The Prevalence, Pattern and Burden of Multimorbidity Among Older Adults in Niger State, Northern Nigeria

Abstract

Objective: While public health planners and practitioners are increasingly aware of the role of inequity in health, the burdens of disease measures have not kept pace with this knowledge. Hence, the aim of this study is to determine the prevalence, and patterns of multimorbidity and to understand the burden of multimorbidity in Niger State Nigeria.

Method: Data were collected on a cross-section of 734 older adults 60 years and older in Niger northcentral Nigeria. The morbidity was assessed by adopting the list of chronic diseases used in prospective urban and rural epidemiology (PURE) studies. Collected data was entered electronically via JISC online survey software between October 2021 and February 2022. The data were analyzed by IBM SPSS version 27. Relational association rules were used for determining the pattern of multimorbidity.

Results: The prevalence of multimorbidity for the study was 51.9%. The commonest dyad combination of multimorbidity among the respondents is hypertension and diabetes mellitus. The top triad of multimorbidity combinations for 3 disease conditions is hypertension, diabetes, and stroke. Hypertension, diabetes, and peptic ulcer represent the highest disease burden respectively.

Conclusion: Health conditions like hypertension, diabetes, and acid-peptic diseases are commonly occurring in clusters of multimorbidity. And they represent the greatest disease burden. To reflect the clinical reality of older adults, identifying the common pattern will provide insight for a more integrative multidisciplinary approach focusing on prevention and better management of these disease conditions in groups.

Keywords: Burden, Multimorbidity, Pattern, Prevalence, Niger State, Nigeria

Introduction

Multimorbidity is defined as the simultaneous presence of more than one health condition in the same individual [1–5] and multimorbidity patterns as the most frequent combination of specific disease pairs and the groups of health conditions with the highest degree of association using the corresponding statistical analyses of either cluster or factor analysis [6]. The multimorbidity global prevalence estimates ranged from 12.9% in the general population to 95.1% among people 65 years and older [6]. Disease conditions such as hypertension and diabetes are the most common in older adults, especially after 60 years of age, and sometimes they occur together [7]. The principal challenge facing the healthcare systems now and in the coming decades is handling multimorbidity, due to its adverse health and economic implications and for health workers whose decisions are principally supported by single disease-specific guidelines (Salisbury et al., 2011a). To improve safety in primary care, it is essential to take into account care of people with multimorbidity.

Patients with multimorbidity usually have more complications in terms of having complex symptoms, and higher mortality rates and more often they do not receive cost-effective treatment when compared with individuals with a single disease [8]. The complications linked to multimorbidity made the patients more prone to the economic and medical burdens that can lead to damage to their physical and mental health and overall reduced quality of life [8,9]. Additionally, multimorbid patients are prone to frequent hospitalization, polypharmacy, treatment burden, and mortality [10,11]. Multimorbid are more likely to die prematurely, and they are frequently associated to increase healthcare utilization [12,13]. In

high-income countries, individuals with multimorbidity make up 78% of all consultations in primary care [14]. Moreover, it is mainly responsible for increase in out-of-pocket expenditure in developing countries.

Multimorbidity as opposed to co-morbidity is considered as a more patient-centered concept and a better reflection of disease burden, this is because regardless of which diseases started first, each disease is regarded has having equal importance [15]. At its most basic level, the 'burden of disease' in public health reports simply characterizes the existence of a disease in a particular population. Non-communicable diseases (NCDs) burden in Low and middle-income countries (LMICs) is undeniably enormous following rapid urbanization, change in nutrition, and epidemiological transitions, this is superimposed on a fragile health and social protection system [16,17]. For instance, LMICs are experiencing a rapid increase in the prevalence of NCDs while the burden of infectious diseases and malnutrition remains significant [18]. This dual burden of infectious and non-infectious disease represents a challenge for population health and healthcare system in developing countries [19]. Sadly, the healthcare system, particularly public health is yet to adjust to accommodate these challenges efficiently.

Irrespective of how disease burden is measured, the burden of disease represents the cornerstone of public health planning and practice. They provide valuable information about the impact of disease and help guide decisions about when and where to intervene. While public health planners and practitioners are increasingly aware of the role of inequity in health, the burdens of disease measures have not kept pace with this knowledge. Prevalence estimates are generally lower in LMICs than in High-income

countries (HICs), and the limited studies from LMICs reported anticipated increases in multimorbidity in the coming years [20]. Considering the fact that the high prevalence of multimorbidity and its burden on both patients and healthcare are less documented in Low- and Middle-Income Countries compared to high-income countries, it's a pointer that less attention is being paid to this phenomenon by these countries. However, understanding which diseases pose the greatest threat to health and well-being, will help public health practitioners and policymakers to be better prepared and decide how to use limited resources for maximum benefit.

