

## Predictors of Comorbidity and Quality of Life Among HIV Positive and HIV Negative Older Persons in a Tertiary Health Facility in Lagos.

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### Abstract

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**Background:** The burden of comorbid conditions may be increased among people living with Human Immunodeficiency Virus. Existing studies on comorbidity and Quality of Life (QoL) among people living with Human Immunodeficiency Virus (HIV) focus on younger adults. In addition, studies on comorbidity and QoL among HIV-positive elderly persons are carried out without comparison with those who are HIV-negative. Hence, there is knowledge gap regarding comorbidity and QoL among elderly persons living with HIV (EPLHIV) compared with those who are HIV-negative. To compare comorbidity and QoL among EPLHIV with those who are HIV-negative. This study was carried out at adult antiretroviral clinic, General Out-patient (GOP) and Medical Out-patient (MOP) departments in Lagos University Teaching Hospital Lagos Nigeria.

**METHODOLOGY:** This is a comparative cross-sectional analytical study. A total of 243 elderly patients were recruited into this study. Charlson Comorbidity Index (CCI) and WHO Quality of Life BREF tools were used. STATA version 13 was used for data analysis.

**Results:** EPLHIV had a significantly higher mean CCI score than HIV-negative elderly persons ( $1.80 \pm 1.45$  vs.  $1.25 \pm 1.23$ ;  $p=0.005$ ) and a higher prevalence of comorbidity (74.07% vs. 60.49%;  $p=0.025$ ). EPLHIV had lower scores in all QoL domains, but the difference was statistically significant only in the environmental domain ( $57.60 \pm 10.84$  vs.  $62.05 \pm 15.11$ ;  $p=0.019$ ); overall QoL did not differ significantly ( $p=0.512$ ).

**Conclusion:** This study revealed that EPLHIV had a higher burden of comorbidity than HIV-negative elderly, while their overall QoL was similar, with a significantly lower score only in the environmental domain. There is a need for health promotion programs among EPLWHIV in order to reduce the risk of multimorbidity.

**Keywords:** Anthropometry, Comorbidity, Charlson Comorbidity Index, Quality of Life, Elderly, HIV

### Introduction

Globally, an estimated 3.6 million people aged 50 years and above are living with HIV. About 100,000 people aged 50 years and above in LMIC acquire HIV every year, with approximately three-quarters (74%) living in sub-Saharan Africa.<sup>1</sup> Nigeria is among the five countries with the highest number of older adults living with HIV. Other countries include Mozambique, South Africa, Zambia and Zimbabwe. These countries account for 54% of the total number of older adults aged 50 years and above who are living with HIV.<sup>2</sup> In Nigeria, the total number of older persons aged 60 years and above increased slightly from 8,741,292 in 2013 to 9,622,056 in 2016. Between 2013 and 2014, the male ageing population increased by 1.8% compared to a 1.4% increase in the female ageing population.<sup>3</sup> Nigeria has the second largest HIV epidemic in the world and one of the countries with highest rates of new infection in sub-Saharan Africa.<sup>4</sup> As of 2018, about 37.9 million people were living with HIV globally. In Nigeria, about 1.9 million people were living with HIV, 53000 had AIDS-related deaths and 130,000 people were newly infected with HIV.

A cross-sectional study among Elderly people living with HIV (EPLHIV) in Nigeria showed that lower Nadir CD4 count significantly predicted multimorbidity among HIV-positive elderly.<sup>5</sup> This was similar to the findings in an African cohort study that showed an association between CD4 nadir less than 200 cells/mm<sup>3</sup> and presence of Non-Communicable Diseases (NCD) [ARR, 1.43; 95% CI, 1.06–1.93].<sup>6</sup> Elderly persons living with HIV are more at risk of developing comorbidity than younger adults, as increasing age is a significant predictor of presence of multimorbidity.<sup>5,7</sup> It is also worthy of note that the population of EPLHIV is increasing. This could be as a result of improvement in medical treatment of HIV.<sup>8</sup> Past studies have not evaluated HIV as an independent predictor of comorbidity in aged-matched comparative studies among older persons.

The theoretical concept linking HIV infection and NCDs among older persons is established.<sup>6,9</sup> Elderly people living with HIV are prone to developing other chronic diseases.<sup>8</sup> There has been a transition in the management of HIV infection from opportunistic infections to the management of chronic non-communicable

comorbidities especially among the older population, and HIV infection is identified as a risk factor for this observation.<sup>6,9</sup> Elderly persons who are overweight or obese are at higher risk of chronic comorbidity. Greater burden of comorbid conditions has been associated with poorer physical QoL among them.<sup>7</sup> The QoL of a person may be affected by aging and HIV infection. Reduced physical QoL has been found among EPLHIV with increased burden of comorbidity.<sup>7</sup> The burden of comorbid conditions may be increased among those who are living with human immunodeficiency virus (HIV).<sup>6,7</sup> A study by Folasire in Ibadan, Nigeria, showed that persons living with HIV and AIDS had good QoL in all domains except social domain, also asymptomatic HIV-positive patients had better scores than the symptomatic HIV-positive patients.<sup>10</sup> Those with higher waist circumference may be at risk of chronic diseases such as hypertension, arthritis and reduced functional ability.<sup>12</sup> Lower QoL have been associated among elderly with low body mass index (underweight) and low waist circumference as well as those with excess body weight.<sup>13</sup> A study conducted by Balderson et al among 452 elderly aged 50 years and above who are living with HIV reported high prevalence of comorbid conditions among the participants, as 94% reported presence of chronic diseases. The top chronic conditions were hypertension (46%), chronic pain other than back pain and headache (45%), hepatitis (39%), and arthritis (35%), and chronic back pain (33%), asthma (32%), and diabetes (21%).<sup>14</sup> A study among Nigerian elderly shows a high prevalence (95.2%) of chronic diseases among the elderly. Hypertension, which is the most prevalent was present in 51% of patients, while 42.9% had diabetes.<sup>15</sup> The proportion of EPLHIV in southwest Nigeria is increasing.<sup>16</sup> Being infected with HIV may confer risks for multimorbidity and reduce QoL among patients. This study aimed at determining and comparing the predictors of multimorbidity and QoL among HIV-positive and HIV-negative participants.

## Objectives

The primary objective in this study was to determine and do a comparison of the burden of comorbidity and quality of life among older persons living with HIV and HIV-negative older persons attending clinics at the Lagos University Teaching Hospital, Idi-Araba, Lagos, Nigeria. While the secondary objectives were to compare the anthropometric characteristics of older persons living with HIV and HIV-negative older persons, and to determine the predictors of comorbidity among the study participants.

## Research methods and design

### Study design

This study was a comparative cross-sectional analytical study to determine and compare comorbidity and quality of life as well as determine the predictors of comorbidity among older persons living with HIV and HIV-negative older persons.

### Setting

Lagos State is a city located in South-western geopolitical zone of Nigeria with a total number of 37 local council development areas

and 20 local government areas. The population is multiethnic and predominated by the Yoruba's, the major ethnic group in south western Nigeria.

