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Prevalence, awareness, and determinants of type 2 diabetes mellitus among commercial taxi drivers in buffalo city metropolitan municipality South Africa

A cross-sectional survey

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Abstract

Undiagnosed type 2 diabetes mellitus constitutes a significant threat to the health of commercial taxi drivers, safety of the passengers and other road users. This study determines the prevalence of pre-diabetes and type 2 diabetes mellitus among commercial taxi drivers in Buffalo City Metropolitan Municipality (BCMM), Eastern Cape and examines the factors associated with type 2 diabetes mellitus.

A cross-sectional survey of 403 commercial taxi drivers was undertaken using the World Health Organization (WHO) STEPwise approach. Anthropometric, blood pressure, and blood glucose measurements followed standard procedure. Diabetes status was determined using the fasting blood glucose (FBG) test. Diabetes was defined as a FBG ≥7.0mmol/L or self-reported history of diabetes or current diabetes medication use (treatment), while pre-diabetes was defined as a FBG of 5.6 to 6.9 mmol/L. Awareness of diabetes was defined as a self-reported history of diabetes.

The mean age of the study participants was 43.3 ± 12.5years. Prevalence of pre-diabetes and diabetes were 17% (95% CI: 13.4–20.6) and 16% (95% CI: 12.4–19.6), respectively. Of those who had diabetes (n = 63), the majority were aware of their diabetes status (n = 43) and were on treatment (n = 30). In the unadjusted logistic regression, age, ever married, hypertension, obesity, and driving for more than 5 years were independently associated with diabetes. However, only age >35 (adjusted odds ratio [AOR]= 3.65, CI: 1.17–11.32), ever married (AOR= 3.26, CI: 1.52–6.99) and hypertension (AOR= 3.23, CI: 1.56–6.69) were associated with diabetes in the adjusted logistic regression model.

The prevalence of diabetes among commercial taxi drivers in this study is high, almost twice the national prevalence of diabetes in South Africa. Periodic health screening among this sub-population group is important to bridge the gap of undiagnosed diabetes in South Africa.

Abbreviations: AOR = adjusted odds ratio, BCMM = Buffalo City Metropolitan Municipality, CI = confidence interval, FBG = fasting blood glucose.

Keywords: commercial taxi drivers, hypertension, pre-diabetes, South Africa, type 2 diabetes mellitus

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Ethical approval for the study was obtained in accordance with Helsinki II Declaration from the University of Fort Hare Research Ethics Committee (Reference number: GOO121SADE01) and the Eastern Cape Department of Health. The Director of the District Department of Transport, as well as the taxi rank chairpersons, gave permission before data collection. All participants provided written informed consent to participate in this study. Rights to confidentiality and anonymity were ensured throughout the study.

All authors approved the submission of this final draft towards publication in a peer-reviewed journal.

The authors declare no conflict of interest.

All the data analyzed in this study will be made available by the corresponding author on reasonable request.

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1. Introduction

Diabetes mellitus is a significant public health challenge. Although previously considered as a disease of rich nations, diabetes mellitus is now growing rapidly in developing nations.[1] South Africa is one of the countries with the highest prevalence of diabetes in sub-Saharan African.[2] It was estimated that about 2.28 million (8.3%) of the population were living with diabetes in the country in 2015.[3] Diabetes is the second leading cause of morbidity and mortality in South Africa.[4]

Diabetes constitutes a significant threat to the health of commercial taxi drivers, the transport industry and the public safety.[5] The threats posed by diabetes is worse among drivers who are being treated with insulin and at the risk of developing hypoglycaemic episodes.[6] Diabetes is also associated with psychological disturbance with a resultant functional impairment,[6] which might affect drivers' performance at work and increase the risks of road traffic accidents.[7] In the light of the highlighted risks, several countries require medical fitness for issuance of drivers' licenses to individuals living with diabetes who may want to venture into driving commercial taxi.[8–10] However, there are currently no measures in place in South Africa, partly because the health status of the commercial taxi drivers is often neglected. This is evidenced by a dearth of information on the prevalence, awareness, treatment, and determinants of diabetes and pre-diabetes among commercial taxi drivers in South Africa.

