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The association between type 2 diabetes and disability: what is the contribution of diabetes risk factors and diabetes complications?

Running Title: Factors explain disability in diabetes

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Abstract

Aims: To evaluate the association between type 2 diabetes and disability in Mauritius and to assess the extent to which the effect of diabetes is explained by diabetes risk factors and concomitant complications.

Methods: Data from a national survey in the multiethnic nation of Mauritius, which comprises South Asians and African Creoles were analysed. Disability was measured using the Katz activities of daily living (ADL) questionnaire in participants aged >50 years.

Results: Among 3,692 participants, 487 (13.2%) had some level of disability. Diabetes was associated with significantly higher risk of disability [OR=1.67 (95% CI 1.34, 2.08)]. After adjusting for demographic, behavioural, metabolic factors and comorbidities, disability was significantly associated with diabetes among African Creoles [OR=2.03 (95% CI 1.16, 3.56)] but not in South Asians [OR=1.27 (95% CI 0.98, 1.66)]. Obesity explained much of the association between diabetes and disability (excess percentage of risk: 26.3% in South Asians and 12.1% in African Creoles). Obesity, history of cardiovascular disease (CVD), asthma-like symptoms and depression together explained 46.5% of the excess risk in South Asians and 29.0% in African Creoles.

Conclusions: Diabetes is associated with a 67% increased risk of disability. Diabetes risk factors and comorbidities explain more of the association between diabetes and disability

among South Asians than Africans. Obesity and history of CVD explained the largest percentage of the relationship between diabetes and disability, respectively, indicating that weight and CVD management might be helpful in controlling disability related to diabetes.

Keywords: Ethnic differences, disability, obesity, Mauritius, Type 2 diabetes

Highlights:

- Diabetes is associated with 67% increased odds of disability.
- The prevalence of disability is higher among women compared to men.
- Forty percent of the association of diabetes with disability can be explained by risk factors and concomitant disease.
- Obesity explained the largest percentage of the relationship between diabetes and disability, indicating that weight management might be helpful in controlling disability related to diabetes.

Introduction

Increasing prevalence of diabetes together with aging of the population may give rise to a large burden of disability which will affect both individuals and health care systems.[1] Disability is associated with many poor outcomes including loss of employment and productivity, difficulty in performing daily self-care activities, increased use of health services, and premature death.[2-4] People with diabetes have a two to three fold higher risk of physical disability.[5]

The high prevalence of disability among people with diabetes has various causes. Diabetes is strongly associated with disabling diseases such as cardiovascular disease, renal failure, blindness and lower limb amputation.[1,6-10] Furthermore, overweight and obesity are major risk factors for type 2 diabetes and are often associated with impaired mobility.[11]

While the relationship between disability and diabetes is well described [5], little is known about how risk factors for diabetes and complications of diabetes contribute to this association. Koye et al. showed that body mass index (BMI) and cardio-metabolic risk factors (hypertension, prior cardiovascular disease, impaired glomerular filtration rate, triglycerides and high-density lipoproteins) together explained 65% of the excess odds of disability among Australians aged >60 years.[12] Gregg et al. reported that among the older U.S. population, comorbidities and diabetes risk factors together contributed to 68% and 58% of the excess odds of disability in women and men, respectively.[3]

We have not been able to identify any study that examined the contribution of diabetes risk factors and concomitant complications to the association between diabetes and disability

among South Asians and Africans. In addition, previous studies have not specifically examined the role of ethnicity in the association between diabetes and disability. The younger age of onset of diabetes and the various levels of adiposity in South Asians than other ethnicities suggest the possibility of a different relationship between diabetes and disability in terms of strength and contributory factors to this association.[13] Understanding the factors that explain the association between diabetes and disability might provide insight into strategies to reduce the burden of disability and its related cost and improving quality of life among people with diabetes.

Mauritius is multi-ethnic nation with the population of 1.3 million people comprising diverse ethnicities including South Asians (Indian origin), Creoles of mainly African origin and Chinese. In 2009, the prevalence of diabetes was 22.3% among men and 20.2 % among women, which makes this one the highest in the world.[14] The high prevalence of diabetes and concomitant diseases, together with ethnic diversity, makes Mauritius an ideal setting in which to investigate the association of disability with diabetes in different ethnic groups in a middle-income country. If the relationship and the factors explaining the association between diabetes and disability differ by ethnicity or gender, then the interventions implemented may be different for each ethnic or gender sub-group.

