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Research Article

Cardiometabolic Disease Comorbidities among Older Adults and the Elderly in a Sub-Urban Occupational Setting in Ogun State, Nigeria

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Abstract: ***Background*:** Cardiometabolic diseases (CMDs) mainly hypertension, diabetes, and dyslipidemia, are on the rapid rise globally, with developing countries lagging behind in prevention efforts among high risk groups. We aimed at assessing pattern of CMD comorbidities among occupationally active older adults and the elderly, in a sub-urban setting in South West Nigeria. ***Methods***: Cross-sectional study was conducted among staff of Babcock University and Babcock University Teaching Hospital, Ogun State, Nigeria. Total enumeration of all staff that were 50 years or older was done, with conduction of their medical screening. Structured questionnaire was used to obtain data, with analysis done using SPSS 21.0. ***Result*:** Data was obtained from sixty-eight (68) subjects with mean age of 62.2 ± 5.4 years. Approximately two-thirds (44, 64.7%) were at least 60 years old, while one-third (22, 32.4%) were academic staff. Mean BMI was 28.6% ± 4.5 kg/m^2, and most subjects (57.4%) were overweight. Approximately half of subjects (48.5%) had prediabetes (32.4%) or diabetes (16.2%). Hypertension, dyslipidemia, and metabolic syndrome, were found in 36.8%, 44.1%, and 13.2%, respectively. Forty-two subjects (61.8%) had one (15, 22.1%) or two (27, 39.7%) morbidities, while twenty six (38.2%) had at least three comorbidities. Among subjects with at least three comorbidities, hypertension, dysglycemia, and abnormal weight (34.6%) was the common comorbid combination. Significantly higher proportion of academic staff were diabetic, while non-academic staff were prediabetic (p=0.01). ***Conclusion***: There is high prevalence of multiple cardiometabolic diseases comorbidities among older adults in an occupational setting. Abnormal weight was the most common factor found alongside other comorbidities, with diabetes and prediabetes being commoner among academic and non-academic staff, respectively. There is need to redouble our efforts towards practice of lifestyle modifications, especially among these higher risk groups. The implications of these findings for non-communicable disease prevention in developing countries are discussed.

Keywords: Cardiometabolic Disease, Obesity, Elderly, Workers, Nigeria.

INTRODUCTION

In diverse global settings, an estimated 1 in every 3 non-accidental deaths among adults is attributable to cardiometabolic diseases (CMDs), mainly hypertension and diabetes mellitus (Naghavi *et al*., 2017). Clinic visits, hospital admissions, and medical emergencies among adults, are also commonly due to at least one form of CMD and/or associated complications (Adhikari *et al*., 2019; Kreig *et al*., 2016; Valls *et al*., 2018). This high morbidity and mortality due to CMD is worse in sub-Saharan Africa, where weak health systems limit access to treatment and prevention services (Miranda *et al*., 2019). Due to poor coverage and ineffective health insurance system, out-of-pocket cost of care for CMDs, has also contributed significantly to various degrees of household poverty in developing countries (Gheorghe *et al*., 2019).

Considering the chronic nature of CMDs, the life-course period before and during elderhood, represents when most at-risk individuals manifest clinical symptoms of disease (Lawlor *et al*., 2014). This is also when complications and comorbidities arise, with potential rapid progression and impairment in quality of life (Singh-Manoux *et al*., 2018). In particular, comorbidities may occur more commonly, when there is a common factor in the sequence of disease progression among potentially inter-related CMDs. These factors such as obesity, may be mediated by underlying modifiable dietary, physical activity and other behavioural attributes of individuals (Upadhyay, 2018). Unfortunately, by the period of elderhood, most of these adverse behaviors would have long been established, with potential difficulty in adherence to prescribed lifestyle modifications (Daw *et al*., 2017).

