

Increased risk of diabetes mellitus among hypertensive patients with HIV/AIDS infection in Western Kenya

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Abstract

With the increasing prevalence of hypertension and diabetes mellitus in areas with high prevalence of HIV/AIDS, it is important to understand the co-existence of the conditions. More importantly, understanding the risk factors for improved prevention and clinical practice. A cross-sectional survey was conducted among 240 hypertensive patients with co-morbidities such as diabetes mellitus and HIV/AIDS in Homa Bay County, western Kenya. Data was collected using a structured questionnaire and multiple regressions were used to identify the risk of diabetes mellitus controlling for age, smoking and HIV/AIDS infection. The study shows co-existing co-morbidities with 50% suffering from HIV/AIDS and another 50% from Diabetes mellitus among the hypertensive patients. In addition, the risk for diabetes mellitus were; smoking (COR=2.89, 95%CI=1.63-5.11, P<0.001) and HIV/AIDS (COR=2.40, 95%CI=1.40-4.08, P=0.001). Also, observed that between 45 and 75 years, the risk of diabetes increased two-fold and when we controlled for age and smoking, the risk of diabetes among the hypertensive patients with HIV/AIDS increased by 1.4 folds (AOR=3.30, 95% CI=1.79-6.05, P<0.001). The study shows high co-existence of hypertension, HIV/AIDS and diabetes mellitus. Further, shows age, smoking and HIV/AIDS as the risk factors for diabetes in the population. The findings underscore the need for improved health promotion on the risk of age and smoking and clinical practice for the co-existing health conditions.

Keywords: High prevalence of HIV/AIDS; Co-morbidities; Risk of diabetes; Hypertensive patients

Introduction

Due to improved clinical practices, now people live long with conditions such as hypertension, diabetes mellitus, HIV/AIDS etc. However, the increasing cases of co-ex-

isting non-communicable and communicable diseases is posing a challenge to the management and clinical intervention practices.¹ Specifically, the prevalence of both hypertension and diabetes mellitus increased by 4.5% between 1975 and 2015.² In addition, the World Health Organization (WHO) estimates that 46% of individual older than 25 years suffer from hypertension in sub-Saharan Africa.³⁻⁵ In Kenya, the overall prevalence ranges from 12.6 to 36.9% ,with more cases observed in urban settings.^{3,6,7} However, implementation of interventions is very complicated because about 40% of individuals are unaware of their hypertension status in sub-Saharan Africa (SSA).⁸ Nonetheless, globally and in particular SSA, there is increasing cases of diabetes mellitus and other non-communicable and communicable diseases, therefore there is a need to search for the burden reduction and management strategies.^{9,10}

Both hypertension and diabetes mellitus are health conditions caused by genetic factors and unhealthy lifestyle, which includes; heavy consumption of alcohol obesity,¹¹⁻¹⁴ physical inactivity^{15,16} etc. Also, the conditions such as hypertension and diabetes mellitus increase the risk of complications such as severe diseases as Cardio Vascular Diseases (CVDs) and Chronic Kidney Disease (CKD) resulting into deaths over a period of time.¹⁷⁻¹⁹ The co-existence of the conditions presents a big challenge in SSA due to unpreparedness of the health systems.

As much as lifestyle interventions are cost effective in the prevention of hypertension and diabetes mellitus related deaths,^{20,21} these have been underutilized in SSA. Consequently, there is a need to have cost effective intergrated management of co-existing non-communicable and communicable diseases. The lessons should be learnt from the devastation of Covid 19 infection among people with the conditions such as hypertension and diabetes mellitus.²² The data on the risk of death among patients with non-communicable diseases conditions remain poorly understood. Here have used the routine data of the hypertensive patients from a rural based health facility in Western Kenya, determined whether HIV/AIDS increases risk of diabetes among hypertensive patients.

Methods

Study site

The study site was Kabondo sub-county hospital in Homa-Bay County in Western Kenya. The hospital serves diabetes mellitus, hypertensive and HIV/AIDS infection

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patients.

Study design

A facility cross-sectional survey was conducted between 1st March 2021 and 22nd April 2021 among hypertensive patients seeking care at the hospital. The study used quantitative approach and structured questionnaire. The dependent variable was diabetes mellitus and independent variables were age, gender, parity, history of smoking and HIV/AIDS.

