who participate or not to a physical activity for at least 20 minutes.

Variable	2009	2010	2011	2012	2013	2014	2015
Physical Activity for at least 20 minutes	19.6(14.5-24.6)	19.9(10.5-20.5)	30.7(26.3-35.1)	27.0(21.4-32.6)	20.6(14.5-25.8)	19.6(14.5-24.6)	19.7(15.5-23.4)
No Physical Activity	31.0(25.5-36.4)	30(22.7-35)	30.2(23.8-35)	30.5(26.7-35.2)	22.3(25.5-28.4)	30(22.7-35)	29.5(28.0-31.0)

Table 3: Physical Activity Among African American Living in New York City, 2009-2015

A1C Levels	Total	6.5% or above
	Number	**Percent**
Bronx	30,142	33(21-35)
Brooklyn	39,188	37(30-33)
Manhattan	19,045	39(30-32)
Queens	35,163	42(29-30)
Staten Island	8,614	40(27-33)

Table 4: Blood Sugar Levels from A1C Registry Among Adults by Regions in New York City,2006-2012

5. Qualitative Analysis

There were 50 participants from the qualitative component which included 30 females and 20 males. The analyses were done using Atlas.ti. Using the word cruncher in Atlas, the most relevant information to the research question was analyzed. The shortcuts to create codes was used to extract the specific information of the surveys. Organizing the codes into groups was found useful to narrow down the topic into themes. The most common words were diabetes care, good life… The content analysis is summarized into table 5. A similar qualitative study has been conducted to help understanding the enablers and barriers to effective diabetes self-management and regular physical activity. Results are depicted in the Table 6. A comprehensive approach by nurses and doctors could help in promoting adherence to exercise among individuals with type 2 diabetes [14]. Other barriers that were associated with physical activity but not depicted in the table are: Lack of infrastructure, social issues, inadequate emphasis by physicians and lack of adherence to standard guidelines [14].

Meaning Units	Condensations	Codes	Categories	Themes
1. What is important for you to be able to live as good a life as possible with diabetes?	To be able to live a good life with diabetes, it is important to be able to come to the diabetes clinic often.	It is important to come to the diabetes clinic often.	Support from diabetes care tailored to individual needs.	To live a good life with diabetes
2. Do you get the opportunity to ask questions to your doctor?	Can ask the doctor questions but would rather not as it be so stressful. Thinks that it feels like he doesn't want to answer questions.	Feels like the doctor doesn't want questions, it is so stressful.	Barriers related to diabetes.	*Mastering management to be able to feel good in the present as well as the future.*
3. What is important in everyday life so you can manage your diabetes well?	Having fixed routines is important, eating regularly and eating good food, checking blood glucose levels and exercising.	Fixed routines are important.	Support from diabetes care tailored to individual needs.	*To live a good life with diabetes*
4. How I feel and how things are going with my diabetes	It is exhausting, both physically and mentally. Over the years it sorts of wears you down. (…) It's constantly on your mind. (…) You never get a break from it.	A desire to be normal and hope for a cure was expressed.	Barriers related to diabetes.	*Mastering management to be able to feel good in the present as well as the future.*

Table 5: Examples of The Analysis Process from Meaning Units to Condensed Meaning Units and Codes

Meaning Units	Condensations	Codes	Categories	Themes
1.	I feel healthier and I also feel my sugar is under control when I exercise.	Managing risks factors of diabetes	Reduction in blood sugar -	Perceived benefits
2.	When my children leave for work in the car, they drop me off a little away from home where there is less traffic. They ask me to walk on roads with less traffic because they are apprehensive that I may meet with an accident or something of the sort	Emotional support	Family support	Awareness of complications
3.	I don't really get the time to exercise. I leave for work at 7 in the morning and come back at around 6 or 7. I'm really tired when I come back so I cannot exercise.	Barriers impact in physical and psychological state	Lack of time	Barriers

| 4. | He (treating physician) told me to exercise to lose weight. But they (treating physicians) don't explain the reasons and I don't ask for an explanation either. | Barriers impact in physical and psychological state | Lack of awareness/ knowledge | Barriers |