Study site is a tertiary hospital established in 1962, located at Idi-araba, Surulere, Lagos state. The hospital serves Lagos state with a population of 25million and surrounding states. This study was carried out at the adult antiretroviral (ART) clinic of the AIDS Preventive Initiative in Nigeria (APIN) center as well as two out-patient clinics, General Out-patient (GOP) and the Medical Out-patient (MOP) department, located at 3<sup>rd</sup> floor at Lagos University Teaching Hospital Idi-Araba. From the APIN ART clinic records, the average total monthly attendance is 6,875 patients, while 631 patients who are aged 60 years and above visit the clinic.

### Study Population

The study population consisted of EPLHIV aged 50 years and above and attending the APIN ART clinic, as well as HIV-negative elderly patients aged 60 years and above attending Medical Out-patient (MOP) clinic, and the General Out-patient Department (GOPD) at Lagos University Teaching Hospital Idi-Araba, Lagos, Nigeria.

### Exclusion Criteria.<sup>17</sup>

1. Patients at MOP and GOPD who tested positive to HIV were excluded from the study
2. Patients with cognitive disorders, functional limitations, including those with non-controlled pain.

### Sample Size Determination

The formula for the sample size required to compare two proportions in two independent study samples considering both alpha and beta errors;<sup>18</sup>

$$n = \frac{[(Z_{\alpha} + Z_{\beta})]^2 (P_1 Q_1 + P_2 Q_2)}{(P_1 - P_2)^2}$$

n = minimum estimated sample size,  $Z_{\alpha}$  = Standard normal deviate at  $\alpha$  probability (95% confidence interval) = 1.96,  $Z_{\beta}$  = Standard normal deviate at  $\beta$  probability = 0.84,  $P_1$  = Prevalence of hypertension among EPLHIV, from previous study<sup>5</sup> = 0.29,  $P_2$  = Prevalence of hypertension among elderly from previous study<sup>15</sup> = 0.51,  $Q_1$  = Prevalence of those without hypertension among EPLHIV from previous study<sup>5</sup> = 0.71,  $Q_2$  = Prevalence of those without hypertension among elderly from previous study<sup>15</sup> = 0.49

$$n = \frac{(1.96 + 0.84)^2 \times [(0.29 \times 0.71) + (0.49 \times 0.51)]}{(0.29 - 0.51)^2}$$

$$n = \frac{7.84 \times 0.2059 + 0.2499}{0.0484}$$

$$n = 74$$

Allowing for 10% for missing data and incomplete data will bring the sample size to 81.

Ratio between HIV-positive and HIV-negative group = 1:2 Therefore, 81 elderly patients living with HIV and 162 patients HIV-negative were recruited. A total of 243 elderly patients were recruited into this study.

### Sampling Strategy

Recruitment of older persons living with HIV

Using consecutive sampling, a total of eighty-one EPLHIV aged 50 years and above who were receiving treatment at the APIN ART clinic at Lagos University Teaching Hospital Idi-Araba and who consented to participate were enrolled to participate in the study.

### Recruitment of HIV-negative elderly

Using proportionate allocation, the proportion of HIV-negative older persons who were to be selected from the MOP and GOP clinics were determined as follows, based on an estimated monthly attendance at each of the clinics:

Estimated monthly attendance at the GOPD was 156, while that at the MOP was 727 elderly patients aged 60 years and above, giving a total of 883. Thus,  $156/883 \times 727 = 29$  HIV-negative elderly patients at the GOPD and  $727/883 \times 156 = 133$  HIV-negative elderly patients at the MOP were recruited using Consecutive Sampling technique until the desired sample size was achieved in both clinics.

### Data Collection Tools

The WHOQOL consists of 26 items, an abridged version of WHOQOL-100 which was developed by the WHOQOL Group in an attempt to develop a tool to assess the QoL which would be cross-culturally applicable. The WHOQOL-BREF is based on a four-domain structure: the physical health domain (which consist of seven facets which assess the activities of daily living, dependence on medicinal substances and medical aids, energy and fatigue, pain and discomfort, work capacity, sleep and rest and mobility), the psychosocial domain (consisting six facets that assess areas such as body image and appearance, negative and positive feelings, self-esteem, spirituality and beliefs, and thinking, learning, memory and concentration), the social relationships domain (consisting of three facets which assess personal relationships, social support, and sexual activity), and the environmental domain (consisting of eight facets that assess areas such as financial resources, freedom, physical safety and security, accessibility and quality of health and social care, home environment, participation in leisure activities, physical environment, and transport). WHOQOL-BREF has been demonstrated in a study among older adult to have a Cronbach's alpha of 0.86.<sup>19</sup>

Charlson Comorbidity Index (CCI) was used to assess comorbidity among the participants. This tool is selected because it has been used in other studies assessing PLWHA including elderly people living with HIV.<sup>7,20</sup> Charlson Comorbidity Index has a strong reliability, and has been validated for use among older adult in a community dwelling with an intraclass reliability coefficient of 0.77.<sup>21</sup> It covers 19 disease burdens, including tissue disease, leukemia, HIV/AIDS, peptic ulcer disease, rheumatism, mild liver disease, tumor, diabetes, diabetes with end-organ failure, lymphoma, hemiplegia, metastatic solid tumor, moderate to severe renal disease, and cerebrovascular disease.

Anthropometric measurement was determined by direct measurement of weight, and height, waist circumference and hip circumference. Waist circumference (WC) was measured at the end of several consecutive natural breaths, at a level parallel to the floor, midpoint between the top of the iliac crest and the lower margin of the last palpable rib in the mid axillary line.<sup>22</sup> The hip circumference was measured at a level parallel to the floor, at the largest circumference of the buttocks.<sup>22</sup> Body Mass Index (BMI) was

calculated as  $\text{weight/height}^2$ , Waist-hip ratio (WHR) was calculated as WC/HC. The Body Mass Index and WHR were graded according to the WHO anthropometric classification.<sup>22</sup>

### Method of data collection

The questionnaire was interviewer-administered, with a session lasting an average of 15 minutes per participant. Following informed consent, HIV testing was carried out among patients at the MOP and GOPD clinics, after which the questionnaire was administered to only those who tested negative to HIV, while those who tested positive were excluded from the study. The questionnaire was also administered to HIV-positive patients who consented to participate in the study at the APIN clinic, viral loads of the participants were retrieved from the APIN clinic database. Patients' comorbid status was retrieved from their medical records.

Weight, height, waist and hip circumference of all respondents were measured. Data collection was carried out from 9:00 am to 4:00 pm at the three clinics until the desired sample size was attained. Data collection took place between 15<sup>th</sup> of June 2021 to 30<sup>th</sup> of July 2021.

### Data Management

Data quality checks for completeness and inconsistencies were done after the collection of data.