Thus, we aimed to evaluate the association between diabetes and disability in the total population as well as in the ethnic subgroups, and to assess the extent to which the association of diabetes is explained by risk factors that may be specific to an ethnicity for diabetes and co-morbidities of diabetes. This information may be valuable in evaluating specific management/interventions.

Participants, Materials and Methods

Survey Design

The Mauritius Non-Communicable Disease (NCD) survey was conducted in 2015 by the Ministry of Health and Quality of Life in Mauritius. The aim of this national population-based survey was to measure the prevalence of non-communicable diseases and explore the risk factors and complications related to these diseases.[14] One of the aims of the survey was to understand the association of chronic disease such as diabetes with disability. Mauritius was divided into nine districts to ensure geographical and ethnic representation. Index clusters (24 in total) were randomly selected from each of the districts. Each index cluster was assigned two neighbouring clusters to create a 'super-cluster'. From these 'super-clusters', one in three households was randomly chosen and one adult per household was randomly selected to participate in the survey. In total, 7,151 individuals were invited to the survey and 5,898 participated in the survey giving a response rate of 82%.

Written informed consent was obtained from all participants. The survey was approved by the Ethics committee of the Ministry of Health and Quality of Life, Mauritius, Monash University Human Research Ethics Committee (number CF16/22 - 2016000010), and the Alfred Ethics Committee (number 624/15), Australia.

Data collection and samples

The methodology of the survey, data collection and laboratory tests have been described elsewhere.[14] Briefly, the assessments included a blood sample, anthropometric and blood pressure measurements, and interviewer-administered questionnaires. An oral glucose

tolerance test (OGTT) was conducted except on those with previously diagnosed diabetes. Participants self-reported their demographic information, ethnicity, educational level, smoking status, medical history and medication usage. Based on self-report of ethnicity, participants were categorised as South Asian, African Creoles and other ethnicities.

Measurements and laboratory tests

Body mass index (BMI) was calculated by dividing the weight (kg) by the square of the height (m). Blood pressure was measured three times using an automated blood pressure monitor (Omron Digital Auto Blood Pressure Monitor M7), and the three readings were averaged.

Blood samples were collected by venepuncture after an overnight fast of at least 8 hours. For glucose testing, blood samples were collected into fluoride-oxalate tubes. For HbA1c testing, samples were collected into EDTA tubes and assayed on a Tosoh G8 automated system using high-performance liquid chromatography. Serum triglycerides, total cholesterol and high density lipoprotein-cholesterol (HDL-cholesterol) were measured using enzymatic methods adapted on the automated system of Abbott Architect c8000. LDL-cholesterol was calculated on participants with triglycerides d4.52 mmol/L, using the Friedewald formula.[15]

Definition of diabetes and other diseases

Diabetes was defined as self-report of previously diagnosed diabetes, and confirmed by fasting plasma glucose (FPG) e7.0 mmol/L or two-hour plasma glucose (2hPG) e11.1 mmol/L after 75 gram glucose load or by self-report of the use of insulin or oral glucose lowering medications.[16] Newly diagnosed diabetes was defined as (FPG) e7.0 mmol/L or

2hPG after a 75 gram glucose load e11.1 mmol/L, among people without previously diagnosed diabetes. Participants were classified as having impaired glucose tolerance (IGT) if FPG <7.0 mmol/ L and 2hPG was between 7.8 mmol/ L and 11.1 mmol/ L. Impaired fasting glucose (IFG) was defined as FPG 6.1– 6.9 mmol/ L and 2hPG<7.8 mmol/ L.[16] The term pre-diabetes was used for either IFG or IGT or combined IFG and IGT in this analysis.

