

Research Article

Prevalence and Pattern of Multi-Morbidity among Elderly People in Rural Nigeria: Implications for Health Care System, Research and Medical Education

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Abstract

Background: Nigeria now faces a growing burden of chronic diseases. Long-term disorders are the main challenge facing health-care systems worldwide, but health systems are largely configured for individual diseases rather than multi-morbidity.

Objective: The study aims to determine the prevalence and patterns of Multi-morbidity among Nigerian elderly and the implications for health care system, research and medical education.

Methodology: A cross-sectional study was conducted among 1650 rural elderly in Nigeria between August 2014 to February 2015. Data were collected using questionnaire, history taking, self-report and medical records. Logistic regression analyses were performed to determine the association between socio-demographic factors and multi-morbidity.

Results: The prevalence of multi-morbidity in this study was 68.4% and it increases with age. Age ≥ 70 was associated with multi-morbidity in multivariate analysis: adjusted OR = 1.72, 95% CI (1.03–2.77, $p = 0.03$). The most common chronic diseases were hypertension (84.2%) 95% CI (81.7; 86.7), diabetes mellitus (26.8%) 95% CI (23.3; 30.3), osteoarthritis (37.9%) 95% CI (34.6; 40.4), visual impairments (25.5%) 95% CI (23.1; 27.9) and malnutrition (33.3%) 95% CI (30.5; 36.1). Those aged ≥ 70 had significantly more malnutrition (39% vs. 20%, $P = 0.004$) and osteoarthritis (21% vs. 16%, $P = 0.02$) than those aged 60–69.

Conclusion: The high prevalence of multi-morbidity among the elderly requires a re-think in the management of geriatric age group in Nigeria and there is a need for primary health care policy direction to reflect this obvious reality.

Keywords: Prevalence; Multi-Morbidity; Rural; Nigeria; Elderly; Health care system; Research; Medical education

Introduction

The elderly constitutes the fastest-growing population group worldwide, with an alarming increase in developing countries. Current estimates indicate that the elderly is 6% of Nigeria's population [1]. At present geriatrics has not been fully established as a specialty in Nigeria and there is little information about the multi-morbidity pattern of the elderly to form the basis of any meaningful plan of action to improve the quality of life of this section of the population [2]. Like other countries in the world, Nigeria is facing a growing burden of chronic diseases and the prevalence of multi-morbidity and implications for the healthcare system, research and medical education have been little researched. The elderly usually suffer from multiple health conditions. Clausen et al [3] found an average of 5.2 health problems per elderly person living in the Mmankodi village, Botswana. Other characteristics of the morbidity pattern amongst the elderly are the presence of co-morbidities, non-specific presentation of diseases, impaired drug metabolism and deranged social factors [3]. Multi-morbidity becomes progressively more common with age

[4,5] and is associated with high mortality, reduced functional status, and increased use of both inpatient and ambulatory health care [5,6].

Multi-morbidity is defined as the co-occurrence of more than one chronic condition in an individual [7], and this has become more common among the elderly. As the world population ages and life expectancy increases, multi-morbidity becomes progressively common in developed [6-8] and developing countries [8-11]. Multi-morbidity is a public health problem in terms of its prevalence, severity and possibility of control [12]. The occurrence of various health problems in older adults is high (>50%) [1] and the consequences may include increased risk of death and functional decline [13], besides having a negative impact on the quality of life and life expectancy [14]. In Nigeria, studies about multi-morbidity are scarce. Although multi-morbidity is possible to control, but an adequate approach to its management is a challenge for health systems and services worldwide [15].

Knowing the magnitude of multi-morbidity can contribute to the organization of services, health worker training and the

Table 1: Study Population Characteristics.

Variable	Frequency	Percentage
Age (Years)		
60-64	568	34.4
65-69	432	26.2
70-74	314	19
75-79	235	14.3
≥ 80	101	6.1
Sex		
Male	860	52.1
Female	790	47.9
Marital Status		
Single	92	5.6
Married	1170	70.9
Divorced	280	17
Separated	40	2.4
Widowed	68	4.1
Residence		
Semi rural	933	56.5
Rural	717	43.5
Education		
No formal education	608	36.8
Primary	521	31.6
Secondary	378	22.9
Tertiary	143	8.7
Occupation		
Employed(Full time/part time)	701	42.5
Un-employed	300	18.2
Pensioner/retiree	527	31.9
House wife	122	7.4
Living Arrangement		
Alone	448	27.2
Marital home	1151	69.8
Institution	49	3
Health care utilization		
Medical visit	846	51.3
Adult emergency services	89	5.4
Hospitalization	68	4.1
None of the above	647	39.2
Monthly Income (*Naira)		
<1000	29	1.8
2000-5000	475	28.8
6000-10000	992	60.1
>10000	154	9.3

elaboration and improvement of clinical guidelines, facilitating the proper management of the health of the elderly, preventing avoidable

hospitalizations and iatrogenesis in the treatment of morbidities [16,17]. It is important to recognise that many elderly people have multiple coexisting chronic medical conditions, or 'multi-morbidity' [18]. Multi-morbidity is associated with poorer functional status, quality of life, and health outcomes, and is higher users of ambulatory and inpatient care than are those without multi-morbidity [19,20-22]. Although the quality of health care received by people with multi-morbidity might be better than that for individuals with only one disorder, at least partly because of greater contact with health services, [23] people with multi-morbidity have more difficulties with fragmentation of care and medical error because much specialist care is focused on treatment of one disease [24]. Improvement in the continuity and coordination of care for people with multi-morbidity is a key challenge for health-care systems worldwide, and each patient needs a dedicated clinician to take responsibility for care coordination [25].