### Data scoring and grading of tools

Charlson's Comorbidity Index scores the burden of illness. Each disease is scored based on its severity and mortality risk: Myocardial infarction (1 point), congestive heart failure (1 point), peripheral vascular disease (1 point), chronic pulmonary disease (1 point), mild liver disease (1 point), diabetes (1 point), hemiplegia (2 points), moderate to severe renal disease (2 points), diabetes with end-organ failure (2 points), any tumor (2 points), leukemia (2 points), cerebrovascular disease (1 point), dementia (1 point), lymphoma (2 points), moderate to severe liver disease (3 points), metastatic solid tumor (6 points), connective tissue disease (1 point), ulcer disease (1 point). AID (6 points) was eliminated from the data, because it is the exposure of interest. The prevalence of each condition was calculated. The CCI score was graded thus: 0 - no comorbidity, CCI score 1-2 - mild, CCI score 3-4 - moderate, while a CCI score 5 and above was graded as severe comorbidity.<sup>20</sup> The CCI score was re-categorized into "no" for no comorbidity and "yes" for mild, moderate and severe comorbidity.

The WHOQOL-BREF consists of questions that assess the socio-demographic status and four domains of QoL (domains 1-4); the items on each domain are categorized into a five-point Likert's scale ranging from 1-5, with 1 as the lowest state up to 5 being the highest possible state. Each domain score denotes an individual's perception of QoL. The mean score of items within each domain was used to calculate the domain score. Domain scores were calculated and scaled in a positive direction (i.e. higher scores denoted higher quality of life), negative questions were reversed to positive direction. Scores were transformed to a 0-100 scale as follows;

Physical domain =  $((\text{raw score} - 7)/28) \times 100$

Psychological domain =  $((\text{raw score} - 6)/24) \times 100$

Social domain =  $((\text{raw score} - 3)/12) \times 100$

Environmental domain =  $((\text{raw score} - 8)/32) \times 100$

The WHOQOL-BREF is a 26 items questionnaire; the overall QoL was generated by adding all the items. The highest possible score is 130, so a cut-off of less than 70 was regarded as poor QoL while 70 and above was graded as good QoL.<sup>19</sup> Body Mass Index of less than 18.5 indicates underweight, 18.5 to 24.9 kg/m<sup>2</sup> indicates normal weight, 25 to 29.9 kg/m<sup>2</sup> indicates overweight, while above 30 kg/m<sup>2</sup> indicates obesity.<sup>22</sup> For women, Waist Circumference (WC) of ≤80cm was graded as normal, 81-88cm graded as increased, and greater than 88cm was graded as substantially increased. While for men, ≤94cm was graded as normal, 95-102cm as increased, and greater than 102cm as substantially increased.<sup>22</sup> Waist-Hip Ratio (WHR) of ≤0.85 was graded as normal and greater than 0.85 as substantially increased for women. While for men, ≤ 0.90 was normal and greater than 0.90 indicated substantially increased.<sup>22</sup>

### Data analysis

STATA version 13 was used as the statistical package for data analysis. Descriptive statistics was presented using percentages, means standard deviation, frequencies, as appropriate. The Shapiro-Wilk normality test was used to test distribution of continuous variables. Non-parametric test was for non-normally distributed variables as appropriate. Chi-square test was used to evaluate associations between the categorical variables. Univariate analysis using logistic regression was used to determine predictors of comorbidity, variables whose p value are <0.2 are included in the multivariate model.

The z-test was used for comparisons where a reference population mean was available, such as the overall population mean quality-of-life score. The independent-samples t-test was used for comparisons where the population mean was not known and the mean was estimated from the study sample, such as comparisons involving the environmental quality-of-life domain.

All analyses were reported at a statistically significant level of p-value < 0.05.

### Ethical consideration

Ethical approval for this study was requested from the Human Research Ethics Committee (HREC) at Lagos University Teaching Hospital Idi-Araba with the assigned number: ADM/DCST/HREC/APP/4190. Administrative authorization to use the selected clinics in the hospital was obtained from respective Heads of Department. Informed consent was obtained from participants before examination and administration of questionnaires.

### Results

A total of 252 elderly patients were recruited into this study. Of these, nine were unwilling to complete the study and were therefore excluded, giving a response rate of 96%. Of the 243 participants who completed the study, 81 were living with HIV while 162 were HIV-negative.

The distribution of CCI among the two groups revealed that 25.93% of the HIV-positive elderly had no comorbidity, while 2.47% had severe comorbidity. Among the HIV-negative elderly, 39.51% had no comorbidity, while 0.62% had severe comorbidity. A smaller proportion of the HIV-positive elderly had no comorbidity

compared with the HIV-negative elderly, while a higher proportion of the HIV-positive elderly had severe comorbidity compared with the HIV-negative group.

**Table 1: Comparison of socio-demographic characteristics between HIV-positive elderly and HIV negative elderly patients.**

|                                  | HIV positive<br>elderly=81<br>N (%) | HIV negative<br>elderly=162<br>N (%) | Total = 243<br>N (%) | T / X <sup>2</sup> | p-Value              |
|----------------------------------|-------------------------------------|--------------------------------------|----------------------|--------------------|----------------------|
| <b>Age (μ±sd) in years</b>       | <b>64.72±3.83</b>                   | <b>66.21 ±5.62</b>                   | <b>65.71±5.1</b>     | <b>2.15</b>        | <b>0.032*</b>        |
| <b>Age (in year)</b>             |                                     |                                      |                      |                    |                      |
| 60-74                            | 78 (96.30)                          | 148 (91.36)                          | 226 (93.00)          | 2.34               | 0.406 <sup>f</sup>   |
| 75-84                            | 3 (3.70)                            | 12 (7.41)                            | 15 (6.17)            |                    |                      |
| ≥85                              | 0 (0.00)                            | 2 (1.23)                             | 2 (0.82)             |                    |                      |
| <b>Gender</b>                    |                                     |                                      |                      |                    |                      |
| Male                             | 36 (44.44)                          | 54 (33.33)                           | 90 (37.04)           | 2.86               | 0.061 <sup>f</sup>   |
| Female                           | 45 (55.56)                          | 108 (66.67)                          | 153 (62.96)          |                    |                      |
| <b>Highest education</b>         |                                     |                                      |                      |                    |                      |
| None                             | 6 (7.41)                            | 11 (6.79)                            | 17 (7.00)            | 7.12               | 0.068                |
| Primary                          | 30 (37.04)                          | 36 (22.22)                           | 66 (27.16)           |                    |                      |
| Secondary                        | 23 (28.40)                          | 68 (41.98)                           | 91 (37.45)           |                    |                      |
| Tertiary                         | 22 (27.16)                          | 47 (29.01)                           | 69 (28.40)           |                    |                      |
| <b>Marital status</b>            |                                     |                                      |                      |                    |                      |
| Single                           | 0 (0.00)                            | 6 (3.70)                             | 6 (2.47)             | 17.85              | <0.001* <sup>f</sup> |
| Separated                        | 4 (4.94)                            | 0 (0.00)                             | 4 (1.65)             |                    |                      |
| Married                          | 60 (74.07)                          | 101 (62.35)                          | 161 (66.26)          |                    |                      |
| Divorced                         | 1 (1.23)                            | 0 (0.00)                             | 1 (0.41)             |                    |                      |
| Widowed                          | 16 (19.75)                          | 55 (33.95)                           | 71 (29.22)           |                    |                      |
| <b>Caregiver</b>                 |                                     |                                      |                      |                    |                      |
| Yes                              | 62 (76.54)                          | 95 (58.64)                           | 157 (64.61)          | 7.57               | 0.004* <sup>f</sup>  |
| No                               | 19 (23.46)                          | 67 (41.36)                           | 86 (35.39)           |                    |                      |
| <b>Occupation</b>                |                                     |                                      |                      |                    |                      |
| Unemployed                       | 41 (50.62)                          | 95 (58.64)                           | 136 (55.97)          | 2.47               | 0.290                |
| Employed                         | 17 (20.99)                          | 22 (13.58)                           | 39 (16.05)           |                    |                      |
| Self employed                    | 23 (28.40)                          | 45 (27.78)                           | 68 (27.98)           |                    |                      |
| <b>Monthly income (in naira)</b> |                                     |                                      |                      |                    |                      |
| <30000                           | 29 (35.80)                          | 64 (39.51)                           | 93 (38.27)           | 10.05              | 0.023* <sup>f</sup>  |
| 30000-60000                      | 31 (38.27)                          | 73 (45.06)                           | 104 (42.80)          |                    |                      |
| >60000-90000                     | 19 (23.46)                          | 15 (9.26)                            | 34 (13.99)           |                    |                      |
| >90000                           | 2 (2.47)                            | 10 (6.17)                            | 12 (4.94)            |                    |                      |