Anecdotally, the nature of the work of commercial taxi drivers affords them little opportunity to seek healthcare. Yet, commercial drivers indulge in unhealthy lifestyle behaviors such as physical inactivity, smoking, excessive alcohol consumption, and poor diet,[11] which are deleterious to health. These behaviors specifically increase risk of developing cardiometabolic diseases.[12,13] Considering the important role commercial taxi drivers play in the transport industry of any given nation, their health status should be critically assessed for better health and public safety. The aims of our study were:

(i) to determine the prevalence of pre-diabetes and type-2 diabetes mellitus among commercial taxi drivers in Buffalo City Metropolitan Municipality (BCMM), East London, and
(ii) to examine the factors associated with type 2 diabetes mellitus.

2. Method

2.1. Study area and design

This was a cross-sectional study involving 403 commercial taxi drivers selected across different taxi ranks in BCMM, Eastern Cape Province, South Africa. BCMM is one of the 8 districts in the Eastern Cape Province. It is made up of some towns in the Eastern Cape which include East London, Bisho, King Williams Town, and Mdanstane and it is largely populated (85.2%) by Black South Africans. The transport industry makes up 12% of its economic sector.[14]

2.2. Participants and sample size

According to the statistics retrieved from Eastern Cape Department of Transport, the numbers of commercial vehicles registered in East London are 3559. Those operating under East London district Taxi Association are 315 and those under the East London Taxi Association are 765. While the numbers of vehicle registered for Mdanstane includes, 1514 under the Mdantsane East London Districts Taxi Association, 288 under the Mdantsane East London Taxi association and 677 under the Mdantsane UNCEDO service Taxi Association. These make up the 3559 vehicles drivers in East London and Mdantsane. The sample size for this study was based on the estimated number of commercial taxi drivers in the district. The appropriate sample size was determined using the Creative Research Systems sample size calculator [15] at a confidence level of 95%, confidence interval (CI) of ±4.6, and population of 3559. The required sample size was 403 participants. To recruit participants, all the 10 taxi ranks serving the BCMM were included in the study. All commercial taxi drivers available at the taxi rank on the days of the study were offered the fasting blood glucose (FBG) test. The recruitment of study participants took place on average of 4 days in each taxi rank. Only commercial taxi drivers who were available, willing and met the inclusion criteria were recruited into the study. This study was conducted in March and April, 2017.

2.3. Eligibility criteria

Participants were included if they were commercial taxi drivers, 18 years and above, held membership of a recognized taxi association, worked for at least 6 months and had fulfilled the mandatory 8 hours fasting preceding the study.

2.4. Study instrument

The participants were interviewed using the validated World Health Organization [WHO] STEPwise questionnaire[16] which comprises 3 major items; demographic, behavioral data, and measurements. A pilot study was conducted on 20 commercial taxi drivers to test its suitability in the settings and the effectiveness of the research process. The results of the pilot study were not included in the main study.

2.5. Ethical approval

Ethical approval for the study was obtained from the University of Fort Hare Research Ethics Committee (Reference number: GOO121SADE01) and the Eastern Cape Department of Health. The Director of the District Department of Transport, as well as the taxi rank chairpersons, gave permission before data collection. All participants provided written informed consent to participate in this study. Rights to confidentiality and anonymity were ensured throughout the study.

2.6. Data collection procedure

Data were obtained through personal interviews on sociodemographic variables: sex, age, race, level of education, marital status, and occupational history. Participants' occupational history was categorized as period of driving below 2 years, within 2 to 5 years, 6 to 10 years, and above 10 years. Level of education was obtained by self-reporting of the highest grade level attained in school and was categorized as; no formal education, primary (grade 1–7), secondary (grade 8–12) and tertiary education. Behavioural variables; cigarette smoking (yes/no), alcohol use (yes/no), and consumption of sugar-sweetened beverages (never/rarely/sometimes/often) were obtained by self-reporting. Physical activity of the participants was obtained by self-reporting and categorized based on their engagement in moderate exercise (such as gardening) (yes/no) leading to an increase in heart rate and respiratory rate. Participants with less than 150 minutes of moderate-intense aerobic physical activity throughout the week were considered physically inactive.