Countries with strong primary health-care systems have better health outcomes and lower health-care costs than do those without [26,27]. Existing approaches focusing on patients with only one disease dominate most medical education, clinical research, and hospital care, but increasingly need to be complemented by support for the work of generalists, mainly but not exclusively in primary care, providing continuity, coordination, and above all a personal approach for people with multi-morbidity [28].

The data on the prevalence and patterns of multi-morbidity among elderly Nigerians are grossly lacking, thus necessitating investigation. This rising elderly population will, in the near future, be a burden to already weakened healthcare delivery system in this country, which is currently only suitable for treating patients with individual diseases as opposed to the treatment of patients with multiple chronic diseases.

In the past, the pattern of mortality in Nigeria has largely been dominated by communicable diseases; but, substantive successes in public health in the last 4 decades in Nigeria has led not only to marked gains in life expectancy but an increase in the prevalence of chronic conditions placing additional strain on healthcare systems that are ill-equipped for coping with the growing widespread demand for chronic disease care

Nigeria, the most populous black nation in the world, is still in the midst of a profound demographic and epidemiological transition. Although Nigeria has a fair primary healthcare structure that is largely delivered through a network of health workers: nurses, midwives, community health officers, health assistants and community health extension workers but the reality is that the country has limited capacity in its public health system to cope with any further increases in healthcare demand.

Knowledge of prevalence, pattern and risk factors for multimorbidity in Nigeria is required to guide the development of appropriate interventions for prevention, disease control and clinical case management. The study aims at describing the prevalence and the pattern of multi-morbidity among Nigerian elderly vis-a-vis looking at the Implications for health care system, research and medical education and the specific objectives include: (a) to determine the prevalence and pattern of distribution of multi-morbidity among community dwelling elderly population in Nigeria, (b) to identify

Table 2: Health problems used to operationalize multi-morbidity.

Morbidity	Method of information collection?	Question or scale	Case
1) Diabetes	Medical diagnosis Self reported	Has a physician told you that you have diabetes or high blood sugar levels?	Yes
2) High Blood Pressure (HBP)	Medical diagnosis Self reported	Has a physician told you that you have High Blood Pressure?	Yes
3) Osteoarthritis, Rheumatism, or arthrosis	Medical diagnosis Self reported	Has a physician told you that you have rheumatism, arthritis or arthrosis?	Yes
4) Heart problem	Medical diagnosis Self reported	Has a physician told you that you have heart problem?	Yes
5) Eyesight problem (Cataract/Glaucoma)	Medical diagnosis Self reported	Does your eyesight hinder you in doing the things you need or want to do?	Yes
6) Lung problem	Medical diagnosis Self reported	Has a physician told you that you have lung problem (bronchitis, emphysema, COPD, asthma)?	Yes
7) Thyroid dysfunction	Medical diagnosis Self reported	Have ever been told by physician that you disease of the thyroid	Yes
8) Prostate disorders	Medical diagnosis Self reported	Have you ever been told by physician that you are have prostate disorders (BPH, Cancer)	Yes
9) Stroke	Medical diagnosis Self reported	Has a physician told you that you have had stroke?	Yes
10) Cancer	Medical diagnosis Self reported	Has a physician ever told you that you had cancer?	Yes
11). Liver problem		Have you ever been told by physician that you have liver problem (Cirrhosis, Hepatitis, Cancer)	Yes
12) Disease of spinal column (any problem reported)	Medical diagnosis Self reported	Has a physician told you that you have a disease in your spinal column	Yes
13) Kidney problem	Medical diagnosis Self reported	Has a physician told you that you have a kidney problem?	Yes
14) Depression	Scale	Geriatric Depression Scale (GDS), composed of 15 items ≥ 6	
15) Cognitive impairment (Dementia)	Scale	Mini-Mental State Examination (MMSE), composed of 30 items	≤ 22
16) Asthma	Self-reported	Do you have any problem or difficulty with breathing?	Yes
17) Urinary incontinence	Self-reported	Do you have problem of accidentally wetting yourself?	Yes
18) Hearing problem	Self-reported	Does your hearing hinder you in doing the activities that you need or want to do?	Yes
19) Falls	Self-reported	Have you fallen at any time since <1 year ago > until now?	Yes
20) Parkinson's disease	Self-reported	Do you have problem with holding object due to continuous shaking of your hand?	Yes

associated socio-demographic factors and, (c) to reveal combinations of chronic health problems among the elderly, (d) to provide policy makers and planners with the information required for future health

plans on the provision of services for elderly with multi-morbidities.