X<sup>2</sup> denotes chi square test and \*: significant pvalue, Z: z test, μ: mean, sd: standard deviation, f: Fisher Exact

Table 1 shows the comparison of background characteristics between HIV-positive and HIV-negative elderly patients. The HIV-positive elderly had a significantly lower mean age than the HIV-negative elderly (64.72±3.83 years vs. 66.21±5.62 years, P=0.032). The age group 60–74 years predominated in both groups, comprising 96.30% of the HIV-positive and 91.36% of the HIV-negative elderly. There were more females than males in both groups, with females constituting 55.56% of the HIV-positive and 66.67% of the HIV-negative elderly. Secondary education was the most common educational level among the HIV-negative elderly (41.98%), while primary education was the most common among the HIV-positive elderly (37.04%).

There was a statistically significant association between marital status and HIV status (P<0.001). The majority of the participants were married, comprising 74.07% of the HIV-positive and 62.35% of the HIV-negative elderly, while 19.75% of the HIV-positive and 33.95% of the HIV-negative elderly were widowed. A significantly higher proportion of the HIV-positive elderly had a caregiver compared with the HIV-negative elderly (76.54% vs. 58.64%, P=0.004). Most of the participants were unemployed, accounting for 50.62% of the HIV-positive and 58.64% of the HIV-negative elderly. The largest proportion of participants earned between ₦30,000 and ₦60,000 monthly, comprising 38.27% of the HIV-positive and 45.06% of the HIV-negative elderly. There was a statistically significant association between monthly income and HIV status (P=0.023).

**Table 2: Comparison of comorbidity between HIV-positive elderly and HIV negative elderly patients.**

|                   | Comorbidity |            | Total = 243<br>N (%) | X <sup>2</sup> | p-Value             |
|-------------------|-------------|------------|----------------------|----------------|---------------------|
|                   | No          | Yes        |                      |                |                     |
| <b>HIV Status</b> |             |            |                      |                |                     |
| HIV positive      | 21 (25.93)  | 60 (74.07) | 81(33.33)            | 4.38           | 0.025* <sup>f</sup> |
| HIV negative      | 64 (39.51)  | 98 (60.49) | 162(66.67)           |                |                     |

X<sup>2</sup> denotes chi square test and \*: significant pvalue

In Table 2, 21 (25.93%) HIV-positive elderly participants had no comorbidity, while 60 (74.07%) had comorbidity. Among the HIV-negative elderly, 64 (39.51%) had no comorbidity, while 98 (60.49%) had comorbidity. There was a statistically significant association between HIV status and comorbidity (p=0.025).

**Table 3: Comparison of comorbid conditions between HIV-positive and HIV negative elderly patients.**

| Variable                            | HIV positive=81<br>N (%) | HIV negative=162<br>N (%) | Total =243<br>N (%) | Z / X <sup>2</sup> | P - value |
|-------------------------------------|--------------------------|---------------------------|---------------------|--------------------|-----------|
| CCI score (mean±sd)                 | 1.80±1.45                | 1.25±1.23                 | 1.44±1.34           | 2.84               | 0.005*    |
| Diabetes (no chronic complications) | 10 (4.17)                | 35 (14.58)                | 45 (18.75)          | 3.29               | 0.070     |
| Chronic pulmonary disease           | 2 (0.84)                 | 3 (1.26)                  | 5 (2.09)            | 0.09               | 0.771     |
| Cancer                              | 0 (0.00)                 | 1 (0.42)                  | 1 (0.42)            | 0.51               | 0.473     |
| Peptic ulcer disease                | 8 (3.35)                 | 20 (8.37)                 | 28 (11.72)          | 0.40               | 0.527     |
| Cerebrovascular accident            | 1 (0.42)                 | 3 (1.26)                  | 4 (1.67)            | 0.14               | 0.705     |
| Mild liver disease                  | 1 (0.42)                 | 4 (1.67)                  | 5 (2.09)            | 0.44               | 0.507     |
| Myocardial infarction               | 5 (2.09)                 | 2 (0.84)                  | 7 (2.93)            | 4.54               | 0.033*    |
| Diabetes with chronic complication  | 7 (2.92)                 | 8 (3.33)                  | 15 (6.25)           | 1.19               | 0.275     |
| Renal disease                       | 3 (1.26)                 | 3 (1.26)                  | 6 (2.51)            | 0.71               | 0.399     |
| Congestive heart failure            | 7 (2.93)                 | 4 (1.63)                  | 11 (4.60)           | 4.55               | 0.033*    |
| Hemiplegia or paraplegia            | 7 (2.93)                 | 12 (5.02)                 | 19 (7.95)           | 0.08               | 0.777     |
| Metastatic solid tumor              | 1 (0.42)                 | 0 (0.00)                  | 1 (0.42)            | 1.96               | 0.162     |
| Peripheral vascular disease         | 1 (0.42)                 | 2 (0.84)                  | 3 (1.26)            | 0.00               | 0.984     |
| Rheumatological disease             | 22 (9.21)                | 9 (3.77)                  | 31 (12.97)          | 21.85              | <0.001*   |
| Hypertension                        | 40 (16.74)               | 62 (25.94)                | 102 (42.68)         | 2.25               | 0.133     |
| Dementia                            | 0 (0.00)                 | 1 (0.42)                  | 1 (0.42)            | 0.51               | 0.473     |
| Depression                          | 8 (3.35)                 | 4 (1.67)                  | 12 (5.02)           | 6.06               | 0.014*    |

CCI : Charlson Comorbidity Index Z: z test X<sup>2</sup>: chi square  
\*: significant pvalue μ: mean sd: standard deviation

In Table 3, the comparison of the comorbid conditions between HIV-positive and HIV-negative elderly is depicted. The HIV-positive elderly had a statistically significantly higher mean CCI score than the HIV-negative elderly (1.80±1.45 vs. 1.25±1.23, P=0.005). Of note was the higher prevalence of myocardial infarction among the HIV-positive compared with the HIV-negative elderly (2.09% vs. 0.84%, P=0.033), as well as congestive heart failure (2.93% vs. 1.63%, P=0.033), rheumatological disease (9.21% vs. 3.77%, P<0.001), and depression (3.35% vs. 1.67%, P=0.014). These conditions were more prevalent among the HIV-positive elderly.