Depression was assessed using the Center for Epidemiologic Studies Depression Scale (CES-D) questionnaire.[17] The prevalence of asthma-like symptoms was measured using The European Community Respiratory Health Survey (ECRHS) screening questionnaire.[18] Impaired glomerular filtration rate (GFR) was defined as having estimated glomerular filtration rate (eGFR) <60 (ml/min/1.73m), and was calculated using the Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) formula.[19] Dyslipidaemia was defined as having LDL-chol e2.59 mmol/L or triglycerides e2.0 mmol/L or HDL-chol <1.03 mmol/L for men and <1.29 mmol/L for women or self-report of using lipid lowering drugs regardless of the lipid values.

Outcome assessment

Disability was estimated in adults aged e50 years using the Katz index of independence in activities of daily living (Katz ADL) questionnaire.[20] This instrument rates adequacy of performance in six major activities of daily living, including: walking, bathing, transferring, toileting, dressing, and eating. For each of the activities the responses were: 1, no difficulty; 2, a little difficulty; 3, some difficulty; 4, a lot of difficulty. Disability was defined as a response of at least a little difficulty to any of the Katz ADL items.

Statistical Methods

Statistical analysis was performed using STATA (version 14; Stata Corp, College Station, TX). Differences in general characteristics of the participants, by disability status, were assessed using Pearson's Chi-square test for proportions and Student's t-test for means, as appropriate. We considered interactions to be significant when $p < 0.2$. For all other analyses, a $p < 0.05$ was considered statistically significant.

A series of logistic regression models was used to examine the association between diabetes and disability, with disability as the main outcome of interest. Adjustments were as follows: model 1, adjusted for demographic and behavioural factors including age, sex and education; model 2, adjustments in model 1 plus BMI; model 3, adjustments in model 1 plus history of cardiovascular disease (CVD); model 4, adjustments in model 1 plus asthma-like symptoms; model 5, adjustments in model 1 plus depression; and model 6, adjustments for all variables included in models 1 to 5.

We calculated the percentage of excess odds in model 1 (adjusted for age, sex and education that could be accounted for by risk factor adjustment, using the following formula: [21]

$$100 \times \frac{(OR^{\text{adjusted for age, sex and education}} - OR^{\text{adjusted for age, sex and education + risk factors}})}{(OR^{\text{adjusted for age, sex and education}} - 1)}$$

We used bootstrapping techniques to estimate the uncertainty intervals around the calculation described above. If the confidence interval estimated by bootstrapping was lower than zero or more than 100, we replaced them by zero and >100, respectively.

Results

Characteristics of participants

Among 3,701 participants aged ≥50 years, 3,692 completed the Katz ADL questionnaire (99.7%) and 487 participants were categorised as having disability. Table 1 shows the characteristics of participants according to disability status. The prevalence of disability in the total population aged ≥50 was 13.2% (95% CI 12.1, 14.3) with significantly higher prevalence among women [16.4% (95% CI 14.8, 18.0)] than men [9.1% (95% CI 7.8, 10.6)]. Participants with disability had a significantly lower level of education, higher BMI, waist circumference and systolic blood pressure than those without disability. Those with disability also had a greater burden of chronic diseases and other conditions such as depression, history of CVD, hyperlipidaemia and impaired eGFR (Table1). The prevalence of each individual components of the disability index, stratified by ethnicity, is shown in the supplementary Table.

Association between diabetes and disability

A series of logistic regression analyses were performed and adjusted for potential risk factors in a stepwise approach to understand how these risk factors might confound the association between diabetes and disability (Table 2). Potential risk factors were defined as those variables which were significantly associated with disability in the multi-variate analysis. Although hypertension, dyslipidaemia and e-GFR were statistically associated with disability in univariate analyses (Table 1), the association of these variables with disability were attenuated and lost significance in the multivariate analysis. Therefore, to make models parsimonious and to facilitate making reliable conclusions as to which individual variables

are genuinely contributing to the association between diabetes and disability, these variables were not included in the final logistic regression model.

In model 1, adjusted for age, sex and education, diabetes was associated with increased odds of disability in the total population [OR = 1.67 (95% CI 1.34, 2.08)]. With further adjustment in model 2 (adjusted for BMI), model 3 (adjusted for history of CVD), model 4 (adjusted for asthma) and model 5 (adjusted for depression) the odds of disability remained significantly higher among people with diabetes. In the fully adjusted model, model 6, the odds of disability was 34% higher among people with diabetes than those without diabetes [OR = 1.34 (95% CI 1.06, 1.70)].