Methodology

Study setting

The study was carried out in Niger State, Nigeria, from August, 2014 to February, 2015. Niger State is located in North Central Nigeria and has a population of above four million people according to 2006 population Census, Nigeria. The State has 25 General hospitals, 275 Primary health care centers and more than a thousand pharmacy and patent medicine vendors, each of which is normally manned by a qualified pharmacist, pharmacy technician or primary health care worker.

Study design & Participants

A descriptive cross-sectional study was conducted among 1650 rural elderly population attending primary health care centers between August, 2014 to February, 2015. The study population comprised elderly 60 years and above. Participants were enrolled within the study period. Eligibility criteria for the **Study included:** age 60 years and above, living in a household in the study area not less than 6 months before the study or during the study period and voluntary consent (signed or thumb printed) to participate in the study. All available sources of information (birth certificate or date of important historical events) at home were used to determine the age of participants. Before carrying out the study, approval and informed consent was obtained from the participants. No incentive was offered for participation in the study. It was completely optional and participants have right to withdraw at any stage of the study.

Sampling

A multistage, stratified random sampling technique was adopted and used. The stages are as follows: 1). Households within residential communities were then randomly selected (using table of random number) from the household lists obtained from the Community house hold survey. 2). the number of households required was calculated using the standard formula adapted from an international guideline on designing household surveys [29]. The sampling frame was 2785 households. 3). in each household, one older adult was interviewed. When there was more than one elderly person in the household, we randomly chose one to participate in the study. The probability of locating an elderly household member was estimated at 1 in every 3 households. This estimate ensures a widespread distribution of the sample. A sample size of 1650 was used.

Study instrument and data collection procedures: Information was collected using validated questionnaire (in English language but translated to local language) containing structured and semi-structured questions. The questionnaire was developed based on a previously conducted literature review and specific cultural considerations. The validity and reliability of the questionnaire were ascertained through a pilot study, in a sub-sample of 50 participants, to ensure that the questionnaire was appropriate, comprehensive, and understandable among prospective respondents. Questionnaire modification was done as necessary. The health problems used to operationalise the multi-morbidity is shown in (Table 2).

Data were collected by questionnaire, interviews, review of medical records and clinical examination. At the interview stage,

Table 3: Logistic regression model for sample description and prevalence of multimorbidity according to socio-demographic and health services characteristics.

Variables	Sample		Multimorbidity (≥2)				Multimorbidity (≥3)				
	n	%	%	OR	(95% CI)	P-value	%	OR	(95% CI)	P-value	
Sex											
Male	860	52.1	65.8	0.8	(61.9; 69.7)	0.037	54.6	0.94	(53.7; 55.5)	0.018	
Female	790	47.9	79.5	1	(77.1; 81.9)	-	61.4	1	(59.2; 63.6)	-	
Age											
60-64	568	34.4	69.7	1	(62.7; 76.7)	-	54.1	1	(48.8; 56.9)	-	
65-69	432	26.2	71.8	2.6	(63.4; 79.2)	<0.05	56.7	2.9	(52.3; 61.1)	<0.05	
70-74	322	19	75.2	3.2	(66.2; 84.2)	<0.05	59.5	3.8	(53.4; 65.6)	<0.05	
75-79	235	14.3	80.6	3.9	(73.6; 87.6)	<0.05	67.8	4.9	(61.6; 70.5)	<0.05	
≥ 80	101	6.1	85.8	4.6	(77.6; 94.0)	<0.05	73.6	5.9	(64.5-72.1)	<0.05	
Education											
None	608	36.8	90.4	4.6	(81.4; 99.4)	0.01	73.8	3.4	(68.6; 79.0)	0.02	
Primary	521	31.6	81.2	3.1	(73.2; 89.2)	0.03	60.6	2.6	(55.1; 65.7)	0.04	
Secondary	342	22.9	70.6	2.5	(63.3; 77.9)	0.56	50.8	1.7	(42.5; 59.3)	0.06	
Tertiary	143	8.7	52.8	-	(43.8; 61.8)	-	41.7	1	(35.7; 46.7)	-	
Monthly Income(*Naira)											
1000	29	1.8	86.6	1.9	(82.2; 91.0)	0.01	70.1	2.1	(67.0; 73.3)	0.01	
2000-5000	475	28.8	78.7	1.4	(75.2; 82.2)	0.02	59.5	1.8	(55.4; 63.9)	0.22	
6000-10000	992	60.1	72.4	1.2	(66.4; 78.4)	0.04	51.8	1.4	(46.3; 57.3)	0.03	
>10000	429	27.1	65.5	1	(64.6; 73.7)		51.3		(46.3; 56.2)	-	
Bedridden											
No	1472	89.2	84.8	1	(79.5; 88.1)	1	70.4	-	(63.3; 77.5)	-	
Yes	178	10.8	95.4	2.2	(91.8; 99.0)	0.9	87.5	0.03	(81.5; 93.5)	0.02	
Medical visit											
No	601	36.4	69.3		(65.9; 72.7)	1	51.2	-	(47.4; 55.0)	-	
Yes	1049	63.6	95.8		(92.5; 99.1)	0.89	76.4	0.01	(72.3; 80.5)	0.04	
Family history of chronic conditions											
No	250	15.6	56.4	1	(52.3; 60.5)	1	50.2	-	(46.1; 54.3)	-	
Yes	1400	84.8	91.8	2.3	(88.5; 95.6)	0.9	84.7	0.03	(80.2; 88.9)	0.01	
Health service Utilisation											
No	204	13.4	45.7	1	(43.2; 49.2)	1	48.6	-	(46.3; 50.9)	-	
Yes	1446	86.6	86.3	1.8	(82.9; 89.7)	0.7	72.1	0.03	(69.6; 74.6)	0.05	
Emergency services visit											
No	100	6.1	43.4	1	(40.9; 45.9)	1	37.7	-	(34.2; 40.2)	-	
Yes	1550	93.9	88.4	2.1	(85.0; 91.8)	0.85	79.6	0.02	(75.3; 83.9)	0.04	
Residence											
Urban	933	56.5	73.3	1	(69.2; 77.4)	1	66.8	-	(63.3; 70.3)	-	
Rural	717	43.5	87.5	2.4	(83.2; 91.8)	0.93	82.4	0.01	(78.5; 86.3)	0.02	
Marital status											
Single	92	5.6	85.8	4.2	(82.4; 89.2)	3.9	80.5	0.01	(77.1; 83.9)	0.01	
Married	1170	70.9	64.7	1	(60.2; 69.2)	1	61.4	-	(57.9; 64.9)	-	
Divorced	280	17	81.3	3.4	(78.3; 84.3)	2.8	77.5	2.4	(73.1; 81.6)	0.04	
Separated	40	2.4	78.4	2.8	(73.9; 82.9)	2.4	72.6	2.4	(68.8; 76.4)	0.05	
Widowed	68	4.1	82.1	3.8	(79.4; 84.8)	3.2	78.4	3	(73.9; 82.9)	0.02	