**Table 4: Comparison of quality of life between HIV-positive elderly and HIV negative elderly patients.**

|                   | Quality of life |            | Total = 243<br>N (%) | X <sup>2</sup> | p-Value            |
|-------------------|-----------------|------------|----------------------|----------------|--------------------|
|                   | Poor            | Good       |                      |                |                    |
| <b>HIV Status</b> |                 |            |                      |                |                    |
| HIV positive      | 52 (64.20)      | 29 (35.80) | 81(33.33)            | 0.01           | 0.517 <sup>f</sup> |
| HIV negative      | 105 (64.81)     | 57 (35.19) | 162(66.67)           |                |                    |

X<sup>2</sup> denotes chi square test and \*: significant pvalue. <sup>f</sup>: Fisher Exact

Table 4 depicts quality of life (QoL) in the two groups. Among the HIV-positive elderly, 52 (64.20%) had poor QoL and 29 (35.80%) had good QoL. Among the HIV-negative elderly, 105 (64.81%) had poor QoL and 57 (35.19%) had good QoL. There was no statistically significant difference in QoL between the two

groups (p=0.517).

**Table 5: Comparison of quality-of-life domains between HIV positive and HIV negative elderly**

|                                    | HIV positive<br>μ±sd | HIV negative<br>μ±sd | Total<br>μ±sd | Test<br>statistics | Pvalue |
|------------------------------------|----------------------|----------------------|---------------|--------------------|--------|
| Physical domain                    | 62.14 ± 13.06        | 65.46±16.36          | 64.36±15.39   | -1.33 <sup>z</sup> | 0.183  |
| Psychological domain               | 64.81±12.77          | 67.68±13.78          | 66.71±13.49   | -1.47 <sup>z</sup> | 0.142  |
| Social relationship                | 61.73±16.07          | 64.08±16.33          | 63.29±16.25   | -0.70 <sup>z</sup> | 0.483  |
| Environmental domain               | 57.60±10.84          | 62.05±15.11          | 60.56±13.97   | -2.36 <sup>t</sup> | 0.019* |
| Self-Perception of Health          | 3.35±0.09            | 3.41±0.07            | 3.38±0.05     | -0.53 <sup>z</sup> | 0.595  |
| Self-Perception of Quality of Life | 3.67±0.84            | 3.59±0.77            | 3.62±0.05     | 1.11 <sup>z</sup>  | 0.268  |
| Over All Quality of Life           | 63.99±12.91          | 65.22±14.04          | 64.81±13.66   | 0.66 <sup>t</sup>  | 0.512  |

\*QOL denotes quality of life, μ=means, sd = standard deviations Z= z test, t=t test

Table 5 shows the comparison of quality-of-life domains between the HIV-positive and HIV-negative elderly. The highest mean QoL score was observed in the psychological domain (66.71±13.49), while the lowest was observed in the environmental domain (60.56±13.97). HIV-positive elderly had lower mean scores than HIV-negative elderly in the physical, psychological, social relationships and environmental domains. However, the difference was statistically significant only in the environmental domain (57.60±10.84 vs. 62.05±15.11, P=0.019). The mean self-perception of health status among the HIV-positive elderly was lower than that of the HIV-negative elderly (3.35±0.09 vs. 3.41±0.07). The mean self-perception of QoL among the HIV-positive elderly was slightly higher than that of the HIV-negative elderly (3.67±0.84 vs. 3.59±0.77). The HIV-positive elderly also had a lower mean overall QoL score than the HIV-negative elderly (63.99±12.91 vs. 65.22±14.04, P=0.512).

**Table 6: comparison of anthropometric parameters between HIV positive and HIV negative elderly patients**

|                            | HIV<br>positive<br>N (%) | HIV negative<br>N (%) | Z test / X <sup>2</sup>   | p-Value             |
|----------------------------|--------------------------|-----------------------|---------------------------|---------------------|
| <b>BMI (μ±sd)</b>          | <b>25.45±4.7</b>         | <b>26.56±3.6</b>      | <b>-1.903<sup>z</sup></b> | <b>0.057</b>        |
| Underweight                | 3 (3.70)                 | 0 (0.00)              | 12.07                     | 0.015* <sup>f</sup> |
| Normal                     | 34 (41.98)               | 51 (31.48)            |                           |                     |
| Overweight                 | 30 (37.04)               | 85 (52.47)            |                           |                     |
| Obesity                    |                          |                       |                           |                     |
| I                          | 11 (13.58)               | 24 (14.81)            |                           |                     |
| II                         | 3 (3.70)                 | 2 (1.23)              |                           |                     |
| <b>Waist Circumference</b> |                          |                       |                           |                     |
| Normal                     | 17 (20.99)               | 33 (20.37)            | 0.57                      | 0.574               |
| Increased                  | 17 (20.99)               | 41 (25.31)            |                           |                     |
| Substantial increase       | 47 (58.02)               | 88 (54.32)            |                           |                     |
| <b>Waist-Hip Ratio</b>     |                          |                       |                           |                     |
| Normal                     | 23 (28.40)               | 41 (25.31)            | 0.27                      | 0.257 <sup>f</sup>  |
| Increased                  | 58 (71.60)               | 121 (74.69)           |                           |                     |

X<sup>2</sup> denotes chi square test and \*: significant pvalue. Z: z test μ: mean, sd: standard deviation, <sup>f</sup>: Fisher Exact

Table 6 shows the anthropometric characteristics of the HIV-positive and HIV-negative elderly. The HIV-negative group had a higher mean BMI than the HIV-positive group (26.56±3.6 kg/m<sup>2</sup> vs. 25.45±4.7 kg/m<sup>2</sup>); however, the difference was not statistically significant (p=0.057). A higher proportion of the HIV-positive elderly were of normal weight (41.98% vs. 31.48%), while a higher proportion of the HIV-negative elderly were overweight (52.47% vs. 37.04%). Obesity was present in 17.28% of the HIV-positive and 16.05% of the HIV-negative elderly. BMI categories differed significantly between the groups (p=0.015). Regarding waist circumference, 58.02% of the HIV-positive and 54.32% of the HIV-negative elderly had substantially increased waist circumference. For waist-hip ratio, 71.60% of the HIV-

positive and 74.69% of the HIV-negative elderly had an increased waist-hip ratio.