Table 6: Patient Experience Under the Supervision of Facilitators

6. Discussion

Chronic illnesses have affected a large and growing number of US individuals [15]. One in particular, diabetes has been one of the leading causes of death in the States with more than 34 million people affected by it [16]. Diabetes is a prevalent disease associated with high rates of mortality and morbidity and has created health disparities among certain ethnic groups such as in the African American community [17]. This study sought to identify the risk factors associated with diabetes among African American living in New York City between the years of 2009 to 2019. The primary research question seeks to determine the relationship between "gender" and "diabetes". In contrast to Harreiter et al. who identify males being more prevalent to have diabetes than females, at 95% confidence level, there was no enough evidence to suggest a statistical difference in diabetes proportion between males and females [18]. Study have shown that diabetes is one of the most important risk factor several diseases such as cardiovascular disease [19]. Although our results show a non-statistical difference between gender and diabetes, previous studies suggest that type 2 diabetes confers a 25-50% greater risk of incident of CVD in women compared to males [19]. A statistically non-significant difference between these two variables might lead to similar treatments and care from medical/ health professionals when facing males and female's diabetes. Some studies have shown that diabetes is more prevalent in males rather than females, but female have more complications and face greater risk of death thus diabetes being a risk factor for CVD [20]. Although both genders should be treated as equal, women need to receive more attention especially when she is at risk of cardiovascular disease that runs in the family. This could reduce health outcomes burden and prevent earlier risk of death. The secondary question involves understand the association between "age groups" and "Body Mass Index". Body Mass Index, commonly known as BMI is a powerful and modifiable risk factor for diabetes [21]. The World Health Organization (WHO) defines overweight and obesity based on body mass index (BMI), with overweight defined as a BMI between 25.0 and 29.9 and obesity as a BMI of 30 or more [22]. Our results showed that African-Americans were more likely to be overweight and obese 34.71% and 35.42% respectively than non -Hispanic Whites with 30.96% and 26.69%. Participants with the ages between 45 and 64 were more likely to be overweight and obese compared to any other age group. Previous studies found that having even moderately elevated BMI was associated with increasing risk of developing diabetes which suggest an association between BMI and diabetes but there was not enough evidence to indicate a significantly difference between age and BMI [23].

A potential explanation for these associations might be due to the misperception of weight among blacks, especially black women who have the highest burden of obesity [24]. A multifaceted community approach that include social, cultural and environmental factors might be helpful to promote interventions and better address potential weight misperception which will lead to better health outcomes [24]. The third research question involves understanding the association between "physical activity" and "A1C level". A t-test generated a t-value t=-8.94 at degree of freedom 2705. A1C levels show the percent of hemoglobin that is glycosylated. CDC suggested that a normal A1C is below 5.7%, a level of 5.7% to 6.4% indicates prediabetes, and a level of 6.5% or more indicates diabetes [25]. On average, about 22.44% respondents participate at least one physical activity and tend to be less than the 29.07% respondents who do not participate in any physical activity. Studies have shown that long-term regular physical activity promote improvement in glycemic control such as HB A1C and cardiovascular fitness among patients with type 2 diabetes which correlate with our findings [26]. At 95% confidence level, results showed a statistically difference in A1C levels with individuals who participate or not to a physical activity for at least 20 minutes.