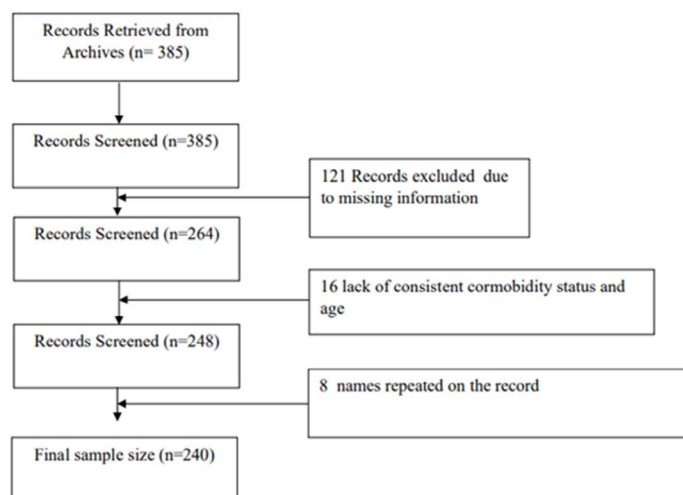
Target population

The target population for this study were people suffering from hypertension systolic blood pressure of ≥ 140 mmHg and/or a diastolic blood pressure ≥ 90 mm Hg or it is the use of drug.²³

Sampling technique

Hospital registers for both outpatient and comprehensive care clinic had a total of 385 hypertensive patient during the study period. The patients were expected to attend the facility within the two months of data collection. To be included in the study, individual patient had to have hypertension together with other related morbidities. The diabetic were individuals with the fasting plasma glucose level of equals or greater than 7 mmol/l and HIV positive cases were tested by either DNA/PCR or HIV antibody test. In this study only 240 participants met the set criteria as shown in Figure 1.

Figure 1: Archival and screening process



Data collection and quality control measures

A structured questionnaire was used to collect data. The questionnaires were administered to 240 hypertensive patients to access the risk factors for hypertension. The pilot study was done at nearby sub-county hospital before the actual data collection exercise.

Data analysis

The collected data were checked for completeness, coded, and then entered into excel sheets. The coded data were

then imported into the Statistical Package for Social Sciences (SPSS) for analysis. To determine the risk factors associated with hypertension and diabetes Mellitus both bivariate and multivariate logistic regression analysis were used and only $P < 0.05$ was considered statistically significant.

Ethical considerations

Permission to conduct the study was sought from Jaramogi Oginga Odinga University of Science and Technology. Further, approval and clearance was obtained from Jaramogi Oginga Odinga Teaching and Referral Hospital Ethical Review Committee (Ref ERC.IB/Volume.1/688, approval number IERC/JOOTRH/688/2020), Kabondo Sub-Country Hospital administration and the sub county health management team. The purpose of the study was discussed to all study participants prior to obtaining consent. The data collected in this study was handled with utmost confidentiality.

Results

Socio-demographic and comorbidities characteristics

The mean age of the study respondents was 54.84 ± 10.39 with a female population of 154 (64.17%). Of the 240 hypertensive patients, 40% were suffering from both HIV/AIDS and diabetes mellitus (Table 1).

Table 1: Socio-Demographic Characteristics of the respondents

Variables, N=240	Frequency (n)	Percentage %
Age groups		
35-44	31	12.92
45-54	98	40.83
55-64	69	28.75
65-74	32	13.33
75+	10	4.17
Gender		
Male	86	35.83
Female	154	64.17
Parity		
1	19	7.92
2	46	19.17
3	69	28.75
4	106	44.17
Comorbidities		
Diabetes mellitus	95	39.58
HIV/AIDS	96	40.00

Association of socio-demographic factors and comorbidities with the diabetes mellitus

The age, history of smoking and HIV/AIDS were associated with Diabetes mellitus ($P < 0.0001$). However, gender and parity were no associated with the diabetes mellitus (Table 2).

Table 2: Association of Socio-demographic and comorbidities with the diabetes mellitus

Factors	Diabetes Mellitus		P-value
	Total	Yes n (%)	
Overall	240(100.00)	95(39.58)	145(60.42)
Age group in years			
35-44	31(12.92)	3(9.68)	28(90.32)
45-54	98(40.83)	33(33.67)	65(66.33)
55-64	69(28.75)	37(53.62)	32(46.38)
65-74	32(13.33)	17(53.13)	15(46.88)
75+	10(4.17)	5(50.00)	5(50.00)
Total	240	95(39.58)	145(60.42)
Gender			
Male	86(35.83)	28(32.56)	58(67.44)
Female	154(64.17)	67(43.51)	87(56.49)
Parity			
1	19(7.92)	4(21.05)	15(78.95)
2	46(19.17)	16(34.78)	30(65.22)
3	69(28.75)	24(34.78)	45(65.22)
4	106(44.17)	51(48.11)	55(51.89)
History of smoking			
Yes	71(29.71)	41(57.75)	30(42.25)
No	168(70.29)	54(32.14)	
HIV Status			
Positive	96(40.00)	50(52.08)	46(47.92)
Negative	144(60.00)	45(31.25)	99(68.75)