Methods

We conducted a questionnaire-based, cross sectional descriptive study between October 2021 and February 2022.

The setting

The survey was conducted at the outpatient department of four public secondary health facilities in Niger state Nigeria. A purposeful sampling method was used to select 4 high-volume general hospitals, one each in the three geopolitical districts and one in the state capital, all having a good representative of multimorbid patients.

Study population

Patients presenting to the outpatient departments of the selected hospital were invited to participate in the study if they were at least 60 years old and older. A systematic random sampling was used to select 734 patients with 2 or more chronic diseases (multimorbidity) aged 60 years and above (as part of a larger study, the detail on sample size

determination was discussed in our earlier studies[21,22]) who presented for routine ambulatory outpatient and consented to participate in the study. However, the study excluded patients having communication problems and the acutely and severely sick that will need admission and/or a specialized line of management. Additionally, patients with any form of cognitive impairment were also excluded.

Measurement of variables

The questions on socio-demographic characteristics of participants were collected, which included age, sex, ethnicity, marital status, types of family or composition of the family, level of education, types of occupation, and monthly family income.

Multimorbidity was operationalized according to the definition recommended by the National Institute for Health and Care Excellence (NICE): the presence of "two or more long-term health conditions. A simple count of individual chronic conditions was used as the approach to measuring multimorbidity, which is also the most common across the literature (Huntley et al., 2012). For this study, multimorbidity comprised self-reported conditions (patient's diagnosis) and confirmation of diagnoses through the use of the patient case note (folder). A total of 21 noncommunicable chronic diseases were included in the study. The morbidity was assessed by adopting the list of chronic diseases used in prospective urban and rural epidemiology (PURE) studies because the disease on the list fulfills WHO criteria for chronic diseases. This includes hypertension, diabetes, peptic ulcer, arthritis, heart failure, stroke, other heart diseases, angina, COPD, CLD, obesity, depression, asthma, cataract, chronic renal failure, osteoporosis, glaucoma, tuberculosis, emotional & mental illness, cancer, Alzheimer's disease, and dementia.

Statistical analysis

The data was collected face-to-face, entered into JISC online survey and exported to SPSS. For this study, all participants have 2 or more chronic diseases. And the highest number of chronic diseases in an individual in this study was 5. The prevalence of multimorbidity was calculated from the total number of all patients that presented to outpatients of the 4 hospitals during the lifespan of data collection. For clustering or pattern of multimorbidity, relational association rules were used. Relational association rules are an extension of ordinal association rules, which are a particular type of association rules that describe numerical orderings between attributes that commonly occur over a dataset [23]. This rule was also adopted in newer studies [24]. Firstly, cross-tabulation of all chronic diseases in the study was done to find the dyad pattern of multimorbidity. The result was presented in a correlation matrix table. For the triad, tetra, and Penta of morbidities combination, the individual's morbidities were summed up and categorized into 4 groups based on the number of chronic diseases (2, 3, 4, and 5). An independent chi-square was performed against each category of multimorbidity. The percentage of the dyads, triad, tetra, and Penta morbidities were determined by the frequency of the chronic disease in the category divided by the total of the category and then multiple by 100. The chronic diseases were presented in frequency and percentage and were disaggregated by gender. Chronic disease was also grouped based on systems and system contributions were calculated and highlighted accordingly.

Results

Here 734 out of 800 contacted participants agreed to participate in the study, accounting for 91.8% response rate. 66 of them withdrew from the study for personal reasons. The analysis of the sociodemographic data is shown in table 1.