Occupation											
Employed	701	42.5	62.5	1	(58.4; 66.6)	1	59.5	-	(56.8; 62.2)	-	
Un-employed	300	18.2	88.2	3.7	(83.7; 92.7)	3.5	84.8	0.02	(80.9; 88.7)	0.01	
Pensioner/retiree	527	31.9	75.5	2.3	(72.2; 79.2)	2	71.9	1.8	(67.9; 75.9)	0.04	
Others	122	2.4	59.4	1.6	(54.9; 63.9)	1.4	56.5	1.2	(53.1; 59.9)	0.05	
Choice of health care services											
Primary	1172	71	80.4	1	(76.9; 83.7)	72.7		-	(69.2; 76.2)	-	
Secondary	322	19.5	54.8	1.9	(51.4; 58.2)	47.9		0.03	(44.4; 51.4)	0.02	
Tertiary	156	9.5	36.5	2.3	(32.1; 40.9)	28.6		0.01	(25.1; 32.1)	0.01	
Private health plan											
No	1251	75.8	88.1		(84.6; 91.6)		70.4	-	(66.9; 73.9)	-	
Yes	399	24.2	41.7		(38.2; 45.2)		36.5	0.01	(32.3; 40.8)	0.03	
Total	1650	100	68.4		(64.9; 71.9)		53.7		(50.2; 57.2)		

Table 4: Prevalence of the chronic diseases in the elderly classified using the International Statistical Classification of Disease and Related Health Problems, 10th Revision.13.

Serial no.	Blocks/title	Class of disease	No. of subjects	Percentage (n=1650)
1	Disease of the circulatory system	Hypertension	1389	84.2
		Cerebrovascular accident	476	28.8
		HHD with CCF	225	13.6
		Cardiomyopathy	24	1.5
		Valvular heart disease	8	0.5
		Ischemic heart disease	13	0.8
2	Endocrine, nutritional and metabolic diseases	Diabetes mellitus	442	26.8
		Hypothyroidism	7	0.4
3	Disease of the digestive system	Chronic liver disease	60	3.6
		Acid-related disease	72	4.3
		Chronic gastritis	6	0.4
4	Neoplasms	Hepatocellular carcinoma	19	1.2
		Cancer of prostate	57	3.6
		Benign prostatic hyperplasia	80	4.8
		Gastric cancer	0	0
		Cancer of the lung	0	0
		Non-Hodgkin lymphoma	0	0
		Brain tumor	0	0
5	Disease of the nervous system	Multiple myeloma	0	0
		Seizure disorder	54	3.3
		Movement disorder (Parkinsonism)	34	2.1
6	Disease of the musculoskeletal system	Osteoarthritis/spondylopathies	625	37.9
7	Disease of the respiratory system	Asthma	120	7.3
		Chronic obstructive airway disease	45	2.7
8	Mental and behavioral disorders	Dementia	17	0.8
		Anxiety disorder	37	2.2
9	Infectious diseases	Tuberculosis	123	7.5
		Human immunodeficiency syndrome	0	0
10	Disease of the genitourinary system	Chronic kidney disease	56	3.4

CCF=Congestive cardiac failure; HHD= Hypertensive heart disease.