Understanding the importance of A1C levels can help individuals to not only monitor their risk of diabetes but also indicates the risk of long-term diabetes complications that could be prevented if known earlier. A1C testing is a tool that can be used by physicians and health professionals to monitor individuals who are at risk of diabetes due to diet or family history and provides a reliable measure of chronic hyperglycemia for individuals [27]. The last research question involves "age groups" and " prevalence of diabetes". The study found that the average age of patients with the highest rate of diabetes was 65 or above with 20.1% following by the age group 45 years old to 64 years old with 12.3%. Similar to Lee et al. diabetes prevalence was the highest among patients over 45-year-old [28]. Identifying as a Black or African American was also associated with the risk of diabetes with an average of 13.77%. At 95% confidence level, there is a statically difference (p-value=0.03) in diabetes among individuals from difference age groups. Previous studies have evaluated the association between age, gender, family history, obesity and hypertension among individuals [29]. Findings of previous studies showed that age was the most significant risk factor of type 2 diabetes for participants [29, 30]. Other potential risk factors that could explain these findings are biological, neighborhood, psychosocial, socioeconomic and behavioral factors that are the most different

factors that are known between Black African Americans when comparing to Whites [31]. Diabetes prevalence in New York city varies widely among the different socioeconomic groups but creates a greater health disparity among African Americans. More focused efforts and interventions to prevent diabetes such as an increase early diagnosis, increase screening rates might help contributing in the decrease of such morbidity and mortality rates among disadvantages socioeconomic groups such as African American [32].

7. Limitations
The findings of this study should be considered within the context of potential limitations. The sample size was on the smaller end which could have affected the reliability of the surveys' results and might have led to bias. Another limitation is that the sample was only drawn from one metropolitan area in New York City where there is a higher prevalence of overweight and obesity than any other locations in New York. With the largest population of Black African American residents of any other cities in the States, NYC was ideal for the study of risk factors among African Americans living with diabetes.

8. Conclusion
The study design is a mixed-method research in which researchers combines elements of quantitative and quantitative research approaches. The study sample involved African American individuals who have been diagnosed with type 2 diabetes and those who are at high risk of type 2 diabetes. The control group included other ethnic groups such as Whites, Hispanic and Asian for comparison purpose. The overall purpose of this study was to identify risk factors that are associated with diabetes among African American living in New York City. Demographics variables such as age, gender and other variables like A1C levels, physical activity was used to determine association and understand the risk factors of diabetes among participants. Among these variables, only physical activity and age were significantly associated with A1C levels and diabetes respectively. As the prevalence of diabetes among African American is still on the rise, a structure lifestyle program or the use of drug or testing should help reduce the incidence of diabetes among the communities' higher risk.33 A1C testing can be used as an efficient tool to help identifying people at risk and will promote advance efforts to identify those at risk of type 2 diabetes to urge them on receiving appropriate preventive interventions.33

Because physical activity has been identified as a significant risk factor of type 2 diabetes, evidence-based programs that include strategies to prevent the risk of type 2 diabetes as well as to reduce health disparities among them should be implemented. Health professionals should considered refer individuals at risk to these programs and should promote a socially and culturally sensitive environment to reduce risk of retention in these programs. With the greater risk factor being 45 or older, health professionals should closely monitor patients around the same age especially those who identify themselves as African American. Early prevention or diagnosis of type 2 diabetes might improve the well-being of participants and reduce the health burden that

could have been avoided if caught earlier. Screening programs might provide healthier behavior lifestyle in which diabetes intervention may be targeted towards individuals and communities who might benefit the most, in the case of this study non-Hispanics African American male and female aged of 45 and above [34]. Screening will not only help reduce the burden of diabetes complications by identifying those with undiagnosed diabetes but will also help those at higher risk of developing diabetes to start early prevention programs which will help reduce the number of people with diabetes [34]. Several barriers to care can arise due to the socioeconomic status of participants. In that case doctors and health professionals need to be trained appropriately to identify and tackle patients habits at a personal level and improve healthier lifestyle behaviors [14]. The standard guidelines for physical activity in diabetes must be used by all doctors and will health not only monitor adherence to exercise in diabetics but also educating the patient regarding the benefits of physical activity for his own health [14].

Further research might focus on physicians and health professionals' perceptions on physical activity and the ability to educate patients on healthy behaviors to break barriers to care. To promote health equity among African American, public health professionals should consider the difference in culture and provide appropriate initiatives as well as adequate access to quality health care when needed [13].

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