Table 1. Socio-demographic characteristics of the respondent. (n= 734)		
Variables	n	%
Gender		
Male	300	40.9
Female	434	59.1
Total	734	100
Age * 67.37 (66.37 for male and 68.06 for female)		
60-64	262	35.7
65-69	267	36.4
70-74	123	16.8
75-79	29	4.0
80 and greater	53	7.2
Total	734	100.0
Marital status		
Never married	11	1.5
Currently married	483	65.8
Divorced	21	2.9
Separated	19	2.6
Widow/er	200	27.2
Total	734	100.0
Family structure		
Nuclear Family	140	19.1
Three Generation Family	150	20.5
Extended Family	442	60.4
Total	732	100.0
Education level		
Illiterate	462	62.9
Can read and write	35	4.8
Primary school level	74	10.1
secondary school	64	8.7
Tertiary school	83	11.3
Post-graduate	16	2.2
Total	734	100.0
Occupation		
Government staff	36	4.9
Own business	280	38.1
Involve in the family business	36	4.9
Company staff/ worker	30	4.1
Dependent	214	29.2
Retired	128	17.4
Others (specify)	10	1.4
Total	734	100
Ethnicity		
Gwarri	193	26.3
Hausa	174	23.7
Nupe	204	27.8
Others	163	22.2
Total	734	100

Level of income		
0-15k naira	477	65.0
16k-30k naira	124	16.9
31k-45k naira	30	4.1
46k-60k naira	27	3.7
greater than 60 naira	76	10.4
Total	734	100

Prevalence of multimorbidity and burden of chronic diseases

The main objective of this phase of the study is to determine the prevalence and pattern of chronic disease conditions and their burden among older people in Niger state Nigeria. Figure 1, the prevalence of chronic health conditions in the sample. The 3 leading chronic diseases in both sexes were hypertension 68.4% (37.45% males and 62.55 males), diabetes 55.30% (40.15 males, and 59.85% females), and peptic ulcer 22.60% (33.73% males and 66.27%). Arthritis was the fourth most common chronic health disease among males and post-CVD (stroke) among females. In both sexes, heart failure came in fifth place. The least common chronic health disease among males is Alzheimer's disease & dementia, and epilepsy in females. Cardiovascular system disease was the most affected system, contributing about 46% (339) of the multimorbidities, followed by the endocrine system at 20.6% (151) and gastroenterology at 10.6% (78). The least affected system was the oncology system with 5 persons see table 2. The overall prevalence of multimorbidity for this study was estimated to be 51.9%. see table 3.

Hypertension, diabetes, and peptic ulcer account for the first, second, and third medical conditions responsible for the most hospital visit, contributing 29.8%, 19.6%, and 8.6% respectively of all the visits by the multimorbid patients in Niger state, Nigeria, see figure 2. Heart failure (8.3%) and stroke (post cerebrovascular accident disease) (7.2%) make up the top five and together they represent the leading cause of disease burden in this study. Similarly, findings from table 4 shows the association of multimorbidity with disease

