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Research Article:

Sociodemographic and Clinical Characteristics Associated with Diabetes Complications in South Eastern Nigeria

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ABSTRACT:
Complications of diabetes are the sum of demographic, disease-related and cardiometabolic variables. Identifying patient features related with problems may facilitate risk classification and focused screening, particularly in resource-poor settings. In this study, the sociodemographic and clinical characteristics of persons with and without diabetic problems in South-Eastern Nigeria were compared. A descriptive cross-sectional multi-center study was undertaken among 640 persons with physician diagnosed diabetes attending chosen health facilities in the five states of South-Eastern Nigeria. The participants were selected via multistage sampling. Data were obtained by an interviewer-administered questionnaire, a clinical assessment checklist, and a review of medical records. The overall diabetes complication status by age, sex, duration of diabetes, diabetes type, comorbidity and facility type was compared using Pearson's chi-square test. Unadjusted odds ratios (ORs) and 95% confidence intervals (CIs) were derived from the reported contingency data Overall, 481 (75.2%) participants reported at least one diabetes complication. Complication prevalence increased considerably with age, from 48.0% among those aged 18 to 39 years, to 74.3% among those aged 40 to 59 years, and 90.6% among those aged ≥60 years ($p<0.001$). The risks of complications were substantially greater in persons with diabetes duration of 5–10 years (OR=3.28; 95% CI: 2.15–5.00) and >10 years (OR=13.07; 95% CI: 7.03–24.29) compared with patients with <5 years of diabetes duration. Participants with type 2 diabetes were more likely to have complications compared to those with type 1 diabetes (OR=4.94; 95% CI: 3.12-7.81). The presence of hypertension, obesity and both hypertension and obesity were each substantially linked with an increased likelihood of complications compared to lack of these comorbidities (all $p<0.001$). Complication status was not substantially linked with sex and type of facility. Diabetes complications were relatively widespread and were more concentrated in older patients, those with longer diabetes duration, those with type 2 diabetes, and those with cardiometabolic comorbidities. In South-Eastern Nigeria, diabetes care services should give priority to risk-based screening for complications and increase integrated management of hypertension and obesity in an effort to reduce the burden of diabetes-related morbidity.
Keyword: Diabetes Mellitus; Diabetes Complications; Sociodemographic Characteristics; Comorbidity; Hypertension; Obesity; Nigeria.

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INTRODUCTION

Diabetes mellitus is a major and rapidly growing public health concern worldwide contributing significantly to morbidity, premature death, disability and health care spending. The burden of diabetes goes beyond that of the rising number of people affected to include the substantial acute and chronic consequences that emerge with poorly treated or long-standing disease [1]. Long-term problems include microvascular problems including diabetic retinopathy, nephropathy and neuropathy, and macrovascular issues such as cardiovascular disease, cerebrovascular disease and peripheral artery disease. These problems account for much of the impairment, lower quality of life, health care utilisation, and premature mortality associated with diabetes. In 2021, the International Diabetes Federation estimated that 537 million adults aged 20–79 years were living with diabetes globally, the majority of whom lived in low- and middle-income countries where health systems are often severely challenged in prevention, diagnosis, monitoring and long-term management [2].

The development of diabetic complications is multifaceted, reflecting the combination of demographic features, disease-related factors, metabolic abnormalities, concomitant disorders, treatment patterns and access to adequate healthcare. Age is an essential determinant since increased duration of exposure to metabolic and vascular abnormalities, along with age-related physiological changes, may raise the risk for organ damage. Likewise, prolonged duration of diabetes is linked to higher cumulative exposure to hyperglycaemia and other metabolic derangements, which increases the risk of microvascular and macrovascular injury. Landmark longitudinal investigations have shown evidence for a robust link between glycaemic exposure and the development and progression of diabetes-related complications[3]. The UK Prospective Diabetes Study demonstrated that

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improved glycaemic control was associated with reductions in microvascular complications . More recent evidence has emphasised the significance of comprehensive control of glucose, blood pressure, lipids, body weight and other cardiovascular risk factors in reducing diabetes-related morbidity and mortality [4] .