The contribution of potential risk factors for diabetes to the association between diabetes and disability

To quantify the contribution of risk factors to the association of disability with diabetes, the percentage of excess odds of disability related to diabetes in each model was calculated and compared it to the base model, which was adjusted for age, sex and education (Table 3). BMI explained much of the association between diabetes and disability. A history of CVD, explained 15.8% of the excess odds of disability related to diabetes, while asthma and depression explained 1.8 and 7.9% of these associations, respectively. Collectively, all the potential factors we included in the logistic regression analysis explained 42.0% of the association of diabetes with disability.

In a further analysis, we assessed the association between obesity and disability among those with and without diabetes. In both diabetes and non-diabetes groups, there was a statistically

significant association between obesity and disability, indicating a direct association of obesity to disability.

Interactions of ethnicity and sex in the association between diabetes and disability

The relationship of diabetes with disability was seen in both ethnic groups, but it was somewhat stronger among African Creoles [OR: 2.57 (95% CI 1.53 – 4.34)] than among South Asians [OR: 1.52 (95% CI 1.19– 1.95)] (Table 2). The association between diabetes and disability remained statistically significant after adjustment for each group of risk factors in models 1 to 5. Adjusting for all risk factors in model 6 attenuated the association of disability with diabetes among South Asians to become non-significant [OR: 1.27 (95% CI 0.98 – 1.66), while in African Creoles, the association remained significant [OR: 2.03 (95% CI 1.16 – 3.56)]. There was no interaction of sex in the association between diabetes and disability.

In regards to the contributory risk factors of the association between diabetes and disability, BMI explained 26.3% and 12.1% of the association between diabetes and disability among South Asians and African Creoles, respectively. The contribution of history of CVD to the association of diabetes and disability was 19.0% among South Asians and 7.8% among African Creoles, and that of depression was, 7.5% and 7.4 % for South Asians and African Creoles, respectively. The contribution of asthma to the association between diabetes and disability was negligible (0.8% for South Asians and 2.7% for African Creoles).

To explore why ethnic sub-groups might have differed from each other in regard to the strength of association between diabetes and disability with diabetes, we examined

characteristics of participants stratified according to ethnicity (Table 4). Among people aged e50 years, the prevalence of diabetes was similar among South Asians (34.5%) and Africans Creoles (33.4%). The prevalence of disability, among those aged e50 years, in African Creoles and South Asians was similar: 13.9% and 12.2% for South Asians and African Creoles, respectively. The prevalence of each individual component of the disability index was similar between African Creoles and South Asians (supplementary Table). However, among women aged >70 years, South Asians were more likely to be classified as having disability than were African Creoles (36.1% vs 24.5% (p= 0.03)). In both ethnic groups, the disabled people were more likely to be female, have lower education, and had a higher prevalence of chronic disease including asthma like symptoms, depression, and history of CVD and impaired eGFR compared to the non-disabled people.

The association of disability with other factors such as age, BMI, education, history of CVD, asthma-like symptoms, depression and history of stroke was similar between South Asians and African Creoles (Table 4). There was strong and significant collinearity between diabetes status and HbA1c levels, thus HbA1c was not added to the models. Nevertheless, there was no significant difference in mean HbA1c levels among those with diabetes of African descent, compared to South Asians with diabetes (8.3% vs 8.2%, p=0.29).

Discussion

In this representative sample of adults aged e50 years in the multi-ethnic country of Mauritius, we have demonstrated that diabetes was associated with a 67% increased risk of

disability. We further observed that high BMI and history of CVD explain a large proportion of the association between diabetes and disability.

Previous studies that examined the association between diabetes and disability were mostly conducted in developed countries, and among Europid population.[3,22,23] Studies in Hong Kong, Japan and Taiwan also showed a positive association between diabetes and disability.[24-26] While the majority of previous studies demonstrated a relationship between diabetes and disability[5], there are inconsistencies reported as to which risk factors might mediate this association.