cluster of multimorbidities. In all categories of multimorbidities, i.e., either in 2,3,4 or 5 chronic diseases hypertension and diabetes are the most implicated chronic medical conditions.
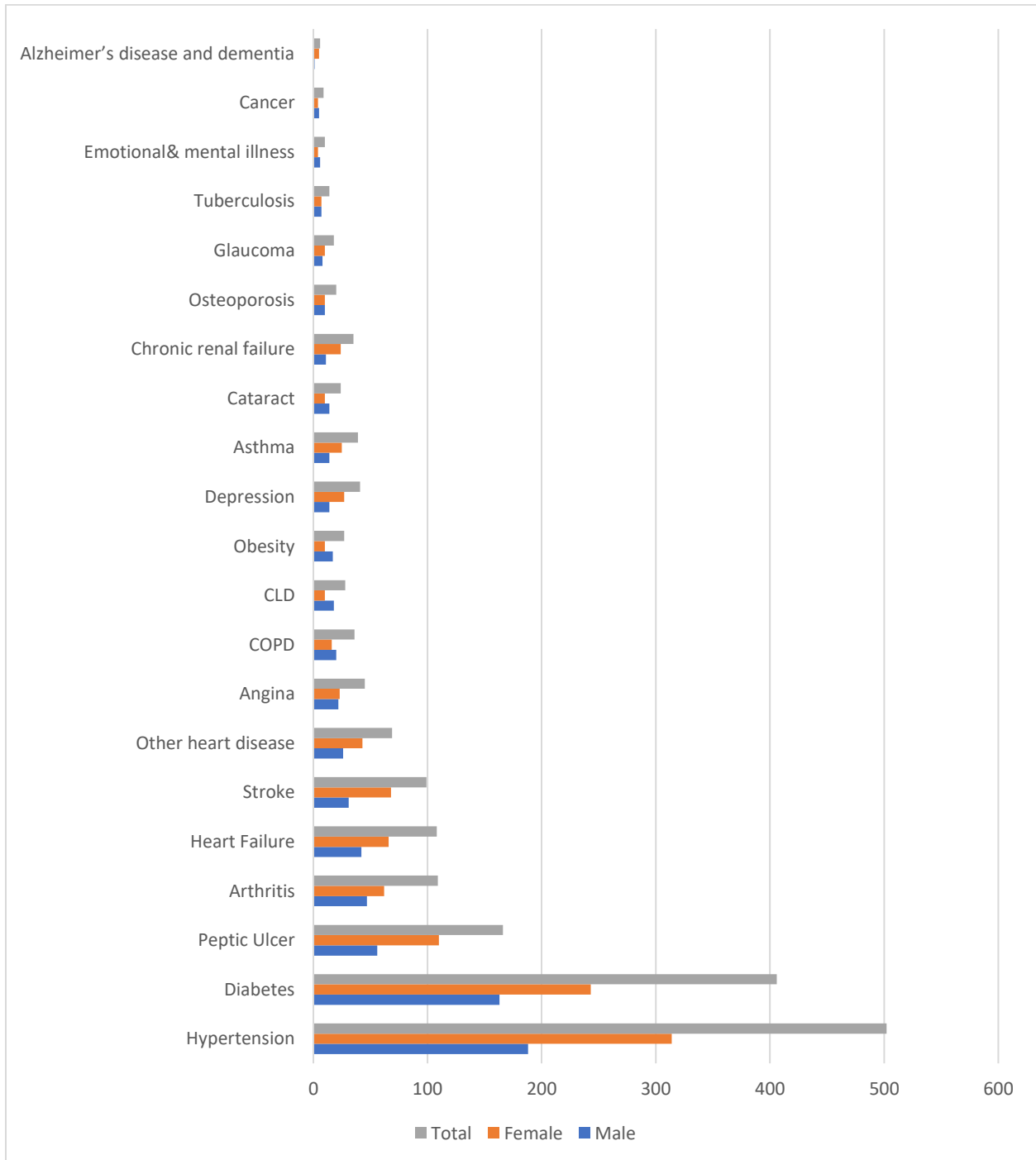
Table 2 % contribution of Multimorbidity by systems

	n	%	% System contribution to MM
Cardiovascular system diseases			
Hypertension	219	29.8	
Heart failure	61	8.3	46.1
Other heart diseases	33	4.5	
Angina/heart attack	26	3.5	
Total	339	46.1	
Endocrinology system			
Diabetes mellitus	144	19.6	20.6
Obesity	7	1.0	
Total	151	20.6	
Gastroenterology			
Peptic ulcer	63	8.6	10.6
Chronic liver disease	15	2.0	
Total	78	10.6	
Respiratory system			
Asthma	7	1.0	4.6
Chronic obstructive pulmonary disease	16	2.2	
Tuberculosis	10	1.4	
Total	33	4.6	
Musculoskeletal system			
Arthritis	14	1.9	2.4
Osteoporosis	4	0.5	
Total	18	2.4	
Central nervous system			
Cerebrovascular disease (stroke)	53	7.2	
Depression	11	1.5	9.9
Emotional and mental illness	10	1.3	
Total	73	9.9	
Renal system			
Chronic renal disease	16	2.2	2.2
Total	16	2.2	
Ophthalmology			
Cataract	9	1.2	2.3
Glaucoma	8	1.1	
Total	17	2.3	
Oncology			
Cancer	5	0.7	0.7
Total	5	0.7	
Others	4	0.6	0.6
Total	734	100	100

			Total number of patients that presented to GOPD of the 4 selected secondary facility during data collection	Patients with multimorbidity during data collection	
Months	Males	Females			
Oct 2021	264	657	921	468	Prevalence of multimorbidity 51.9 %
Nov 2021	287	581	868	462	
Dec 2021	290	564	854	403	
Jan 2022	302	662	964	470	
Feb 2022	137	560	697	432	
Total	1280	3024	4304	2235	