Fortunately, regular medical screening has remained useful for early diagnosis, treatment, and at least prevention of rapid progression of disease. The number and severity of comorbidities, may also be largely

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controlled through implementation of screening-based prevention strategies (Yan *et al*., 2019). Yet, routine or regular medical screening is unpopular in most developing country health systems. Focus of these systems, have been on waiting for disease to occur, before providing treatment or rehabilitation, rather than prevent disease onset or progression ab initio (Yan *et al*., 2019). The repercussions of this deficit may be more severe if the national workforce is largely involved. This workforce, which includes highly skilled and experienced staff of educational and health institutions, play vital roles in national growth and development. High measures of loss of productivity incurred due to their resultant morbidity and mortality, cannot be overemphasized (Rasmussen *et al*., 2017).

Review of rationale for developing country health system deficit of non-medical screening, suggest several potential drivers. These include poor funding, widespread poverty and ignorance of disease risk factors, and lack of evidence-based information on disease burden and drivers among different age groups and settings (Kane *et al*., 2017; Azevedo *et al*., 2017). Yet, in developing countries, there is paucity of research on burden of CMDs, which focuses on pattern of comorbidities among occupationally active older adults and the elderly (Gouda *et al*., 2019; Kaze *et al*., 2017).

Independent reviews of studies on hypertension in Africa (Bosu *et al*., 2019), and cardiovascular diseases in sub-Saharan Africa (Hamid *et al*., 2019), excluded assessment of other potential cardiometabolic comorbidities, and without focus on older adults as high risk groups. Where the key cardiometabolic profiles and comorbidities were studied in Ethiopia, focus was not on older adults or the elderly (Gabreyes *et al*., 2019). Meta-analysis of the Global Aging and Adult Health data among 2,091 elders from Ghana, found overweight (13.8%) and obesity (16.7%) to be associated with hypertension. There was no focus on occupational settings, and other cardiometabolic comorbidity measures, including blood sugar and lipids were not assessed (Boateng *et al*., 2017). Also, independent studies on cardiometabolic comorbidities among the elderly in South East Nigeria, did not focus on occupational settings (Iloh *et al*., 2013; Iloh *et al*., 2015). This study was therefore aimed at assessing prevalence and pattern CMD comorbidities among active older adults and the elderly, in a sub-urban educational and healthcare occupational setting in South West Nigeria. Findings may be useful for better understanding of drivers of CMD progression, towards cost-effective prevention among working class of older people.

METHODS

Cross-sectional study was conducted among older staff of Babcock University, and Babcock University Teaching Hospital, Ogun State, Nigeria. These Seventh Day Adventist institutions, have staff strength of about 350, with campuses in Ilishan-Remo and Iperu, both in Ikenne Local Government area of Ogun State, South West Nigeria. Also, they have medical insurance for staff, covering or including medical screening. Each of the institutions also has a gymnasium which is accessible to all staff for a regular subscription fee.

Staff list was obtained from the registry department of both institutions. Total enumeration of all staff that were 50 years or older was done, with conduction of their medical screening. Only staff that were at least 50 years old were eligible to participate. Subjects that were critically ill were excluded from participation. Eligible subjects were introduced to the study and pre-informed of their need to fast towards obtaining laboratory samples during the study dates. The study was carried out in the general outpatient clinic in BUTH, for four weeks within June, 2019.

Structured questionnaire was used to obtain data on sociodemographic, clinical and laboratory characteristics. Systemic blood pressure, fasting blood sugar, lipid profile, and other laboratory measurements were conducted using standard procedures. Data entry and analysis was done using SPSS version 21. Chi-square and Fishers Exact were used as inferential statistics, with p-value set at 0.05. Ethical approval from Babcock University Research Ethics Committee (BUREC) and informed consent from subjects were obtained before data collection.

RESULT

Data was obtained from sixty-eight (68) subjects with equal male:female ratio of 0.5:0.5. Mean age was 62.2 ± 5.4 years, ranging from 54 to 78 years old. Forty-four subjects (64.7%) were at least 60 years old, while approximately one-third (32.4%) were academic staff (table 1).