The contribution of obesity to the association of disability with diabetes can be explained from different perspectives; obesity *per se* is one key cause of immobility[11] and hence disability. This was confirmed by the significant association between obesity and disability in the non-diabetic groups in the current study. Further, since obesity is considered to be one of the major risk factors for type 2 diabetes, some of the extent to which obesity appears to explain the diabetes-disability association may actually be a direct effect of diabetes in people in whom diabetes was caused by obesity. Given this is a cross-sectional study, causal pathways cannot be established, but it is likely that obesity is related to disability via several pathways.

The Australian Diabetes, Obesity and Life Style showed that the association between diabetes and disability was attenuated and became non-significant after adjusting for risk factors for diabetes, and for comorbidities of diabetes. Similar to our findings, in that study, BMI explained much of the association between diabetes and disability.[12] A study conducted

among older Americans reported that risk of disability associated with diabetes was reduced by 52% in women when they accounted for coronary heart disease (CHD) together with BMI. Similarly, adjustment for stroke and CHD, reduced the risk of disability by 23% in men.[3] Maggie et al demonstrated sex disparity among Italians in the association between diabetes and disability.[22] They found that adjusting for age, education and BMI, resulted in a significant association between diabetes and disability among women, but not in men. In both sexes, BMI and CVD together explained much of the association between diabetes and disability with a 19% reduction in excess odds of disability among women and 12% reduction in excess odds among men. In contrast to Maggie et al, two studies from East Asia demonstrated significant association between diabetes and disability among men, but not women.[22] We did not observe any difference in the association between diabetes and disability by sex.

In our study, adjustment for risk factors, partially attenuated the strength of the association between diabetes and disability, suggesting that the residual association between diabetes and disability may be explained by other unmeasured factors. It should be noted that our study employed a cross-sectional study design that does not allow us to assess causality i.e. high BMI is one of the risk factors for disability while disability *per se* can lead to high BMI by reducing physical activity levels.

We observed that the relationship between diabetes and disability might be differ between African Creoles and South Asians. However, further studies are needed to confirm this finding. The possible differences between ethnic sub-groups in the association of diabetes with disability may be explained by genetic and environmental factors such as lifestyle.

Previous studies have shown that, compared to other ethnicities, older Africans have a higher percentage of intramuscular adipose tissue, which may indicate that metabolic insults such as diabetes have a greater impact on muscle function.[27,28]

We showed that the possible ethnic difference was not due to the difference in HbA1c, educational level, age, BMI, history of CVD, smoking status, history of stroke or ethnic differences in reporting of disability. The p-value for the interaction was 0.06, but the confidence intervals of the ethnic-specific odds ratios overlapped each. Thus we are unable to make a robust conclusion that the association of diabetes with disability differs by ethnicity. However, the borderline p-value for the interaction suggests the possibility of some differences between South Asians and Africans in the association between diabetes and disability, and that further studies are required to examine this finding. This study sheds light on the potential existence of ethnic disparity in the association between diabetes and disability, but further studies are required to confirm this finding.

The strength of this study is the nationally representative sample and high response rate. Asthma-like symptoms and depression were evaluated at the survey by validated questionnaire rather than relying on self-report of presence of disease. This study is limited by its observational cross-sectional design, and lack of an objective measurement to assess disability. Furthermore, since the main aim of the paper was to understand the association between diabetes and disability, rather than presenting prevalence, we did not weight the samples. A further limitation of this study is that people with severe disability or cognitive deficits would have been less likely to attend the survey. Since this survey was not designed *a*

priori for the exploration of the association between diabetes and disability, some factors that might contribute to this association were not examined in the study.

Conclusion

We found that diabetes is associated with a 67% increased odds of disability, and that this association might differ by ethnicity. The association between diabetes and disability is multi-factorial. BMI explains much of the association, indicating weight management as one of the possible strategies in preventing disability associated with diabetes. However, control of hyperglycaemia and other factors may also have a role to play. These findings provide an important basis for further studies to identify interventions that will reduce the burden of physical disability in people with diabetes.

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Disclosure

No potential conflicts of interest relevant to this article were reported.