Table 5: Distribution of Chronic diseases by gender & age.

Chronic diseases	Study subjects		Gender				P-value	Age group					P-value					
	Freq %		Male		Female			60-64	65-69	70-74	75-79	>80						
			Freq %	Freq %	Freq %	Freq %		Freq %	Freq %	Freq %	Freq %	Freq %						
Diabetes mellitus	442	26.8	257	15.6	185	11.2	0.3	171	10.4	110	6.7	79	4.8	57	3.4	25	1.5	0.6
Hypertension	1389	84.2	709	43.0	680	41.2	0.58	498	30.2	365	22.1	258	15.6	185	11.2	83	5.1	0.4
Osteoarthritis	625	37.9	468	28.4	157	9.5	0.72	70	4.2	90	5.5	101	6.1	160	9.7	204	12.4	0.02
Heart Failure	507	30.7	366	22.2	141	8.5	0.3	207	12.5	122	7.4	84	5.1	67	4.1	28	1.7	0.6
Visual impairment (Cataract/Glaucoma)	420	25.5	220	13.3	200	12.2	0.6	134	8.1	104	6.3	86	5.2	68	4.1	30	1.8	0.4
Chronic Obstructive lung disease	40	2.4	12	0.7	18	1.7	0.3	12	0.7	9	0.5	7	0.4	7	0.4	5	0.3	0.7
Thyroid dysfunction	64	3.8	23	1.4	41	2.4	0.5	22	1.3	15	0.9	11	0.7	8	0.5	6	0.4	0.6
Dementia	17	0.8	10	0.6	7	0.2	0.2	5	0.3	2	0.1	3	0.2	3	0.2	4	0.3	0.04
Cancer	34	2.1	25	1.5	9	0.6	0.5	12	0.7	8	0.5	6	0.4	5	0.3	3	0.2	0.2
Chronic liver disease	60	3.7	38	2.3	22	1.4	0.4	22	1.4	14	0.9	12	0.7	7	0.4	5	0.3	0.5
Prostate disorders	80	4.8	80	4.8	0	0.0	0.3	30	1.8	19	1.2	14	0.8	10	0.6	7	0.4	0.2
Asthma	120	7.3	70	4.2	50	3.1	0.4	40	2.5	28	1.7	20	1.2	17	1.0	15	0.9	0.8
Parkinson's disease	34	2.1	20	1.2	14	0.9	0.2	12	0.7	9	0.5	7	0.4	5	0.3	2	0.1	0.6
Depression	450	27.3	210	12.7	240	14.6	0.4	145	8.8	115	7.0	81	4.9	70	4.2	39	2.4	0.5
Stroke	185	11.2	105	6.4	80	4.8	0.3	57	3.5	48	2.9	36	2.2	30	1.8	14	0.8	0.4
Hearing Impairment	70	4.2	42	2.5	28	1.7	0.004	12	0.6	16	0.9	18	1.0	21	1.2	9	0.5	0.2
Malnutrition	550	33.3	290	17.8	260	15.5	0.2	85	5.2	100	6.1	115	6.9	120	7.3	130	7.8	0.002
Urinary incontinence	85	5.2	68	4.1	17	1.1	0.2	40	2.4	25	1.5	10	0.6	7	0.4	3	0.3	0.3
Kidney problem	56	3.4	35	2.1	21	1.3	0.4	20	1.2	15	0.9	10	0.6	7	0.4	4	0.3	0.6
Lipid disorder	41	2.5	17	1.0	24	1.5	0.3	8	0.5	12	0.7	9	0.6	7	0.4	5	0.3	0.4

assistance of a family member was sought if the participant was unable to answer the questions asked. The questionnaire was administered by the researchers and health workers who had received training as research assistants for the study. Respondents were assured of the confidentiality of the information they provided, and interviews were conducted in the language in which the respondent felt comfortable. Data was collected on respondents' demographic and socio-economic and health care utilization characteristics, in addition to self-reported diagnoses (where applicable) and other information provided by respondents on their medical histories. The questionnaires were matched with the patient records in the health facilities, from which we extracted additional information on each respondent's medical diagnoses and routine medications over a one year period. Only definitive diagnoses were used for the purposes of analysis. Data extraction from patient records was carried out by the researchers and research assistants who are health workers.

Variables

The independent variables such as sex, age, residence area, marital status, education, living arrangements, occupation, and economy were assessed. The clinical data (chronic health problems) were collected using the patient's history, patient's self-report and medical records. Health problems were defined as chronic by the O'Halloran criteria: (a) have a duration that has lasted, or is expected to last, at least 6 months; (b) have a pattern of recurrence or deterioration; (c) have a poor prognosis and (d) produce consequences or sequelae

that impact on the individual's quality of life [30]. With regards to outcome variables, for each patient, multi-morbidity was measured either by the presence of ≥ 2 or ≥ 3 chronic health problems at the time of data collection. The chronic health problems of interest were drawn from the 147 International Classification of Primary Care, Second edition (ICPC-2) rubrics list gathered by the Family Medicine Research Centre, University of Sydney [30].