Risk factors for diabetes mellitus among the hypertensive patients

In the (Table 3), both bivariate and multivariate logistic regression analyses show that age, smoking and HIV/AIDS are risk factors for Diabetes mellitus, in particular, the risk for Diabetes mellitus increases with age for example, aged 45 to 54 years (COR=4.74, 95%CI=1.34-16.74, P=0.016), aged 55 to 64 (COR=10.80,95%CI=3.00-38.86, P<0.001), aged 65 to 74 (COR=10.58,95%CI=2.67- 41.97, P=0.001) and aged 75 and above COR=9.33,95%CI=1.67-52.06, P=0.011) compared to individuals aged below 45 years. In addition, we observed that hypertensive patients who are smokers were 2.89 times more likely to have diabetes mellitus as

compared to non-smokers (COR=2.89, 95%CI=1.63-5.11, P<0.001). Also, Hypertensive patients who were HIV positive were 2.40 times more likely to have diabetes mellitus as compared to hypertensive patients who were HIV negative (COR=2.40, 95%CI=1.40-4.08, P=0.001).

Controlling for age, smoking, and HIV status on multivariate logistic regression analysis, the adjusted odd ratio remained statistically significant for age groups, smoking, and HIV status as shown in Table 3. However, HIV status increased with some folds (AOR=3.30, 95%CI=1.79-6.05, P<0.001) vs (COR=2.40, 95%CI=1.40-4.08, P=0.001). Similarly, the risk of smoking increased from odds ratio of 2.89 to 2.75.

Table 3: Risk factors for diabetes mellitus

	Bivariate regression			Multivariate regression		
	COR	95% CI	P-value	AOR	95% CI	P-value
Age group						
35-44	Ref	-	-	Ref	-	-
45-54	4.74	1.34-16.74	0.016	4.06	1.12-14.71	0.033
55-64	10.80	3.00-38.86	<0.001	9.55	2.56-35.56	0.001
65-74	10.58	2.67-41.97	0.001	7.15	1.7-29.94	0.007

75+	9.33	1.67-52.06	0.011	7.53	1.26-45.07	0.027
History of smoking						
Yes	2.89	1.63-5.11	<0.001	2.75	1.43-5.30	0.002
No	Ref	-	-	Ref	-	-
HIV status						
Positive	2.40	1.40-4.08	0.001	3.30	1.79-6.05	<0.001
Negative	Ref	-	-	Ref	-	-

Discussion

The study shows high prevalence of diabetes and HIV/AIDS infection among the hypertensive patients. In addition, reports age, smoking, and HIV/AIDS as the risk factors for diabetes in this population. Our findings further show increased risk of diabetes due to HIV/AIDS. Our findings demonstrate high prevalence of diabetes and hypertension cases and indeed, this is in agreement with the worldwide report that showed an increase of 4.5% of two conditions from 1975 to 2015.²⁴ Elsewhere, the increase of the diabetes and hypertension cases have been associated with the aging population, but in SSA there is increase despite the young populations.²⁵ With the high prevalence of HIV/AIDS and improved life span in sub-Saharan Africa, further increase of diabetes and hypertension cases is expected. Studies have reported high prevalence diabetes among the hypertensive patients.²⁶⁻²⁹ Also, reported high prevalence of hypertension among the diabetes patients.^{26,27,30-36} We observed increasing risk of diabetes in our study population and this is in agreement with the other studies^{37,38}. We also observed increased risk of diabetes among the smokers, and this findings is also in agreement with a prospective cohort study that showed a relative risk of type 2 diabetes among women smokers compared with individuals who never smoked.³⁹ Other study on the Japanese population also confirmed that smoking is a risk factor to diabetes.^{40,41} Furthermore, we observed increased risk of diabetes among hypertensive patients due to HIV infection, studies have shown that there is increasing cases of diabetes due to HIV.^{42,43}

With increasing case of Non Communicable Diseases (NCD) in areas with high burden of infections such as HIV/AIDS, it is important to think of prevention and control strategies, in particular, an infection such as Covid-19, the vulnerable population are those with pre-existing NCDs and those engaged in risky behavior such as smoking and obesity.⁴⁴⁻⁴⁷

Conclusion

As much as our study demonstrates the potential of the routine data to determine the prevalence of the diabetes and other conditions, and also to assess the risk of diabetes among the hypertensive patients, our study is limited by the relatively small sample size. This mainly because of poor record keeping resulting into incomplete or missing data. Also, due to missing data, we could not associate other comorbidities with the risk of diabetes as reported

elsewhere. Also, due to poor records, we could not control for potential confounders. Nonetheless, the study shows high co-existence of hypertension, diabetes mellitus and HIV/AIDS in the population. Also, shows that risk factors of diabetes as age, smoking and HIV/AIDS. The findings of this study suggest the need for improved health promotion and clinical practice for the prevention and treatment of the co-existing health conditions.

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