Table 3 Total number of patient with multimorbidity over the survey lifespan and prevalence of multimorbidity
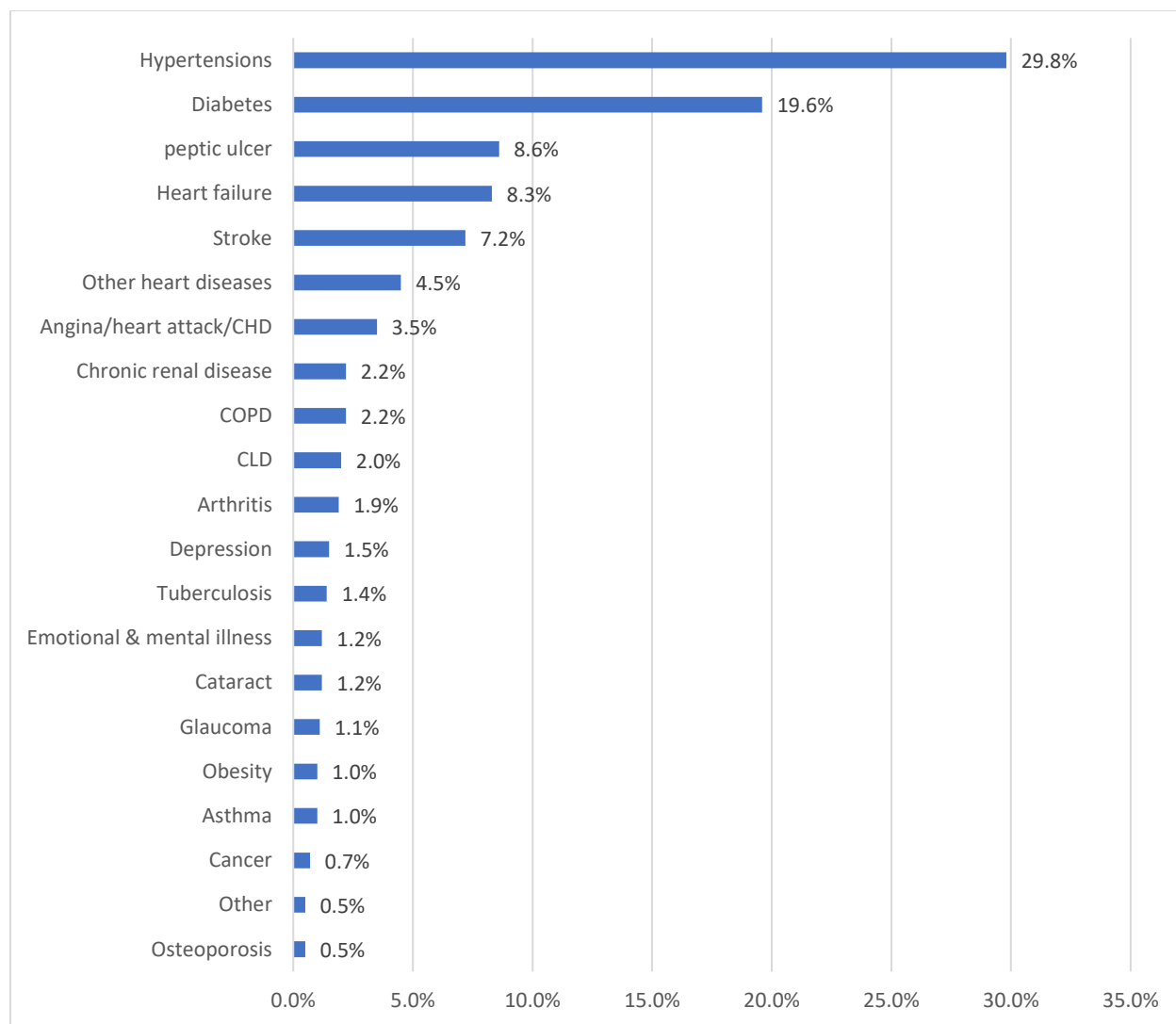
Table 4 Association of morbidity with patterns of multimorbidity

Multimorbidity	Multimorbidity (Number of chronic diseases)				
	Two	Three	Four	Five	Total
Diabetes	197	167	30	12	406
Hypertension	272	179	37	14	502
Stroke	15	58	17	9	99
Angina	27	45	1	2	45
Heart failure	35	45	21	7	108
Other heart diseases	38	24	5	2	69

Cancer	6	3	0	0	9
COPD	21	15	0	0	36
Asthma	33	6	0	0	39
Tuberculosis	13	1	0	0	14
Osteoarthritis	40	48	12	9	109
Osteoporosis	15	4	1	0	20
Cataract	14	6	2	2	24
Glaucoma	12	3	2	1	18
Depression	9	22	5	5	41
Emotional mental illness	6	3	0	0	9
Acid peptic disease	108	46	9	2	165
Chronic liver disease	17	9	3	0	28
Obesity	6	17	3	1	27
Alzheimer's disease and dementia	1	3	1	1	6
Chronic renal failure	15	16	4	1	36