The clinical picture and risk of complications may depend on the type of diabetes. People with type 1 diabetes are usually diagnosed at a younger age and may have had the condition for a long time. Type 2 is often associated with obesity, hypertension, dyslipidaemia, insulin resistance and other cardiometabolic abnormalities. These factors may coexist and combine to expedite the process of vascular injury and to enhance the total burden of problems. Hypertension is of particular importance since chronic rise of blood pressure may independently lead to renal, retinal, cerebrovascular, and cardiovascular disease . Similarly, obesity is related with insulin resistance, low-grade chronic inflammation, dyslipidaemia and other metabolic abnormalities that may have a negative impact on the outcomes in diabetes. Therefore, screening and treatment of concomitant cardiometabolic disorders are crucial parts of comprehensive diabetes management[5].

The situation is particularly acute in sub-Saharan Africa where the epidemiological transition, urbanisation, population ageing, changing food habits, physical inactivity and increasing incidence of obesity are contributing to the increasing burden of diabetes. At the same time many health systems in the region still face constraints in early diagnosis, regular follow-up, access to key drugs, laboratory testing, expert services and routine screening for diabetic complications[6]. The delayed presentation and lack of continuity of care may result in patients remaining untreated or poorly followed until issues become clinically apparent. Moreover, high out-of-pocket healthcare costs can restrict access to frequent consultations, diagnostic investigations, prescriptions and preventative services. These problems may be contributing to the increased burden of diabetic complications in African communities [7].

Nigeria is also seeing a similar transformation with diabetes being an increasingly important contributor to non-communicable disease morbidity. The country has been witnessing an increase in the prevalence of diabetes and its complications, but the existing data are limited to studies conducted at individual institutions or in specific patient populations, which do not allow a clear understanding of the overall pattern of characteristics associated with complications across healthcare settings[8]. Furthermore, information from South-Eastern Nigeria is still very scarce, especially studies that directly compare persons with diabetes with complications to those without complications. It is vital to understand these disparities as the distribution of risk may not be uniform among age groups, duration of disease, type of diabetes, sex, comorbidity status or healthcare facilities[9].

Clear characterisation of patients with and without diabetic problems can give useful evidence for clinical risk classification and targeted screening. Where universal intensive screening may be difficult to sustain in resource constrained settings, identification of groups with a higher burden of complications can help health care providers to prioritise patients for earlier assessment, closer follow-up and integrated management of modifiable risk factors. Such findings may also help with healthcare planning and the allocation of limited diagnostic and treatment resources[10].

Hence, this study was designed to evaluate and compare the sociodemographic and clinical features of adults with and without diabetes problems who attended chosen health facilities in the five states of South-Eastern Nigeria. Specifically, the study looked at the relationships between age, gender, duration and type of diabetes, comorbid illnesses, and institution type with the presence of diabetes complications. The findings are expected to help better identify high-risk patients and enhance risk-based complication screening and integrated diabetes management in the region.

Materials and Methods

Study Design and Setting

A multicentre descriptive cross-sectional study was conducted among adults with diabetes mellitus attending selected private, secondary, and tertiary healthcare facilities across South-Eastern Nigeria. The South-Eastern geopolitical zone comprises five states: Abia, Anambra, Ebonyi, Enugu, and Imo. The region includes diverse urban, semi-urban, and rural communities and a range of healthcare facilities providing diabetes screening, diagnosis, treatment, monitoring, and follow-up services.

Study Population and Sampling

The study population comprised adults aged 18 years and above with physician-confirmed type 1 or type 2 diabetes mellitus who were receiving care at the participating health facilities and provided written informed consent. Individuals with gestational diabetes, unconfirmed diabetes diagnoses, or insufficient clinical or medical-record information for reliable ascertainment of complication status were excluded.

The minimum sample size was initially determined using the Leslie Kish formula for estimating a single population proportion. Assuming a prevalence of 50%, a 95% confidence level, and a 5% margin of error, the initial sample size was 384 participants. To account for clustering associated with the multicentre sampling design, a design effect of 1.5 was applied, resulting in a sample size of 576. Allowing for an anticipated 10% non-

response or incomplete data rate increased the required sample to approximately 640 participants.