Table 1: Sociodemographic and anthropometric characteristics of subjects

Variable	Frequency	Percentage
Sex		
Male	34	50.0
Female	34	50.0
Total	68	100
Age group (in years)		
<60	24	35.3
60-69	38	55.9
≥70	6	8.8
Total	68	100
Staff category		
Academic	22	32.4
Non-academic	31	45.6
Healthcare	15	22.1
Total	68	100
BMI category		
Normal	11	16.2
Overweight	39	57.4
Obesity class 1	12	17.6
Obesity class 2	4	5.9
Obesity class 3	2	2.9
Total	68	100

Mean BMI was 28.6% ± 4.5 kg/m^2, ranging from 21.1 to 46.6 kg/m^2. Most subjects were overweight (57.4%), while eighteen (29.4%) were obese. Two subjects (2.9%) had abnormal urinalysis, while a little above one-tenth (11.8%) were mildly anemic. Approximately half of subjects (48.5%) had prediabetes (32.4%) or diabetes (16.1%) (table 2).

Table 2: Laboratory and clinical characteristics of subjects

Variable	Frequency	Percentage
Urinalysis		
Normal	66	97.1
Abnormal	2	2.9
Total	68	100
PCV		
Normal	60	88.2
Mild anemia	8	11.8
Total	68	100
Fasting Blood Sugar		
Normal	35	51.5
Impaired (prediabetes)	22	32.4
Diabetes	11	16.1
Total	68	100
Blood pressure		
Normal	43	63.2
Hypertension	25	36.8
Total	68	100
Fasting lipid profile		
Normal	38	55.9
Deranged	30	44.1
Total	68	100
Metabolic syndrome		
Present	9	13.2
Absent	59	86.8
Total	68	100
Hepatitis B status		
Negative	66	97.1
Reactive	2	2.9
Total	68	100
Intraocular pressure status		

Normal	66	97.1
Elevated	2	2.9
Total	68	100
Number of comorbidities		
One	15	22.1
Two	27	39.7
Three	11	16.2
Four	10	14.7
Five	4	5.9
Six	1	1.5
Total	68	100

Hypertension, dyslipidemia, and metabolic syndrome, were found in 36.8%, 44.1%, and 13.2%, respectively. Two subjects each (2.9%) were hepatitis B reactive, and had elevated intraocular pressure (IOP). One subject each (1.4%) had lumbar spondylosis, chronic dermatitis, and elevated prostate specific antigen (PSA). Forty-two subjects (61.8%) had one (15, 22.1%) or two (27, 39.7%) morbidities, while twenty six (38.2%) had at least three comorbidities. Among subjects with only one morbidity, overweight (33.3%), dyslipidemia (26.7%), prediabetes (13.3%) and obesity class 1 (13.3%) were the common findings.

Table 3: Comorbid frequency distribution among subjects

Variable	**Frequency**	**Percentage**
One disease / risk factor (n=15)		
Overweight	5	33.3
Dyslipidemia	4	26.7
Prediabetes	2	13.3
Obesity class 1	2	13.3
Obesity class 2	1	6.7
Hypertension	1	6.7
Total	15	100
Two diseases / risk factors		
Dyslipidemia and abnormal weight	10	37.0
Dysglycemia and abnormal weight	7	25.9
Hypertension and abnormal weight	5	18.6
Abnormal weight and other non-CMD problem	3	11.1
Hypertension and dysglycemia	1	3.7
Dysglycemia and dyslipidemia	1	3.7
Total	27	100
Three or more diseases / risk factors		
Hypertension, dysglycemia, abnormal weight	9	34.6
Dysglycemia, dyslipidemia, abnormal weight	6	23.1
Hypertension, dyslipidemia, abnormal weight	4	15.4
Hypertension, dysglycemia, dyslipidemia, abnormal wt.	3	11.5
Hypertension, dyslipidemia, dysglycemia	2	7.7
Dysglycemia, abnormal weight, other non-CMD problems	2	7.7
Total	68	100

Among subjects with two co-morbidities, dyslipidemia with abnormal weight (37.0%), and dysglycemia with abnormal weight (25.9%) were the common comorbid combinations. Among subjects with three or more comorbidities, hypertension, dysglycemia, and abnormal weight (34.6%) and dysglycemia, dyslipidemia, and abnormal weight (23.1%) were the common comorbid combinations. Compared with younger subjects, those that were 70 years or older, had higher proportion of three or more comorbidities, though this difference was not statistically significant (p=0.06).