Statistical analyses

Reported data were collated, checked, coded, and entered into a Microsoft Access database. The data were then cleaned and analyzed using descriptive and inferential statistics. A descriptive and comparative statistical data analysis was processed with the SPSS 17.0 (SPSS Inc., Chicago, IL, USA). Multivariate analysis was performed to identify independent predictors of multi-morbidity. Multivariate logistic regression analysis was also conducted to examine factors associated with multi-morbidity and healthcare utilization outcomes after controlling for demographic and socio-economic confounders. Adjusted Odds ratios (OR), 95% Confidence Intervals (CI), and p-values were calculated for each independent variable. Continuous data were presented as means, along with their 95% Confidence Intervals (CIs). A p-value less than 0.05 were considered statistically significant.

Result

Study population characteristics: The study recruited 1720 elderly,

Table 6: Distribution of co-occurring dyads of co-morbidities ($\geq 10\%$) with observed and expected values.

Frequent co-occurring dyads (n)	Observed (%)	Expected (%)	Observed/expected	95% CI
HBP/diabetes (1566)	31.4	8.4	3.7	2.24-5.20
HBP/Osteoarthritis (1401)	16.2	15.1	1.07	0.99-1.36
HBP/heart disease (1366)	25.6	16.4	1.56	1.32-1.63
HBP/eyesight problem (1454)	19.8	15.2	1.3	1.11-1.44
HBP/urinary incontinence (1069)	14.7	11.4	1.29	1.18-1.83
Heart problem/cognitive impairment (1514)	12.8	10.1	1.27	1.08-1.31
Heart problem/eyesight problem (1299)	11.2	8.1	1.38	1.20-1.51
Osteo arthritis/falls (1079)	9.8	7.6	1.29	1.20-1.38
Eyesight problem/falls (1288)	11.6	7.7	1.51	1.42-1.64
HBP/falls (1453)	18.2	15.5	1.17	1.11-1.25
Osteoarthritis/spinal column disease (1432)	17.4	10.2	1.71	1.56-1.82
Heart problem/spinal column disease (1325)	13.5	11.1	1.22	1.19-1.47
Spinal column disease/falls (1317)	13.6	10.5	1.29	1.21-1.44
HBP/spinal column disease (1224)	25.11	20.7	1.21	1.16-1.29
HBP/cognitive impairment (1488)	20.6	18.9	1.09	0.93-1.23
HBP/depression (1413)	13.2	10	1.32	1.02-1.48
HBP/Asthma (1007)	10.6	7.4	1.43	1.29-1.62
Spinal column disease/cognitive impairment (1474)	10.3	12.8	0.81	0.71-0.94
Cognitive impairment/eyesight problem (1339)	12.7	9.4	1.35	1.22-1.48
Osteoarthritis/cognitive impairment (1228)	11.5	9.3	1.24	1.17-1.62
Spinal column disease/eyesight problem (1344)	13.7	10.3	1.33	1.25-1.47
Cognitive impairment/falls (1479)	--*-- MN V0042.0	9.5	1.31	1.18-1.47

aged 60 years and above. Seventy declined participation for personal reasons, thus given a response rate of 95.5%. Of the 1650 respondents, 860 (52.1%) were males while 790 (47.9%) were females. The mean age for the study sample was 64.2 years (67.3 years for males and 65.6 years for females). More than one-third (39.3%) of the sample respondents were pensioners and retirees. Majority (1170; 70.9%) of respondents were married and poor monthly income was reported by more than three-quarter (80.7%) of them (Table 1). Elderly people between 60 and 64 years old accounted for 34.4% and those aged ≥ 75 accounted for 20.4% of those interviewed. The majority 899 (54.5%) of the elderly had between primary and secondary education, and 8.7% had tertiary education while 36.8% had not attended school (No formal education). The bedridden represented 178 (10.8) of the sample. Slightly more than half 846 (51.3%) had a medical visit, 89 (5.4%) visited adult emergency services and 68 (4.1%) were hospitalized. More than half 933 (56.5%) were urban residents (Table 1).

Chronic diseases and pattern of multi-morbidity

The number of diseases in the same individual ranged from zero to six for the 20 problems listed in (Table 2). Only 121 (7.3%) of the sample did not have any morbidity. Less than ten percent (1.1%) had six or more morbidities (Figure 1). The percentage of participants with multi-morbidity was 68.4% (95% CI: 63.2; 73.6) for ≥ 2 morbidities and 57.3% (95% CI: 52.8; 61.8) for ≥ 3 morbidities. In both cases occurrence was higher among females, the more elderly, those with low level of education, low monthly income, the bedridden, those

without private health plan, those with past medical consultations and, and those that had visited hospital adult emergency unit and those living in rural areas (Table 3). The distribution of chronic diseases by gender and age is in (Table 4). The prevalence of hypertension was 84.2% (1389/1650), 95% CI (75- 89). More females than males had hypertension ($P = 0.58$). Those aged 70 and older had significantly more osteoarthritis ($P = 0.02$), dementia ($P = 0.04$) and malnutrition ($P = 0.002$), than those aged 60-69 (Table 5). The mean number of chronic diseases was 2 (SD: 1.18). The prevalence of 22 dyads (Table 6) of morbidities was equal or more than 10% while the prevalence of 31 triads of morbidities was equal or more than 5% (Table 7).