A multistage sampling procedure was used to select participating health facilities across the five states. Facilities were categorized according to level of care, including private, secondary, and tertiary facilities, after which eligible facilities were selected. Within the selected facilities, eligible adults attending diabetes clinics were recruited using systematic random sampling until the required sample size was achieved.

Ethical Considerations

Ethical approval was obtained from the Health Research Ethics Committee of Imo State University and from the relevant authorities of the participating health facilities. Written informed consent was obtained from all participants before enrolment. Participation was voluntary, and participants were informed of their right to withdraw from the study at any time without consequences for their healthcare.

Questionnaires and study records were identified using unique codes rather than participants' names. All collected information was treated confidentially and stored securely, with access restricted to authorized members of the research team. Results were reported in aggregate to ensure that individual participants could not be identified.

Data Collection and Study Variables

Data were collected using a structured interviewer-administered questionnaire, clinical assessment checklist, and medical-record review. The questionnaire captured relevant sociodemographic and clinical information, including age and sex. Clinical variables included duration of diabetes, diabetes type, hypertension, obesity, facility type, and documented diabetes complications.

Information obtained during participant interviews and clinical assessments was cross-checked against available medical records to improve the accuracy of reported clinical characteristics and complication status. Diabetes complications were identified from documented clinical diagnoses and relevant findings recorded in participants' medical records.

The primary outcome variable was the presence or absence of at least one documented diabetes complication. Participants with one or more documented acute or chronic diabetes-related complications were classified as having complications, while those without a documented complication were classified as having no complications.

The independent variables included age group, sex, duration of diabetes, diabetes type, comorbidity status, and facility type. For statistical analysis, age was categorized as 18–39, 40–59, and ≥60 years, while diabetes duration was categorized as <5 years, 5–10 years, and >10 years. Comorbidity status was classified according to the presence of hypertension, obesity, or both hypertension and obesity.

Data Analysis

Data were entered, cleaned, coded, and analysed using IBM SPSS Statistics version 25. Categorical variables were summarized using frequencies and percentages. The distribution of diabetes complications across sociodemographic and clinical characteristics was assessed using Pearson's chi-square test.

Unadjusted odds ratios (ORs) and corresponding 95% confidence intervals (CIs) were calculated from two-by-two contingency-table contrasts to quantify the association between selected characteristics and the presence of diabetes complications. The reference categories were participants aged 18–39 years, males, diabetes duration of <5 years, type 1 diabetes, absence of comorbidity, and attendance at private facilities. Statistical significance was set at $p<0.05$.

Because the odds ratios were derived from unadjusted bivariate comparisons, they represent crude associations and should not be interpreted as independent predictors of diabetes complications. No multivariable adjustment was performed.

Results

Overall complication status

Among the 640 participants, 481 had at least one diabetes complication, giving a prevalence of 75.2%; 159 participants (24.8%) had no documented complication.

Complication status	Frequency	Percentage
With complications	481	75.2
Without complications	159	24.8
Total	640	100.0

Sociodemographic and clinical characteristics

Complication prevalence rose across the age categories and with increasing duration of diabetes. Type 2 diabetes and every recorded cardiometabolic comorbidity category had higher unadjusted odds of complications than their reference groups. Sex and facility type showed no statistically significant bivariate association.

Characteristic	With	Without	Prevalence %	Unadjusted OR (95% CI)	Chi square	p value
Age 18-39 years	60	65	48.0	Reference		
Age 40-59 years	208	72	74.3	3.13 (2.01-4.87)		
Age >=60 years	213	22	90.6	10.49 (5.98-18.40)	79.65	<0.001
Sex: Male	213	64	76.9	Reference		
Sex: Female	268	95	73.8	0.85 (0.59-1.22)	0.64	0.425
Duration <5 years	70	73	49.0	Reference		
Duration 5-10 years	223	71	75.9	3.28 (2.15-5.00)		
Duration >10 years	188	15	92.6	13.07 (7.03-24.29)	85.79	<0.001
Type 1 diabetes	42	51	45.2	Reference		
Type 2 diabetes	439	108	80.3	4.94 (3.12-7.81)	50.57	<0.001
No comorbidity	79	86	47.9	Reference		
Hypertension	216	34	86.4	6.92 (4.31-11.10)		
Obesity	71	15	82.6	5.15 (2.73-9.73)		
Hypertension and obesity	115	24	82.7	5.22 (3.05-8.91)	89.48	<0.001
Private clinic	104	35	74.8	Reference		
Secondary hospital	159	43	78.7	1.24 (0.75-2.07)		
Tertiary hospital	218	81	72.9	0.91 (0.57-1.43)	2.19	0.335