Table 4: Factors associated with number of comorbidities among subjects

Variable	One or two	Three or more	Total	Chi-square
	n (%)	n (%)	n (100%)	(p-value)
Sex				
Male	20 (58.8)	14 (41.2)	34 (100)	0.25
Female	22 (64.7)	12 (35.3)	34 (100)	(0.62)
Age category (in years)				
<60	16 (66.7)	8 (33.3)	24 (100)	Fisher's
60-69	25 (65.8)	13 (34.2)	38 (100)	(0.06)
≥70	1 (16.7)	5 (83.3)	6 (100)	
Staff category				
Academic	11 (50.0)	11 (50.0)	22 (100)	1.9
Non-academic	21 (67.7)	10 (33.3)	31 (100)	(0.39)
Healthcare	10 (67.7)	5 (33.3)	15 (100)	

The number of comorbidities was not significantly different comparing sex and staff categories (p>0.05). Significantly higher proportion of academic staff were diabetic, while non-academic staff were prediabetic (p=0.01, table 5).

Table 5: Factors associated with dysglycemia among subjects

Variable	Normal	Prediabetes	Diabetes	Total	Chi-square
	n (%)	n (%)	n (%)	n (100%)	(p-value)
Sex					
Male	15 (44.1)	13 (38.2)	6 (17.6)	34 (100)	1.53
Female	20 (58.8)	9 (26.5)	5 (14.7)	34 (100)	(0.47)
Age category (in years)					
<60	16 (66.7)	7 (29.2)	1 (4.2)	24 (100)	Fisher's
60-69	18 (47.4)	12 (31.6)	8 (21.1)	38 (100)	Exact
≥70	1 (16.7)	3 (50.0)	2 (33.3)	6 (100)	(0.13)
Staff category					
Academic	10 (45.5)	4 (18.2)	8 (36.4)	22 (100)	Fisher's
Non-academic	15 (48.4)	15 (48.4)	1 (3.2)	31 (100)	Exact
Healthcare	10 (66.7)	3 (20.0)	2 (13.3)	15 (100)	(0.01)

Compared with younger subjects, those that were 70 years or older had higher proportion of prediabetes and diabetes, though this difference was not statistically significant (p>0.05). All sociodemographic characteristics assessed (sex, age, staff category) were not found to be significantly associated with presence of hypertension (p>0.05, table 6) and dyslipidemia (p>0.05, table 7).

Table 6: Factors associated with blood pressure status among subjects

Variable	Normotensive	Hypertensive	Total	Chi-square
	n (%)	n (%)	n (100%)	(p-value)
Sex				
Male	14 (41.2)	20 (58.8)	34 (100)	0.57
Female	11 (32.4)	23 (67.6)	34 (100)	(0.45)
Age category (in years)				
<60	8 (33.3)	16 (66.7)	24 (100)	Fisher's
60-69	13 (34.2)	25 (65.8)	38 (100)	Exact
≥70	4 (66.7)	2 (33.3)	6 (100)	(0.28)
Staff category				
Academic	9 (40.9)	13 (59.1)	22 (100)	0.26
Non-academic	11 (35.5)	20 (64.5)	31 (100)	(0.88)
Healthcare	5 (33.3)	10 (66.7)	15 (100)	