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Table 1: General characteristics of the study population according to disability status

	Disability status		P value
	Disabled	Not disabled	
N (%)	13.2 (487)	86.8 (3205)	
Age (year)	62.1 (8.0)	67.0 (9.2)	<0.001
Men (%)	30.6 (149)	46.3 (1483)	<0.001
Ethnicity (%)			0.008
South Asians	79.3 (386)	74.5 (2387)	
Africans	18.1 (88)	19.7 (631)	
Other	2.7 (13)	5.9 (187)	
Education (%)			<0.001
Primary (0-6 years)	72.2 (307)	51.0 (1548)	
Secondary (6-12 years)	26.1 (111)	41.0 (1244)	
Tertiary (>12 yesr)	1.6 (7)	8.0 (244)	
Smoking (%)			0.27
Current smoker	22.8 (34)	25.8 (383)	
Ex-smokers	23.5 (35)	18.2 (270)	
None smokers	53.7 (80)	56.0 (830)	
Diabetes status (%)			<0.001
Normal	23.6 (107)	36.1 (1124)	
Pre diabetes	16.5 (75)	20.3 (632)	
Diabetes	59.9 (272)	43.6 (1359)	
HbA1c (%)	7.2 (1.7)	6.9 (1.7)	0.004
BMI (kg/m^2)	27.4 (5.57)	25.9 (4.58)	<0.001
Men	25.5 (5.1)	25.1 (4.0)	0.27
Women	28.2 (5.6)	26.6 (4.9)	<0.001
Waist circumference (cm)			
Men	94.1 (12.96)	91.5 (10.81)	0.011
Women	92.9 (11.65)	89.0 (10.71)	<0.001

Blood pressure (mmHg)			
Systolic	136.0 (23.65)	133.0 (22.51)	0.008
Diastolic	80.0 (11.68)	81.0 (11.85)	0.280
Hyperlipidaemia (%)	81.3 (396)	77.0 (2496)	0.035
Asthma (%)	20.7 (101)	8.1 (257)	<0.001
Depression (%)	28.2 (133)	11.0 (347)	<0.001
History of CVD (%)	24.6 (119)	11.7 (373)	<0.001
eGFR <60 (%)	25.5 (124)	12.0(384)	<0.001

Data are percentage (n) or mean (SD)

Abbreviations: BMI, body mass index; CVD, cardiovascular disease; eGFR, estimated glomerular filtration rate

Table 2: Odds ratios for the association of diabetes with disability, stratified by ethnicity

	Total population		South Asians		Africans	
	OR	P	OR	P	OR	P
Model 1	1.67 (1.34, 2.08)	<0.001	1.52 (1.19, 1.95)	0.001	2.57 (1.53, 4.34)	<0.001
Model 2	1.50 (1.19, 1.88)	<0.001	1.36 (1.05, 1.76)	0.018	2.30 (1.33, 3.95)	0.003
Model 3	1.54 (1.23, 1.93)	<0.001	1.40 (1.09, 1.81)	0.008	2.39 (1.41, 4.06)	0.001
Model 4	1.66 (1.33, 2.07)	<0.001	1.52 (1.18, 1.95)	0.001	2.51 (1.48, 4.26)	0.001
Model 5	1.61 (1.28, 2.01)	<0.001	1.48 (1.14, 1.90)	0.003	2.40 (1.40, 4.12)	0.001
Model 6	1.34 (1.06, 1.70)	0.01	1.27 (0.98, 1.66)	0.07	2.03 (1.16, 3.56)	0.01

Data are odds ratios (95% confidence intervals).
Model 1: adjusted for age, sex and education; Model 2: adjustments in Model 1 plus BMI; Model 3: adjustments in Model 1 plus history of CVD, Model 4: adjustments in Model 1 plus asthma, Model 5: adjustments in Model 1 plus depression, Model 6: adjustments in Model 1 plus BMI, history of CVD, asthma and depression

Table 3: The effect of separately controlling for risk factors on the percentage of excess odds of disability associated with diabetes