Note: Chi-square and p values are shown once for each variable. OR means odds ratio; CI means confidence interval.

Discussion

This multicentre study among people getting care in selected health institutions across South-Eastern Nigeria reveals a considerable burden of diabetes-related morbidity as three-quarters of the patients experienced at least one diabetes complication. The high prevalence has substantial clinical implications, as diabetic complications can cause disability, poorer quality of life, greater use of health-care services, higher treatment expenses and premature mortality. This finding is consistent with the general challenges of diabetes management in sub-Saharan Africa, where delayed diagnosis, poor follow-up, limited access to routine complication screening, and financial barriers to healthcare may contribute to the development and progression of diabetes-related complications [11] The facility based character of the present study indicates that the observed prevalence should not be understood to be an estimate of the prevalence of complications in the general community of patients with diabetes in South-Eastern Nigeria.

Age was strongly associated with diabetes complication status in a graded fashion. Compared with participants aged 18-39 years, persons aged 40-59 years had almost threefold greater unadjusted chances of suffering a complication, and those aged ≥60 years had more than tenfold higher odds. This pattern is medically realistic as increasing age is frequently associated with cumulative exposure to hyperglycaemia, vascular risk factors, oxidative stress and other metabolic abnormalities [12]. Older persons may also have a prolonged period of undiagnosed or poorly managed diabetes prior to diagnosis. However, age should not be regarded in isolation from diabetes duration, as older people are more likely to have lived with diabetes for a longer period. The substantial age gradient consequently supports greater surveillance of older persons, while recognising that the observed correlation may partially reflect the effect of disease duration and other unmeasured factors[13].

The duration of diabetes revealed an even steeper gradient. Participants with diabetes duration of 5-10 years had roughly three times the odds of problems compared to those with a duration of less than five years, while those with a duration of more than ten years had approximately thirteen times the risks. This observation is consistent with the cumulative nature of diabetes-associated tissue and vascular damage[14]. The biochemical and structural alterations that result from prolonged hyperglycaemia increasingly impact the microvasculature and bigger vessels. Evidence of an association between glycaemic exposure and future development of diabetes-related problems was shown by the United Kingdom Prospective Diabetes Study [15]. The increased risk of complications with disease duration in our study underscores the need for ongoing surveillance instead than waiting for symptoms to appear. Duration of diabetes should therefore be included in routine risk assessment and scheduling of complication screening[16].

This study found that type 2 diabetes also was associated with significantly increased odds of complications compared with type 1 diabetes. This finding should be, however, interpreted cautiously. The association found is not evidence that type 2 diabetes independently increases the risk of complications as the analysis was unadjusted. The observed association may be partly explained by variations in age distribution, diabetes duration, treatment history, hypertension, obesity, glycaemic management, and the likelihood of delayed diagnosis. Moreover, type 2 diabetes accounted for a bigger proportion of the study population and it is often associated with several cardiometabolic risk factors. Therefore, the finding should be viewed as an observed correlation that requires confirmation through multivariable analysis rather than as evidence of an independent effect of diabetes type[17].

Hypertension and obesity, particularly when both diseases were present, were substantially related with diabetic complications. These findings emphasise the significance of evaluating diabetes within the wider context of cardiometabolic health. Persistent hypertension can contribute to renal, retinal, cerebrovascular and cardiovascular damage. Obesity is related with insulin resistance, inflammation, dyslipidaemia and other metabolic abnormalities. Thus, the combination of these disorders may enhance the overall burden of vascular risk in patients with diabetes. The findings indicate an integrated strategy to diabetes therapy in which glycaemic management is complemented by systematic blood-pressure assessment, weight management, cardiovascular risk assessment and screening for diabetes-related organ damage[18].