Table 7: Factors associated with dyslipidemia status among subjects

Variable	Normal	Dyslipidemic	Total	Chi-square
	n (%)	n (%)	n (100%)	(p-value)
Sex				
Male	14 (41.2)	20 (58.8)	34 (100)	0.24
Female	16 (47.1)	18 (52.9)	34 (100)	(0.63)
Age category (in years)				
<60	11 (45.8)	13 (54.2)	24 (100)	0.32
60-69	17 (44.7)	21 (55.3)	38 (100)	(0.85)
≥70	2 (33.3)	4 (66.7)	6 (100)	
Staff category				
Academic	10 (45.5)	12 (54.5)	22 (100)	0.90
Non-academic	12 (38.7)	19 (61.3)	31 (100)	(0.64)
Healthcare	8 (53.3)	7 (46.7)	15 (100)	

DISCUSSION

This study was aimed at assessing pattern of cardiometabolic disease comorbidities, among occupationally active older adults and elders in selected institutions, in a developing country setting. Abnormal weight comprising overweight and obesity was a common factor found among subjects. With almost 9 in every 10 subjects (86.8%) having abnormal weight, the risk factor should be seen as highly prevalent among older adults and the elderly. Similar study among general population of the elderly in Ghana, found much lower 27.6% prevalence of abnormal weight (Boateng et a., 2017). Though the study areas and settings are different, this difference in proportion may suggest higher risk of obesity among institutionally-based elderly people, compared with those in general population. The elderly in general population compared with those in institutions, may be engaged in more active forms of occupation or physical activities, resulting in their reduced risk of obesity.

Obesity among the elderly may be due to ignorance or low-risk perception of potential adverse effects of the cardiometabolic risk factor (Jørgensen *et al*., 2014). Obese individuals may not be aware of their weight status, as well as potential long-term adverse effects on their health and wellbeing (Ghost *et al*., 2017). This ignorance may be commoner among those with poor access to healthcare services, including routine medical screening. Yet, obese individuals who are aware of their weight status, as well as potential adverse health effects, may still have difficulty in attaining or maintaining healthy weight (Jørgensen *et al*., 2014). This may be because besides referral to dieticians, with occasional counseling for lifestyle modification, there is lack of definitive measures for obesity prevention in most developing country settings (Miranda, 2019; Cappuccio *et al*., 2016). Health systems in resource-poor settings are typically treatment-oriented, with little or no measures for risk reduction or disease prevention.

Approximately one in every two subjects (48.5%) was dysglycemic, comprising 2:1 ratio of prediabetes (32.4%) to diabetes (16.1%). In other words, prediabetes was twice as common as diabetes. This high prevalence of prediabetes is a key finding, considering the innocuous nature of progression of the disease. Prediabetic individuals are often unaware of their disease onset and progression, especially due to its asymptomatic nature and typically incidental situation of its diagnosis (Tsimihodimos *et al*., 2019). Unfortunately, this scenario may be contributing to non-compliance with prescribed preventive measures of lifestyle modification, in tune with health belief model (HBM) of behavior change. In the case of prediabetes, key component drivers in the flipside of the model will be, perceived lack of susceptibility (to eventually becoming diabetic), benign nature of disease (being asymptomatic), and perceived difficulty in sustaining lifestyle modification (lack of self-efficacy) (Barry *et al*., 2018). Caregivers need to understand the presence and interplay of these components for each prediabetic client, towards provision of more evidence-based counselling services (Khorsandi *et al*., 2017).

Another set of key cardiometabolic risk factors found in this study was hypertension, dyslipidemia, and metabolic syndrome, which was found in 36.8%, 44.1%, and 13.2%, of subjects respectively. Fortunately, like prediabetes, these CMD risk factors have precursors (such as pre-hypertension), which could be identified through early and regular medical screening, towards prevention of disease progression (Tsimihodimos *et al*., 2019). Unfortunately, such vital service is beyond the scope of the current drive of health systems in most developing countries, due to dysfunctional primary health care (PHC) systems (Miranda, 2019; Cappuccio *et al*., 2016). This findings, therefore underscores the need to revive our PHC

system, towards control of rapidly rising morbidity and mortality due to cardiometabolic diseases. Also, non-incorporation of routine medical screening in the existing, but barely functional National Health Insurance Scheme (NHIS), may be contributing to poor access to such cost-effective preventive services (Etobe *et al*., 2015). Perhaps many health insurance providers, may not be aware of the cost-saving and profit-yielding potentials of incorporation of early, mandatory, and regular medical screening of their enrollees (Eteng & Ijim-Agbor, 2016).