Models	The percentage of excess odds accounted for by risk factor adjustment (95% CI)		
	Total population	**South Asians**	**Africans**
Model 1: Adjusted for age, sex and education	Base model	Base model	Base model
Model 1 + BMI	21.7 (9.9, 37.1)	26.3 (10.3, 63.4)	12.1 (0.5, 30.6)
Model 1+ history of CVD	15.8 (8.0, 31.5)	19.0 (8.2, 54.8)	7.8 (0.0, 22.7)
Model 1+ asthma	1.8 (0.0, 9.7)	0.83 (0.0, 11.6)	2.7 (0.0, 16.0)
Model 1+ depression	7.9 (0.0, 11.6)	7.5 (0.0, 16.1)	7.4 (0.0, 16.7)
Model 1+ plus BMI, history of CVD, asthma and depression	42.0 (17.5, 76.7)	46.5 (18.7, 100)	29.0 (0.0, 67.8)

Table 4: General characteristics of the study population stratified by ethnicity

	South Asians		P value	Africans		P value
	Disabled	**Not disabled**		**Disabled**	**Not disabled**	
N	13.9 (386)	86.1 (2386)		12.2 (88)	87.8 (631)	
Age (year)	66.9 (9.1)	61.8 (7.8)	<0.001	66.6 (9.5)	62.6 (9.0)	<0.001
Men (%)	30.3 (117)	46.9 (1120)	<0.001	28.4 (25)	43.3 (273)	0.009
Education (%)			<0.001			0.001
primary	72.9 (1407)	52.2 (1167)		75.9 (63)	54.8 (337)	
secondary	38.1 (976)	39.9 (892)		22.9 (19)	41.6 (256)	
tertiary	7.0 (180)	7.8 (175)		1.2 (1)	5.6 (22)	
Smoking (%)			0.76			0.85
Current smoker	19.7 (23)	25.7 (288)		36.0 (9)	31.9 (87)	
Ex-smokers	24.8 (29)	17.1 (191)		20.0 (5)	24.5 (67)	
None smokers	55.6 (65)	57.2 (641)		44.0 (11)	43.6 (119)	
Diabetes status (%)			<0.001			<0.001
Normal	25.6 (92)	35.1 (816)		14.6 (12)	35.8 (219)	
Pre diabetes	16.1 (58)	20.0 (465)		15.8 (13)	20.5 (125)	
Diabetes	58.3 (210)	44.8 (1041)		69.5 (57)	43.7 (267)	
HbA1c (%)	7.1 (1.6)	7.0 (1.6)	0.19	7.6 (1.8)	6.9 (1.8)	0.002
BMI (kg/m^2)	27.1 (5.5)	25.8 (4.4)	<0.001	29.5 (5.5)	27.0 (5.0)	<0.001
Men	25.0 (4.9)	25.1 (4.0)	0.796	28.3 (5.7)	25.7 (4.2)	0.009
Women	27.9 (5.5)	26.4 (4.7)	<0.001	29.9 (5.4)	27.8 (5.2)	0.007
Waist circumference (cm)						
Men	93.0 (12.8)	91.9 (10.7)	0.323	99.6 (13.5)	92.1 (10.9)	0.003
Women	92.5 (11.6)	88.8 (10.5)	<0.001	96.2 (11.3)	91.3 (10.7)	0.001
Hypertension (%)	69.4 (268)	55.9 (1333)	<0.001	75.9 (66)	66.5 (419)	0.082
Dyslipidaemia (%)	80.3 (310)	77.2 (1844)	0.18	86.4 (76)	79.1 (499)	0.11
Asthma (%)	21.0 (81)	8.5 (202)	<0.001	21.6 (19)	8.2 (52)	<0.001
Depression (%)	27.3 (102)	11.3 (265)	<0.001	36.9 (31)	12.2 (76)	<0.001
History of CVD (%)	25.1 (96)	11.6 (276)	<0.001	21.6 (19)	13.6 (85)	<0.001
eGFR <60(%)	27.5 (106)	13.7 (327)	<0.001	19.3 (17)	7.6 (48)	<0.001
Stroke (%)	21.1 (20)	9.5 (26)	0.004	36.8 (7)	9.52 (8)	0.005

Data are percentage (n) or mean (SD)

P-values calculated using chi^2 and oneway ANOVA

Abbreviations: BMI, body mass index; CVD, cardiovascular disease; eGFR, estimated glomerular filtration rate