Table 7: Association of comorbidity and quality of life among HIV positive and HIV negative elderly

| Severity of comorbidity | Quality of life |            |             |                |         |              |           |            |                |         |
|-------------------------|-----------------|------------|-------------|----------------|---------|--------------|-----------|------------|----------------|---------|
|                         | HIV Positive    |            |             |                |         | HIV Negative |           |            |                |         |
|                         | Poor N(%)       | Good N(%)  | Total N(%)  | X <sup>2</sup> | P-Value | Poor N(%)    | Good N(%) | Total N(%) | X <sup>2</sup> | P-value |
| No comorbidity          | 11 (52.38)      | 10 (47.62) | 21 (100.00) | 3.65           | 0.302   | 30(46.88)    | 34(53.13) | 64(100.00) | 18.09          | <0.001* |
| Mild comorbidity        | 19 (61.29)      | 12 (38.71) | 31 (100.00) |                |         | 49(71.01)    | 20(28.99) | 69(100.00) |                |         |
| Moderate comorbidity    | 20 (74.07)      | 7 (25.93)  | 27 (100.00) |                |         | 25(89.29)    | 3(10.71)  | 28(100.00) |                |         |
| Severe comorbidity      | 2 (100.00)      | 0(0.00)    | 2 (100.00)  |                |         | 1(100.00)    | 0 (0.00)  | 1(100.00)  |                |         |

X<sup>2</sup> denotes chi square test and \*: significant pvalue, Z: z test,  $\mu$ : mean, sd: standard deviation, **f**: Fisher Exact

In Table 7, among the HIV-positive elderly, 47.62% of those without comorbidity had good QoL, while all those with severe comorbidity had poor QoL. There was no statistically significant association between severity of comorbidity and QoL among the HIV-positive elderly (p=0.302). Among the HIV-negative elderly, 53.13% of those without comorbidity had good QoL, while the single participant with severe comorbidity had poor QoL. There was a statistically significant association between severity of comorbidity and QoL among the HIV-negative elderly (p<0.001).

Table 8: Association between anthropometric and comorbidity among the HIV negative and HIV positive elderly

| Anthropometry  | HIV NEGATIVE |                     |             |       | X <sup>2</sup>     | P-value    | HIV POSITIVE |                      |             |                     | X <sup>2</sup> | P-value |
|----------------|--------------|---------------------|-------------|-------|--------------------|------------|--------------|----------------------|-------------|---------------------|----------------|---------|
|                | No co N (%)  | Presence of co N(%) | Total N (%) |       |                    |            | No co N (%)  | Presence of co N (%) | Total N (%) |                     |                |         |
| <b>BMI</b>     |              |                     |             |       |                    |            |              |                      |             |                     |                |         |
| Underweight    | 0 (0.00)     | 0 (0.00)            | 0 (100.00)  | 5.49  | 0.064              | 2 (66.67)  | 1 (33.33)    | 3 (100.00)           | 7.27        | 0.064               |                |         |
| Normal         | 28 (54.90)   | 23 (45.10)          | 51 (100.00) |       |                    | 12 (35.29) | 22 (64.71)   | 34 (100.00)          |             |                     |                |         |
| Overweight     | 32 (37.65)   | 53 (62.35)          | 85 (100.00) |       |                    | 6 (20.00)  | 24 (80.00)   | 30 (100.00)          |             |                     |                |         |
| Obesity        | 8 (30.77)    | 18 (69.23)          | 26 (100.00) |       |                    | 1 (7.14)   | 13 (92.86)   | 14 (100.00)          |             |                     |                |         |
| <b>WC</b>      |              |                     |             |       |                    |            |              |                      |             |                     |                |         |
| Normal         | 21 (63.64)   | 12 (36.36)          | 33 (100.00) | 15.30 | 0.001*             | 9 (52.94)  | 8 (47.06)    | 17 (100.00)          | 9.55        | 0.009*              |                |         |
| Increased      | 22 (53.66)   | 19 (46.34)          | 41 (100.00) |       |                    | 5 (29.41)  | 12 (70.59)   | 17 (100.00)          |             |                     |                |         |
| Sub. increased | 25 (28.41)   | 63 (71.59)          | 88 (100.00) |       |                    | 7(14.89)   | 40 (85.11)   | 47 (100.00)          |             |                     |                |         |
| <b>WHR</b>     |              |                     |             |       |                    |            |              |                      |             |                     |                |         |
| Normal         | 21 (51.22)   | 20 (48.78)          | 41 (100.00) | 1.93  | 0.114 <sup>f</sup> | 10 (43.48) | 13 (56.52)   | 23 (100.00)          | 5.15        | 0.026* <sup>f</sup> |                |         |
| increased      | 47 (38.84)   | 74 (61.16)          | 121(100.00) |       |                    | 11 (18.97) | 47 (81.03)   | 58 (100.00)          |             |                     |                |         |

X<sup>2</sup> denotes chi square test and \*: significant pvalue. Z: z test,  $\mu$ : mean sd: standard deviation, **f**: Fisher Exact

According to Table 8, among the HIV-positive elderly, 80.00% of those who were overweight had a comorbidity, while 92.86% of those who were obese had a comorbidity. There was no statistically significant association between BMI category and comorbidity among the HIV-positive elderly (P=0.064). Presence of comorbidity was significantly associated with waist circumference among the HIV-positive elderly (P=0.009). Among those with substantially increased waist circumference, 85.11% had a comorbidity. There was also a statistically significant association between waist-hip ratio and comorbidity among the HIV-positive elderly (P=0.026), with 81.03% of those with an increased waist-hip ratio having a comorbidity.

Among the HIV-negative elderly, 62.35% of those who were overweight had a comorbidity, while 69.23% of those who were obese had a comorbidity. There was no statistically significant association between BMI category and comorbidity among the HIV-negative elderly (P=0.064). Presence of comorbidity was significantly associated with waist circumference among the HIV-negative elderly (P=0.001), with 71.59% of those with substantially increased waist circumference having a comorbidity. There was no statistically significant association between waist-hip ratio and comorbidity among the HIV-negative elderly (P=0.114).

Overall, presence of comorbidity was associated with BMI among the HIV-negative elderly, as well as waist circumference and waist-hip ratio among the HIV-positive elderly. The largest proportion of participants with substantially increased waist circumference and comorbidity was observed among the

HIV-positive elderly (85.11%) and HIV-negative elderly (71.59%).