2.7. Measurements

FBG of each participant was measured with a validated ACCU-CHEK glucose monitoring apparatus (Mannheim, Germany) in fasting state following standard procedure. Participants were diagnosed as having diabetes if the FBG was ≥7.0mmol/L or a self-reported history of diabetes or current use of anti-diabetic therapy, while pre-diabetes was defined as a FBG of 5.6 to 6.9 mmol/L.[17] Blood pressure was measured in accordance with standard protocols[18] with a Medic+ Digital Blood Pressure Monitor Model 1219 (Hamburg, Germany). Hypertension was defined according to the Eight Joint National Committee (JNC-8) Criteria as the average of 2 systolic blood pressure ≥140mmHg and diastolic ≥90mmHg or a history of hypertension or current medication use.[19] Using a SECA weighing scale and standiometer (Hamburg, Germany), body weight was measured in light clothes to the nearest 0.01 kg in the standing position and height was measured to the nearest 0.1 cm in standing position with closed feet (without shoes).[20] Body mass index (BMI) was calculated as weight in kilogram (kg) divided by height in square metres (kgm^{-2}). BMI was categorized as not obese (<18.5 kgm^{-2}–29.9 kg/m ^{2}) or obese (≥30 kg/ m^2).[21]

2.8. Statistical analysis

Data were expressed as mean values ± standard deviations (SD) for continuous variables. Counts (frequencies=n) and proportions (%) were reported for categorical variables. Pearson Chi-Square statistics were used to identify the factors significantly associated with diabetes at a 95% confidence level. Adjusted and unadjusted logistic regression was used to determine predictors of diabetes mellitus among the study participants. All statistical analyses were performed using the Statistical Package for Social Science (SPSS) version 22. A P value <.05 was considered statistically significant.

3. Results

The mean age of the participants was 43.3 ± 12.5 years. The majority of the participants were male, had grade 8 to 12 educational level, were of black race, and had been driving for over 6 years (Table 1).

The prevalence of pre-diabetes and diabetes was 17% (95% CI: 13.4–20.6) and 16% (95% CI: 12.4–19.6), respectively. Of those who were diagnosed with diabetes (n = 63), 43 (68%) were aware of their diabetes status and 30 were already on treatment. Newly diagnosed participants were referred to clinics for confirmatory test and treatment.

3.1. Associated risk factors with Diabetes

Age, marital status, level of education, period of driving, obesity, physical activity, and hypertension were significantly associated with diabetes mellitus. Race, alcohol use, and smoking were not significantly associated with diabetes. The prevalence of diabetes was higher among participants aged above 35 years compared to participants aged 35 years and below (21.4% vs 3.1%, P <.001). The participants who were ever married, with no formal education and a minimum level of education (grade 1–7) (32.2%) had a higher prevalence of diabetes compared to never-married participants (24.1% vs 5.5%, P <.001) and those with a higher level of education (40.0% vs 9.4%, P <.001). Also, there was a high prevalence of diabetes among participants who were obese (20.5% vs 12.7%, P <.036) and hypertensive (23% vs 6.3%, P <.001). Prevalence of diabetes among physically inactive participants (17.3% vs 8.1%, P <.049) was double the prevalence found among those physically active (Table 2).

Table 1

Demographic characteristics of study participants.

Variables	Frequency, n	Percentage, %
Sex		
Male	398	98.8
Female	5	1.2
Age, Yr		
20–30	72	17.9
31–40	103	25.6
41–50	105	26.1
Above 50	123	30.5
Level of education		
No formal education	15	3.7
Grade 1–7	59	14.6
Grade 8–12	297	73.7
Tertiary	32	7.9
Race		
Black	376	93.3
Coloured	27	6.7
Marital Status		
Married	190	47.1
Separated	8	2.0
Divorced	16	4.0
Widowed	6	1.5
Single	183	45.4
Years of driving		
<2	30	7.4
2–5	103	25.6
6–10	80	19.9
>10	190	47.1

3.2. Logistic regression showing determinants of diabetes

In the unadjusted logistic regression, age, ever married, hypertension, obesity, and driving for more than 5 years were independently associated with diabetes. However, only age >35 (adjusted odds ratio [AOR] = 3.65, CI: 1.17–11.32), ever married (AOR= 3.26, CI: 1.52–6.99), and hypertension (AOR= 3.23, CI: 1.56–6.69) were associated with diabetes in the adjusted logistic regression model. Participants aged above 35 years were about 4 times more likely to develop diabetes compared to participants aged 35 and below. Participants who were ever married were 3 times more likely to develop diabetes compared to those never married. Hypertensive participants had thrice the likelihood of developing diabetes compared to those not hypertensive (Table 3).