Patterns of Multimorbidity

The commonest dyads (2 chronic diseases) combination of multimorbidity among the respondents in the study is hypertension + diabetes mellitus contributing to about 19% of all the possible combinations of multimorbidity when considering 2 chronic disease conditions. See the cross-tabulation in table 5. Hypertension + heart failure, hypertension + stroke, and hypertension + acid peptic diseases. Diabetes + heart failure completes the top ten of the dyads of multimorbidity.

From table 6 the top triad of multimorbidity i.e., the commonest combination of 3 disease conditions is first (hypertension + diabetes + stroke), second (hypertension +diabetes + osteoarthritis), and third (hypertension + diabetes + acid peptic diseases. The commonest

combination of 4 chronic disease conditions is (hypertension + diabetes + heart failure + stroke) followed by (hypertension + diabetes + heart failure + osteoarthritis). Hypertension + diabetes + heart failure + acid peptic disease or angina. Two patterns of multimorbidity of 5 chronic diseases were observed in the study predominantly. The first is the combination of (hypertension + diabetes + stroke + osteoarthritis + heart failure) and the second is (hypertension + diabetes + stroke + osteoarthritis + acid peptic). For all classes of multimorbidity, it is higher in females than males (figure 3).

Table 5   Dyads combination of multimorbidity

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Hypertension	1	1	306	70	64	89	85	50	22	10	9	14	21	6	5	119	4	15	0	0	0	5
Diabetes Mellitus	2	306	1	58	49	47	63	18	11	7	5	16	26	6	20	22	4	4	0	3	1	2
Acid peptic disease	3	70	58	1	22	10	5	10	7	7	6	1	2	28	2	3	2	0	1	1	2	0
Arthritis	4	64	49	22	1	15	11	10	7	4	1	5	5	2	4	3	1	2	0	3	0	0
Heart failure	5	89	47	10	15	1	21	5	8	4	2	3	3	1	0	4	0	2	0	0	1	0
Stroke	6	85	63	5	11	21	1	5	2	0	0	0	14	0	0	4	1	1	0	0	1	3
Other heart diseases	7	50	18	10	10	5	5	1	0	2	0	3	1	0		1	2			1		1
Angina	8	22	11	7	7	8	2	0	1	3	0	4	2	0	0	0	1	0	0	0	0	1
Chronic Obstructive Pulmonary Diseases	9	10	7	7	4	4	0	2	3	1	7	3	0	0	0	0	3	0	0	0	1	0
Chronic liver disease	10	9	5	6	1	2	0	0	0	7	1	1	2	0	1	1	1	0	4	0	0	0
Obesity	11	14	16	1	5	3	0	3	4	3	1	1	0	1	0	2	0	0	0	0	0	0
Depression	12	21	26	2	5	3	14	1	2	0	2	0	1	0	4	0	0	2	2	1	2	1
Asthma	13	6	6	28	2	1	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0
Cataract	14	5	20	2	4	0	0	0	0	0	1	0	4	0	1	0	2	0	0	0	2	0
Chronic renal failure	15	19	22	3	0	4	4	1	0	0	1	2	0	0	0	1	1	0	1	0	0	0
Osteoporosis	16	4	4	2	1	0	1	2	1	3	1	0	0	0	2	1	1	1	4	0	0	0
Glaucoma	17	15	4	0	2	2	1	0	0	0	0	0	2	0	0	0	1	1	1	0	0	0
Tuberculosis	18	0	0	1	0	0	0	0	0	0	4	0	2	1	0	1	4	1	1	0	0	0
Emotional mental illness	19	0	3	1	3	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0
Cancer	20	0	1	2	0	1	1	0	0	1	0	0	2	0	2	0	0	0	0	0	1	0
Alzheimer's disease and dementia	21	5	2	0	0	0	3	1	1	0	0	0	1	0	0	0	0	0	0	0	0	1