In this study, over a third of subjects (38.2%) had at least three comorbidities, commonly comprising triad of dysglycemia, dyslipidemia, and hypertension, with obesity as common factor. The triad is not unexpected considering the interrelationships of their aetiopathophysiology, including the established obesogenic sequelae of long-term physical inactivity and inappropriate dietary habits (Morales-Villegar *et al*., 2013). Though it is established that obesity as the common factor, commonly precedes each of these components of the triad, it is not clear which of the triad components precede the other (dos Prazeres-Tavares *et al*., 2015). Such knowledge of disease sequence may be useful for cost-effective screening in low-resource settings with high prevalence of CMD. For instance, where resources are highly limited, interventionist may need to decide which of blood sugar or lipid profile should be done, depending on prevalent age groups and other characteristics of intervention population (Aikins *et al*., 2010).

High prevalence of two of more comorbidities found in this study, is also cause for much concern. The resulting polypharmacy may potentially contribute to non-compliance with treatment, and further progression of disease as a vicious cycle (Mannuci *et al*., 2018; Koberlein *et al*., 2013). Fortunately, lifestyle modification of diet and physical activity improves each of the comorbidities. Yet, individuals with comorbidities may require more rigorous monitoring and follow-up of lifestyle modification, with application of health belief model and other relevant behavioural change theories (Obirikorang *et al*., 2018).
Significantly higher proportion of academic staff were diabetic, while non-academic staff were prediabetic, even after controlling for age. In other words, academic compared with non-academic staff, were found to be at the more severe spectrum of dysglycemia. Non-screening and therefore late diagnosis, may be commoner among academic staff, with potential lead-time bias due to lack of knowledge of duration of disease following its onset (Kestenbaum, 2019). Academic staff may also have shorter duration of transition from prediabetes to diabetes, perhaps due to their potentially poorer compliance with lifestyle modification (Kuwahara *et al*., 2019).

It is not clear whether there are significant differences in diet and physical activity pattern, between academic and non-academic staff. Existing workplace differences in these lifestyle measures, may be based on individual or institutional mode of service delivery. For instance, office-based non-academic staff, as well as academic staff that deliver long duration of lectures while maintaining stationary position, may be more sedentary with potentially higher risk of dysglycemia (MacEwen *et al*., 2017). Unfortunately, these lifestyle measures were not assessed on this study. Yet, difference in adoption of these measures, may be due to differences in accessibility to available prevention services. For instance, despite availability of gymnasium in the institution, its far distance from most office areas may deter staff from its active and regular usage, especially with high burden of work pressure (Jorvand *et al*., 2018).

CONCLUSION

This study found high prevalence of multiple cardiometabolic diseases comorbidities among older adults in an occupational setting. Abnormal weight was the most common factor found alongside other comorbidities, with diabetes and prediabetes being commoner among academic and non-academic staff, respectively. There is need to redouble our efforts towards practice of lifestyle modifications, especially among these higher risk groups. This may include decentralization of enabling facilities such as gymnasium centers, for easier access to staff. Also, the current National Health Insurance Scheme needs to incorporate routine / annual screening of older adults and other high risk groups, towards more cost-effective management and prevention of cardiometabolic comorbidities. Further research with larger sample in diverse rural, urban, and other occupational settings is recommended.

Author Contribution

EA – conceptualized the study, wrote the study proposal, and reviewed draft manuscript
OO – improved on study concept, analyzed the data and wrote the draft manuscript
OAO – supervised data collection and entry, and reviewed the draft manuscript
OS – supervised data collection and reviewed the draft manuscript
SE - reviewed the draft manuscript
DD – reviewed draft manuscript

Conflict of Interest

The authors declare that there is no conflict of interest concerning this work

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