The relevance of (Tables 6 and 7) in this study is to show the frequency of occurrence of 2 or 3 morbidities occurring simultaneously in one individual and appreciate the importance of their management. The most prevalent dyads of morbidities were hypertension and diabetes (31.4%), and hypertension and heart disease (25.6%). Only one of the dyads of morbidities had prevalence that was not statistically higher than expected by chance (Table 6). In the dyads of morbidities, the highest ratio between observed and expected frequency was found in hypertension and diabetes O/E: 3.7; 95% CI: 2.24-5.2 (Table 6 dyad). For triads of morbidities, the highest prevalence was found in HBP, diabetes and heart problem (10.3), and HBP, heart problem and Osteoarthritis (9.8%). In triads of morbidities, the highest ratio between observed and expected frequency was found in hypertension, diabetes and heart problem (O/E: 3.82; 95% CI: 2.12- 5.52 (Table 7).

Table 7: Distribution of co-occurring triads of co-morbidities ($\geq 5\%$) with observed and expected values.

Frequent co-occurring triads (n)	Observed (%)	Expected h (%)	Observed/expected	95% CI
HBP/diabetes/heart problem	10.3	2.7	3.82	2.12- 5.52
Hypertension/diabetes/osteoarthritis (1577)	9.8	2.5	2.52	1.84 –2.79
HBP/heart problem/Osteoarthritis (1547)	8.5	4.5	1.89	1.73–2.89
HBP/heart problem/falls (1522)	8.2	4.6	1.78	1.67–2.13
HBP/heart problem/eyesight problem (1543)	9.1	4.5	2.02	1.84– 2.64
HBP/Osteoarthritis/falls (1480)	6.9	4.2	1.64	1.39–1.89
HBP/eyesight problem/falls (1532)	6.5	4.3	1.52	1.29–1.78
HBP/heart problem/urinary incontinence (1498)	5.8	3.4	1.71	1.57–1.85
HBP/Osteoarthritis/eyesight problem (1530)	5.5	4.2	1.31	1.13–1.48
HBP/urinary incontinence /eyesight problem (1517)	4.8	3.2	1.5	1.31–1.69
HBP/heart problem/depression (1486)	4.7	2.9	1.62	1.48–1.76
HBP/Osteoarthritis/urinary incontinence (1467)	4.2	3.1	1.35	1.24–1.49
HBP/urinary incontinence /falls (1368)	4.7	3.2	1.47	1.24–1.70
HBP/depression/falls (1443)	4.1	2.8	1.5	1.27–1.73
HBP/depression/eyesight problem (1478)	5.1	2.7	1.9	1.55–2.35
Osteoarthritis/spinal column disease/urinary incontinence (1472)	4.9	2.1	2.33	2.16–2.52
HBP/cognitive impairment/urinary incontinence (1488)	4.8	3.9	1.23	1.12–1.34
HBP/cognitive impairment/depression (1456)	4.8	3.4	1.41	1.19–1.642
Osteoarthritis/spinal column disease/falls (1501)	5.7	2.9	1.97	1.72–2.22
HBP/spinal column disease/urinary incontinence (1465)	5.7	4.3	1.33	1.12–1.54
Osteoarthritis/spinal column disease/eyesight problem (1448)	4.9	3.5	1.4	1.16–1.66
HBP/spinal column disease/depression (1510)	5.2	3.7	1.41	1.18–1.67
Heart problem/spinal column disease/eyesight problem (1378)	4.2	3.8	1.11	0.88–1.44
HBP/spinal column disease/falls (1467)	7.2	5.8	1.24	1.03–1.45
HBP/heart problem/cognitive impairment (1452)	6.9	5.6	1.23	1.01–1.45
HBP/cognitive impairment/falls (1499)	6.1	5.3	1.15	0.95–1.35
HBP/cognitive impairment/eyesight problem (1485)	6.6	5.2	1.26	1.07–1.45
HBP/Osteoarthritis/spinal column disease (1503)	9.7	5.6	1.73	1.50–1.96
HBP/heart problem/spinal column disease (1477)	8.8	6.1	1.44	1.26–1.62
HBP/spinal column disease/cognitive impairment (1464)	7.2	7.1	1.01	0.86 –1.16
HBP/Osteoarthritis/falls (1523)	6.4	4.2	1.52	1.31–1.73
HBP/Osteoarthritis/cognitive impairment (1451)	5.9	5.1	1.12	0.96- 1.28

Prevalence of multi-morbidity

Figure 1 showed the prevalence of morbidities by number. The prevalence of multi-morbidity for 2 or more chronic health problems was 68.4% of the sample and 57.3% for 3 or more morbidities. The occurrence was more in female than male. There was a significant relationship ($p < 0.05$) between some demographic characteristics and multi-morbidity (Table 3), e.g. females, old age, residing in rural areas, becoming a widow or widower, living alone, having a low level of education, being a pensioner or a retiree, and perceiving an insufficient monthly income were associated with higher rates of multi-morbidity. A similar trend was observed for three or more chronic health problems in multi-morbidity cut-off. Chronic diseases having prevalence more than 10% include Hypertension (84.2%), Diabetes mellitus (26.8%), Diseases of musculoskeletal system (37.9),

cardiovascular accident (28.8%) and Hypertensive Heart Disease (HHD) with Congestive Cardiac Failure (CCF) (13.6%). Parkinson's disease and Spinal cord compression had the lowest prevalence, 2.1% and 0.2% respectively (Table 4).