Discussion

In this cross-sectional study among multimorbid older adult patients receiving care at 4 high-volume general hospitals, the total number of diseases in an individual range from 2 to 5 chronic diseases. The total number of health conditions in individuals increases with advancing age, this is consistent with findings in the earlier studies. See for example [25–28]. This steady finding is important because reported that if we are to deal with an increasing prevalence of multimorbidity in an ageing population, we need to know about disease combinations so we can design best practice guidelines for clinicians [29]. To our knowledge, this is the first study to determine the pattern of multimorbidity only among multimorbid patients in Niger state north-central Nigeria. A worldwide study reported that multimorbidity varies between 55% and 98% among people aged 65 and over (Marengoni et al., 2011a). the prevalence of multimorbidity in our study is 51.9%, this is consistent with findings in other studies from Canada 49.4% [30], Ireland 53.7% [31], but was less than the value in Burkina Faso 65% [32] and falls within the prevalence estimates range from 27% to 74.4% among elderly Nigerians. And closest to 49% in a study in Anambra.

higher than the value in Nigeria 27% [33]. This is, however, lower than finding from other parts of the world. For example, a study in Belgium showed that the multimorbidity rate was as high as 82.6%[34] and another study in Australia showed that 83.2% of the respondents suffered from multimorbidity [35].

The prevalence of multimorbidity among studies should be interpreted and reported with caution because of differences in the definition of multimorbidity, demography of the

sample and different study methodologies [36]. This could be the explanation for the contrasting differences studies in Belgium showed that the multimorbidity rate was as high as 82.6% [35] and another study in Australia showed that 83.2% of the respondents suffered from multimorbidity [37].

So many dyads' combinations of morbidities have been reported in previous studies. The commonest dyads pair in this study are hypertension and diabetes which is consistent with a previous Nigeria study [29]. However, this is inconsistent with findings that reported rheumatoid and digestive disease as the most frequent dyads [27,37]. For triads of morbidities, hypertension, diabetes, and post-cerebrovascular disease were the commonest in this study. This partially coincides with other study who reported the highest prevalence was in HBP, diabetes, and heart problem (10.3), and HBP, heart problems, and Osteoarthritis (9.8%) [29]. However, the result partially disagreed with findings from other studies where Arthritis or rheumatism, stomach or other digestive diseases, and hypertension were the commonest triads [34,37]. While it was evident that arthritis can easily coexist in these studies, the medical condition that easily co-exists in our study is hypertension mainly because the prevalence of hypertension in this study is high (28.9%), substantiating with existing studies in Nigeria [38].

Figure 1 ranked health conditions according to the reason for hospital visits. Hypertension and diabetes represent the greatest burden, this was buttressed by a high relative risk for hypertension and diabetes (27.72, and 22.42 respectively). Hypertension and diabetes are also among the leading component of all the leading morbidity in the dyads and triads, tetra and Penta commonly occurring diseases in multimorbidity in this study. Though the frequent occurrence of hypertension or diabetes in multimorbidity in this study might be

simply due to the high prevalence of these diseases, this is vital when designing and implementing management guidelines for multimorbid patients in this part of the world. This is consistent with findings from other studies, see for example [38–40].

Strength and Limitation

Although the result of this study revealed the burden of multimorbidity and the existence of associations beyond chance among the different diseases, which has the potential to address this emerging health priority holistically, by adopting a more integrated and sustainable model of care, the sample selection is limited to 4 hospitals in Niger state, thus the findings cannot be generalized to Nigeria. However, the study can be replicated elsewhere in the country to increase its impact.

Conclusion

In all categories of multimorbidity, women are more affected than men, perhaps because women live longer. Chronic disease conditions like hypertension, diabetes, and acid peptic diseases are commonly occurring in clusters of multimorbidity with the first 2 representing the greatest burden of morbidities. Information on burden of disease provide valuable information about the impact of disease and this will help guide decisions about when and where to intervene.

List of figure legend

1. Figure 1 is a bar chart showing the frequency of chronic diseases, aggregated by gender among older adults in Niger state north-central Nigeria.

2. Figure 2 is a Pareto chart showing the chronic disease with the percentage of hospital visits among older adults in Niger state north-central Nigeria.

3. Figure 3 is a bar chart showing the relationship of the number of chronic diseases (multimorbidity) and gender among older adults in Niger state north-central Nigeria. In all categories of multimorbidity, females are more affected.

Consent
Participants freely signed their informed consent about 24 h prior to participating in the study, and the individual's right to withdraw partially or completely was observed. Infor med Consent Statement: Participants freely signed their informed consent about 24 h pr ior to participating in the study, and the individual's right to withdraw partially or complet ely was observed.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

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