4. Discussion

This present study determined the prevalence, awareness, treatment, and determinants of diabetes and pre-diabetes among commercial taxi drivers in BCMM, South Africa. This study is among the few studies reporting the prevalence of diabetes and

Table 2

Factors associated with diabetes.

Variables	Diabetes n, %	Non diabetes n, %	*P* value
Age, yr			
Above 35	59 (21.4)	217 (78.6)	<.001
35 years and below	4 (3.1)	123 (96.9)	
Marital status			
Ever married	53 (24.1)	167 (75.9)	<.001
Never married	10 (5.5)	173 (94.5)	
Level of education			
No formal school	6 (40.0)	9 (60.0)	<.001
Grade 1–7	19 (32.2)	40 (67.8)	
Grade 8-12	35 (11.8)	262 (88.2)	
Tertiary	3 (9.4)	29 (90.6)	
Income			
2000 and below	32 (19.0)	136 (81.0)	.110
Above 2000	31 (13.2)	204 (86.8)	
Race			
Black	58 (15.4)	318 (84.6)	.669
Coloured	5 (18.5)	22 (81.5)	
Period of driving			
Above 5years	50 (18.5)	220 (81.5)	.023
5 years and below	13 (9.8)	120 (90.2)	
Smoking			
Yes	31 (15.6)	168 (84.4)	.976
No	32 (15.7)	172 (84.3)	
Obesity			
Obese	31 (20.5)	120 (79.5)	.036
Not obese	32 (12.7)	220 (87.3)	
Have you ever consumed any alcohol			
Yes	41 (17.1)	199 (82.9)	.331
No	22 (13.5)	141 (86.5)	
How often do you take sweet drinks			
Never	6 (35.3)	11 (64.7)	.006
Rarely	10 (30.3)	23 (69.7)	
Sometimes	9 (10.8)	74 (89.2)	
Often	38 (14.1)	232 (85.9)	
Do you do any sports, fitness or recreational activities			
Yes	6 (8.1)	68 (91.9)	.049
No	57 (17.3)	272 (82.7)	
Hypertension			
Yes	52 (22.8)	176 (77.2)	<.001
No	11 (6.3)	164 (93.7)	

Table 3

Adjusted and unadjusted binary logistic regression showing determinants of diabetes.

Variables	UOR, CI	AOR, CI
Age		
above 35	8.36 (2.97–23.57)***	3.65 (1.17–11.32)*
35 years and below (reference)		
Marital status		
Ever married	5.49 (2.70–11.15)***	3.26 (1.52–6.99)*
Never married, reference		
Hypertension status		
Hypertensive	4.4 (2.22–8.73)***	3.23 (1.56–6.69)*
Non-hypertensive, reference		
Obesity		
Obese	1.78 (1.03–3.05)*	1.16 (0.64–2.10)
Non obese, reference		
Period of driving		
Above 5 years	2.01 (1.01–4.12)*	0.98 (0.48–2.03)
Below 5 years, reference		

UOR = unadjusted odd ratio, AOR = adjusted odds ratio, CI = confidence interval.
*** *P* value <.001.
* *P* value <.05

pre-diabetes among commercial taxi drivers in South Africa. The findings of this study revealed an overall prevalence of 16% and 17% for diabetes and pre-diabetes, respectively. The prevalence of diabetes in this study is higher than studies carried out among drivers in countries like Hong Kong,[22] Iran,[7,23,24] and Brazil[25,26]; although, Sangaleti et al[27] reported a similar finding (16.4%) among commercial taxi drivers in South Brazil. However, when compared to a study conducted among the general population of South Africa, the prevalence rate found in this study is more than the 8.3% overall prevalence of diabetes in South Africa.[2] Diabetes mellitus is a metabolic disorder that poses a significant threat to the life of drivers, passengers, and other road users.[6] With the incessant projection of an increase in the prevalence of diabetes, coupled with the high prevalence of pre-diabetes found among the study participants, there is a need for prompt interventions to curb this growing menace, especially among this high-risk population group.