Table 9: predictors of comorbidity among the HIV Positive and HIV negative elderly

| Independent variables      | HIV POSITIVE |             |             |         | HIV NEGATIVE |             |             |         |
|----------------------------|--------------|-------------|-------------|---------|--------------|-------------|-------------|---------|
|                            | Adj OR       | 95%CI Lower | 95%CI Upper | P value | Adj OR       | 95%CI Lower | 95%CI Upper | P value |
| Age (in years)             | 0.97         | 0.85        | 1.10        | 0.645   | 1.02         | 0.96        | 1.08        | 0.574   |
| <b>Gender</b>              |              |             |             |         |              |             |             |         |
| Female                     | 6.40         | 2.05        | 19.98       | 0.001*  | 1.49         | 0.76        | 2.92        | 0.248   |
| <b>Occupation</b>          |              |             |             |         |              |             |             |         |
| Unemployed                 | 1.00         | ref         | ref         | ref     | ref          | ref         | ref         | ref     |
| Employed                   | 1.85         | 0.67        | 5.13        | 0.486   | 1.86         | 0.67        | 5.13        | 0.233   |
| <b>BMI</b>                 |              |             |             |         |              |             |             |         |
| Normal                     | 1.00         | ref         | ref         | ref     | 1.00         | ref         | ref         | ref     |
| Overweight                 | 2.03         | 0.66        | 6.27        | 0.219   | 2.56         | 1.24        | 5.28        | 0.011*  |
| Obesity                    | 7.91         | 0.93        | 7.23        | 0.058   | 2.70         | 1.01        | 7.25        | 0.049*  |
| <b>Waist-hip ratio</b>     |              |             |             |         |              |             |             |         |
| Normal                     | 0.50         | 1.50        | 1.78        | 0.230   | 0.49         | 0.24        | 1.00        | 0.049*  |
| Increased                  | 1.00         | ref         | ref         | ref     | 1.00         | ref         | ref         | ref     |
| <b>Waist circumference</b> |              |             |             |         |              |             |             |         |
| Normal                     | 0.90         | 0.23        | 3.40        | 0.877   | 0.40         | 0.15        | 1.24        | 0.119   |
| Increased                  | 1.00         | ref         | ref         | ref     | 1.00         | ref         | ref         | ref     |
| Very increased             | 6.40         | 1.71        | 23.83       | 0.006*  | 1.80         | 0.69        | 4.87        | 0.222   |
| <b>Viral load</b>          |              |             |             |         |              |             |             |         |
| Detectable                 | 0.17         | 0.03        | 0.81        | 0.026*  | NA           | NA          | NA          | NA      |

\*: statistical significant CI: confidence Interval OR: Odds Ratio ref: reference Adj: adjusted

Table 9 depicts the predictors of comorbidity among the HIV-positive and HIV-negative elderly. Among the HIV-positive elderly, females had higher odds of comorbidity than males (adjusted OR=6.40, 95% CI: 2.05–19.98, P=0.001). The odds of comorbidity among those who were overweight were approximately twice those of participants with normal BMI (adjusted OR=2.03, 95% CI: 0.66–6.27, P=0.219), while those who were obese had approximately eight times the odds of comorbidity compared with those with normal BMI (adjusted OR=7.91, P=0.058). The odds of comorbidity among those with substantially increased waist circumference were higher than among those with normal waist circumference (adjusted OR=6.40, 95% CI: 1.71–23.83, P=0.006). Participants with detectable viral load had lower odds of comorbidity than those with undetectable viral load (adjusted OR=0.17, 95% CI: 0.03–0.81, P=0.026).

Among the HIV-negative elderly, the odds of comorbidity among those who were overweight were 2.56 times those of participants with normal BMI (adjusted OR=2.56, 95% CI: 1.24–5.28, P=0.011), while those who were obese had approximately three times the odds of comorbidity compared with those with normal BMI (adjusted OR=2.70, 95% CI: 1.01–7.25, P=0.049). Participants with a normal waist-hip ratio had lower odds of comorbidity compared with those with an increased waist-hip ratio (adjusted OR=0.49, 95% CI: 0.24–1.00, P=0.049).

Discussion

This study was carried out to assess the burden of comorbidity, QOL and anthropometric indices among elderly patients living with HIV and HIV-negative elderly patients attending LUTH. A total of 243 (81 HIV-positive and 162 HIV-negative) elderly patients aged 60 years and above were recruited in the study.

The HIV-positive elderly had a lower mean age compared to the HIV-negative elderly (64.72±3.83 vs. 66.21±5.62 years;

$p=0.032$ ). This is similar to the findings in a Nigerian study by Obimakinde et al.<sup>5</sup> However the mean age in this study is lower, compared to that which was reported in a study done in the United States.<sup>23</sup> This difference can be understood based on higher life expectancy in high income countries compared with the LMIC where this study was conducted. Also, the distribution across age groups did not differ, as the large majority of both groups were aged 60-74 years.

The prevalence of female gender was higher among the HIV-negative group (66.67%) than the HIV-positive group (55.56%). This is also similar to the study by Obimakinde et al.<sup>5</sup> However in a Brazilian study, the male gender predominated the study and control groups.<sup>9</sup> The high concentration of females in this study may indicate better health seeking behavior of females and high burden of HIV infection among females. Majority of the elderly were unemployed, and this could be due to the official retirement age in the country (60 years).

Among the HIV-positive group, 89.89% had an undetectable viral load. This prevalence is higher (79%) compared with the findings in a Brazilian study in an outpatient clinic.<sup>9</sup>

In this study, the HIV-positive elderly had a statistically significant higher CCI score ( $1.80 \pm 1.45$ ) compared with the HIV-negative elderly ( $1.25 \pm 1.23$ ), ( $p=0.005$ ). This finding is similar to a Brazilian study which compared comorbidity using CCI tool among HIV-positive and HIV-negative older and younger adult.<sup>7</sup>

The most prevalent comorbid conditions among the HIV-positive elderly were hypertension (16.74%) and Diabetes (7.09%). Similar previous studies had reported various comorbid conditions among HIV-positive elderly. An African cohort study in four countries (Kenya, Uganda, Tanzania, and Nigeria) reported hypercholesterolemia, hypertension, dysglycemia, cognitive impairment, and renal insufficiency as the most common comorbidities identified among those who were infected with HIV.<sup>6</sup> Also, a study conducted by Balderson et al among 452 EPLHIV aged 50 years and above reported high prevalence of chronic conditions of hypertension (46%), chronic pain (45%), and arthritis (35%), asthma (32%), and diabetes (21%). Hypertension is also the most prevalent condition as observed in this study, although the prevalence is higher than what was observed in this study (46% vs. 16.74%). In addition, 94% reported presence of chronic disease which is higher than what was observed in our study (37.97%). These differences may be due to sample population, sample size and data collection tools used for the study.