Sex was not significantly linked with complication status (. Some studies have revealed disparities in the complications of diabetes for men and women, 9-13 although these differences may depend on the individual complication studied, age distribution, disease duration, health care use, and prevalence of concomitant risk factors. The present study did not show a significant correlation, and so, it should not be confined by sex when screening for complications. Appropriate screening and preventative services should be available to both male and female patients depending on their particular clinical risk profiles[19].

Facility type was also not substantially connected with complication status . Although tertiary facilities may have had higher absolute numbers of patients with problems, absolute frequencies are highly impacted by the number of patients attending each kind of facility and by referral patterns. No statistically significant difference was seen in the burden of complications between the facility categories studied. However, tertiary hospitals may receive more difficult or advanced cases due to referral patterns. This cannot be appropriately evaluated with the current cross-sectional data. Improved standardised processes for screening for complications at private, secondary and tertiary facilities might assist guarantee that opportunities for early diagnosis are not reliant on the type of healthcare facility attended[20].

The results reveal that the diabetes complication status in this population is related especially to age, diabetes duration, diabetes type, and cardiometabolic comorbidity. The observed odds ratios were uncorrected, which is worth noting. Therefore, the data should be considered as evidence of bivariate relationships rather than independent predictors. Age, diabetes duration, diabetes type, hypertension and obesity are connected factors and their individual impact cannot be separated by the present analysis. Further research using multivariable regression models and including measures of glycaemic control, medication adherence, socioeconomic variables and particular types of problems would provide a fuller picture of the determinants of diabetic complications in the region.

The findings have a number of implications for diabetes services in South-Eastern Nigeria. First, complication screening may be increasingly risk-stratified by age, duration of diabetes, type of diabetes, and presence of cardiometabolic comorbidities, while still appropriately screening all patients. Second, blood pressure measurement and assessment of body weight should be consistently incorporated into diabetes treatment with appropriate interventions for hypertension and obesity. Third, individuals with a longer duration of diabetes, especially those with more than 5 years of disease, may benefit from systematic and regular examination for retinal, renal, neurological, foot, and cardiovascular issues. Fourth, enhancing standardised screening and referral practices in private, secondary and tertiary health care facilities for early identification and management of problems. Finally, longterm studies with multivariable analyses are needed to identify whether the observed correlations remain following adjustment for potential confounding factors.

A major strength of this study is its multicentre design and inclusion of individuals from different tiers of health facilities across South-Eastern Nigeria. The unusually large sample also permitted comparisons of some significant sociodemographic and clinical parameters between people with and without diabetic problems. Multiple sources of information on participants' clinical characteristics and complication status were gathered using questionnaires, clinical evaluation and medical-record inspection.

However, there are some limits must be taken into account. First, the cross-sectional design prohibits us from determining temporal correlations and drawing causal inferences. Second, recruitment from a facility-

based sample might limit generalisability to patients with diabetes not attending official healthcare facilities. Third, clinical information may be impacted by the incompleteness of medical records or participant recollection. Fourth, the study took into account overall complication status and did not analyse particular complications independently, and hence the variations in the drivers of specific complications may have been concealed. Finally, the odds ratios are based on unadjusted analyses, therefore residual and confounding effects are possible, especially among age, duration of diabetes, diabetes type, hypertension and obesity. Thus, the results should not be taken to indicate independent predictors of diabetic complications.

CONCLUSION

Complications of diabetes were very common among the people who received care in selected health institutions in South-Eastern Nigeria. In unadjusted analyses, older age, longer duration of diabetes, type 2 diabetes, hypertension, obesity, and combined cardiometabolic comorbidity were associated with higher likelihood of having diabetes complications. Sex and facility type were not significantly associated with complication status. These findings underline the significance of rigorous risk-informed complication screening and integrated management of cardiometabolic risk factors. Improving routine screening, early identification and integrated diabetes management in different tiers of the healthcare system can help minimise the burden of diabetes related problems in the region.

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