The analysis reveals that 68% (n = 43) of participants diagnosed in this study were already aware of their diabetes status and of these, the majority (n = 30) reported being on treatment. This result is close to that of Sangaleti et al,[27] who reported an awareness rate of 63% among drivers in Brazil. Diabetes awareness and treatment rate among the study participants is commendable. Also, as practiced in some countries,[7,8,23] adoption of mandatory medical fitness test for commercial drivers living with diabetes in South Africa could assist in improving awareness, treatment, and control. This could also ensure the safety of the commercial drivers, passengers, and other road users.

This study found that older age is associated with diabetes, which is consistent with previous studies conducted among drivers in Iran[7] and Hong Kong.[22] Aging increases susceptibility to diabetes.[28] Older age is associated with reduction in physical activities and weight gain, which are risk factors for diabetes.[29] Also, aging has been reported to be associated with a higher incidence of insulin resistance, inflammation, and impaired insulin secretion precipitated by impairment in the functioning and proliferative capacity of the islet cells with a resultant development of diabetes.[29–31] Thus, the American Diabetes Association[32] specified the need for regular diabetes screening among older adults.

A higher prevalence of diabetes was also found among the married commercial taxi drivers. This is similar to the findings of Owolabi et al[33] among adults in BCMM, South Africa. The association between diabetes and marriage is unclear. It could be due to the influence of clusters of modifiable and non-modifiable risk factors among the study participants.[34] Also, it might be that married participants have better and regular access to staple foods like maize meal coupled with regular snacking and unhealthy diets commonly eaten at various taxi ranks.

Also, hypertension was found to be associated with diabetes among the study participants. This is not surprising. Several studies have also reported similar association among drivers across various countries such as Iran,[7] Poland,[13] and Hong Kong.[22] This association is often linked to the similar metabolic pathways between both conditions as well as their shared risk factors, which range from genetics, behavioral, metabolic, and demographic to physiological factors.[35–37]

There is a tendency of obesity to be related with diabetes,[33,38] however we are unable to confirm this association after controlling for important covariates, Most of the commercial taxi drivers usually sit for long hours (sedentary) without engaging in any physical activity. They work in a stressful environment and with fewer hours of sleep (6.37 ± 1.6).[32] These lifestyle behaviors could lead to obesity and the development of diabetes.[38,39]

Surprisingly, a higher prevalence of diabetes was found among participants who reported not taking sweet beverages. This is contrary to several studies that illustrate the harmful effect of sweet beverages and their negative effect on type 2 diabetes.[40–42] One plausible explanation for our result is that taxi driver already diagnosed with diabetes may have stopped consuming sweet beverages, while those who consume sweet beverages are still to develop diabetes.

5. Strengths and limitations

The study provides useful data on the health condition of the commercial drivers in South Africa. However, some study limitations should also be acknowledged. First, the cross-sectional study design does not allow establishing causality between the risk factors and diabetes. Also, the diagnosis of diabetes among participants without previous history was based on a single fasting capillary glycaemia, which is associated with diagnostic bias. It is noteworthy that the 20 newly diagnosed diabetics were referred to clinics but we lack their results, which would have added value to the study and would have confirmed the prevalence results. The use of capillary glycaemia is a convenient method for diabetes diagnosis in epidemiological study.[43] In addition, our sampling strategy was not random, which is the best technique for providing an unbiased representative sample of a target population. This is because we were unable to get the sampling frame of drivers in East London. However, in order to reduce the bias of the opportunity sampling adopted in this study, we gave every driver in each taxi rank a chance to be chosen for the study by spending a minimum of 4 days in each taxi rank in the study settings. Data collection took place only on working days (Monday to Friday), when all drivers are more likely to be present at the taxi Rank. Despite our sampling limitations, our study provides much-needed data on the prevalence and awareness of diabetes among commercial drivers in South Africa.

6. Conclusion

The prevalence of diabetes mellitus among commercial taxi drivers in this study is high; almost twice the national prevalence of diabetes in South Africa, and higher than the reported prevalence in other developing countries. Age, ever married, and hypertension were the significant and independent predictors of diabetes among the study participants. The majority of the drivers living with diabetes were aware of their status and already on treatment. There is a need to further encourage and organize opportunistic screening for diabetes among this cohort in order to further reduce the burden of undiagnosed diabetes in the country.

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Author contributions

AOA, DTG, EOO, OVA and AIA contributed to study conception and manuscript preparation. AOA EOO and AIA contributed to the collection of data, data analysis and manuscript preparation. All authors read, and approved the final manuscript before submission.

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