It is worthy of note that the HIV-positive group had higher prevalence of myocardial infarction (2.09% vs. 0.84%;  $p=0.033$ ), and congestive heart failure (2.93% vs. 1.63%;  $p=0.033$ ). This finding is similar to that in a study by Alonso et al which reported a higher incidence of myocardial infarction and heart failure among people living with HIV (PLWHA) compared to those who were HIV-negative.<sup>24</sup> Also, the prevalence of rheumatological diseases in the HIV-positive elderly compared to the HIV-negative elderly in this study (9.21% vs. 3.77%;  $p<0.001$ ) is similar to that by Walker et al. which observed high prevalence of rheumatic diseases among PLWHA.<sup>25</sup> Lastly, the prevalence of depression among HIV-positive elderly in this study was significantly higher compared to

HIV-negative elderly (3.35% vs. 1.67%;  $p=0.014$ ). This can be explained to be due to the burden of antiretroviral therapies (ART), HIV-related stigma and loneliness among the HIV-positive older group.<sup>26</sup>

The HIV-positive elderly had lower mean scores than the HIV-negative elderly in the physical, psychological, social relationship and environmental domains of QoL, but the difference was statistically significant only in the environmental domain ( $57.60 \pm 10.84$  vs.  $62.05 \pm 15.11$ ;  $p=0.019$ ). There was no significant difference between the two groups in overall QoL ( $63.99 \pm 12.91$  vs.  $65.22 \pm 14.04$ ;  $p=0.512$ ), self-perception of health ( $p=0.595$ ) or self-perception of QoL ( $p=0.268$ ), and the proportions with poor QoL were almost identical (64.20% vs. 64.81%;  $p=0.517$ ). Thus, in this study, HIV infection was associated with a lower environmental QoL but not with a lower overall QoL. The relatively preserved QoL among the HIV-positive elderly is in keeping with a study in Ibadan, Nigeria, in which people living with HIV and AIDS had good QoL in all domains except the social domain.<sup>10</sup> In both groups, the highest mean score was in the psychological domain and the lowest in the environmental domain, which may point to the socioeconomic circumstances of older persons in this setting.

Among the HIV-negative elderly, QoL declined progressively with increasing severity of comorbidity ( $p<0.001$ ). This is consistent with previous studies that reported lower QoL with an increasing burden of comorbidity among elderly outpatients<sup>17</sup> and among persons living with HIV.<sup>7</sup> A similar gradient was observed among the HIV-positive elderly (52.38%, 61.29%, 74.07% and 100% respectively), but the association was not statistically significant ( $p=0.302$ ). This is likely to reflect the smaller size of the HIV-positive group, particularly the very small number with severe comorbidity ( $n=2$ ), rather than an absence of association, since the direction of the relationship was the same in both groups. It is also notable that more than half (52.38%) of the HIV-positive elderly without comorbidity had poor QoL, which suggests that factors other than comorbidity contribute to poor QoL in this group.

The HIV-positive elderly had a lower BMI compared with the HIV-negative elderly ( $25.45 \pm 4.7$  vs.  $26.56 \pm 3.6$ ;  $p=0.057$ ), although not statistically significant; and underweight was found only among the HIV-positive elderly (3.70%). This finding is consistent with the findings of Maciel et al., who reported a higher mean BMI among HIV-negative controls than among persons living with HIV.<sup>9</sup> A larger proportion of the HIV-negative elderly were overweight (52.47% vs. 37.04%), whereas more of the HIV-positive elderly had normal weight (41.98% vs. 31.48%). The prevalence of obesity was similar in both groups (17.28% vs. 16.05%).

On multivariate analysis, the predictors of comorbidity differed between the two groups. Among the HIV-positive elderly, female gender (aOR: 6.40, 95% CI: 2.05-19.98,  $p=0.001$ ) and a very increased waist circumference (aOR: 6.40, 95% CI: 1.71-23.83,  $p=0.006$ ) were independent predictors of comorbidity. Among the HIV-negative elderly, being overweight (aOR: 2.56, 95% CI: 1.24-5.28,  $p=0.011$ ) and obese (aOR: 2.70, 95% CI: 1.01-7.25,  $p=0.049$ ) were independent predictors of comorbidity, while a normal waist-hip ratio was associated with lower odds of comorbidity (aOR: 0.49, 95% CI: 0.24-1.00,  $p=0.049$ ). This is consistent with previous

reports that elderly persons who are overweight or obese are at higher risk of chronic comorbidity.<sup>12</sup> Majority of the participants in this study were unemployed. Unemployment may be related with reduced level of activity and a sedentary lifestyle which could lead to increase in obesity and overweight, both of which are risk factors for chronic disease.

### Strength

The viral load of the patients with HIV was determined and correlated with quality of life. In addition, a validated tool, Charlson Comorbidity Index questionnaire, was used to assess comorbid conditions while WHOQOL-BREF questionnaires were used to compare quality of life domains among HIV-positive and HIV-negative participants.

### Limitation of the study

This study was cross-sectional, hence temporal relationship could not be generated between the independent variables and dependent variables. The study was also hospital-based, and therefore may not be fully representative of older persons in the general population. The recruitment of participants from specific hospital clinics may also have introduced selection bias. The relatively modest sample size, particularly for the regression analysis, may have limited the statistical power to detect some associations and may have resulted in less precise estimates. Although relevant variables were included in the analysis, residual confounding from unmeasured or inadequately measured factors cannot be excluded.

Records of CD4 count of the elderly People Living With HIV/AIDS (PLWHA) were not obtained because the participants were not routinely required to do it. Information on comorbidities was obtained from existing medical records and may not have completely reflected the participants' current clinical status. In addition, the duration of antiretroviral therapy was not available and could not therefore be assessed in relation to comorbidity or quality of life.

### Implications and recommendations for future research

There is a need for health promotion programs to ensure optimal body weight in order to reduce the risk of non-communicable disease and improve quality of life of the elderly most especially among HIV-positive elderly. Future research may focus on relating CD4 counts with comorbidity and quality of life among HIV-positive patients.

### Conclusion

This study revealed that EPLHIV had a higher burden of comorbidity than HIV-negative elderly persons, with a higher mean CCI score, a higher prevalence of comorbidity and a more severe distribution of comorbidity.

EPLHIV had lower scores than HIV-negative elderly in all QoL domains, but the difference was statistically significant only in the environmental domain. Overall QoL and the proportion with poor QoL did not differ between the two groups. Increasing severity of

comorbidity was significantly associated with poor QoL among HIV-negative elderly, and a similar but non-significant trend was observed among EPLHIV.

HIV-negative elderly were more often overweight than EPLHIV. Female gender and very increased waist circumference were independent predictors of comorbidity among EPLHIV, while overweight and obesity were independent predictors among HIV-negative elderly.

### Competing interests

The authors declare no financial or personal relationship(s) that may have inappropriately influenced the writing of this article.

### Authors' contributions

BAA conceptualized, designed, interpreted the data and wrote the first draft of the manuscript while Literature search, data acquisition, analysis and interpretation were performed by MOO, MSO, OO, OAO, SO, and PO. Critical revision of the manuscript and data interpretation was done by FO, MSO, THA, OAO, KD and THA. All authors approved the final version to be published and BAA is the guarantor and will be responsible for the integrity of the work as a whole from inception to published article

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### Data availability

Raw data supporting the findings of this study are available from the corresponding author (BAA) on request.

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The views expressed in the submitted article are ours and not an official position of the institution or funder.

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