Risk factors

In logistic regression model, apart from age, factors most strongly and independently associated with multi-morbidity were female gender, low education status, poor monthly income/ unemployment, hospitalization, medical visits and emergency services (Table 3). After adjusting for the effects of those risk factors which were significantly associated with multi-morbidity, only age, sex and a family history of a chronic condition were found to be independently associated with the risk of having multi-morbidity. Age was the most significant independent risk factor. Increasing age was associated with a higher

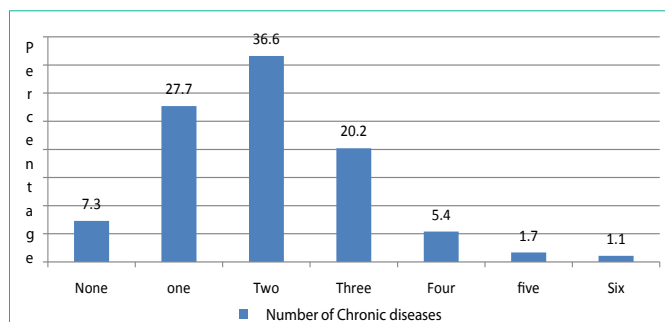


Figure 5: Effects of *Terminalia arjuna* extracts on 2-deoxy-D-[H³] glucose transport. Results are mean \pm SEM of 4 separate observations. ***P<0.001 compared with incubations in the absence of insulin. ***P<0.001 compared to 10⁻⁹ M insulin alone. ^aP<0.05 compared to *Terminalia arjuna* incubations without insulin.

risk of multi-morbidity. Compared with subjects aged 60-64 years, older subjects were at progressively greater risk of multi-morbidity. Subjects with higher level of monthly income reported slightly less multi-morbidity. In this study, Multi-morbidity was associated with the choice of healthcare services. Of the 1650 subjects, 80.4% of those that used primary health care had 2 or more multi-morbidities, whereas 36.5% of those that used tertiary health care services had 2 or more multi-morbidities. Similar trends were reported for among those with 3 or more multi-morbidities (Table 3).

Discussion

This study determined the prevalence and pattern of multi-morbidity in a large representative sample in rural Nigeria. We followed the most commonly used international definition of multi-morbidity in order to increase the compatibility with the international literature. A standardized definition of individual morbidity was used. We explicitly reported the assumptions and limitations of our approach to make the design open to critique. We used twenty health problems to operationalise the multi-morbidity, which is in line with some previous studies [31]. Multi-morbidity has been defined and assessed by various approaches, with diseases count per individual (as used in the current study) being the most common [32]. Estimates of the prevalence of multi-morbidity vary widely in different studies in many countries, depending on a number of factors including the age groups included, the sampling frame and the number of conditions included. The prevalence reported in the current study is similar to that found in Bukinafaso study [33], though higher in most other large studies [28]. Whether this is a true difference between Nigerian and developed countries or a reflection of different methods of estimating multi-morbidity will require future study. This study noted that multi-morbidity is not only common, but increases with age, and that the majority of people with any chronic disease have one or more additional conditions. In addition to increasing age, female gender, low education, poor monthly income and un-employment were factors independently associated with multi-morbidity.

The higher prevalence of multi-morbidity in females is similar to previous study [34]. The reason for this is not clear, and a range of factors may be at play [35,36].

Another study [8] contended that the reasons for this increased risk in females to multi-morbidity may be due to genetic factors,

living and working environments, life events, behavioural risk factors or the general risks associated with low socio-economic status. Other explanations given by other studies for higher occurrence of multi-morbidity among women is survival bias since men tend to die earlier and those who survive are usually the healthiest [37] and greater utilization of medical services by females [38] thus enabling more opportunities for medical diagnosis of diseases.

The large effect of increasing age on the prevalence of multi-morbidity was unsurprising, as numerous studies across the world have established this [33,39]. To the best of our knowledge, this is the first study that reported the prevalence and patterns of multimorbidity in the Nigerian rural population among the elderly. The study used cross-sectional design, which is the most frequently used design to assess the epidemiology of multi-morbidity [40]. A simple count of individual chronic conditions was the approach used to measure multi-morbidity, which is also the most common across the literature [41]. Although there is no agreement regarding the number and type of chronic health problems that should be included in multi-morbidity related studies, however use of 12 or more frequent chronic diseases has been suggested by some authors [42] as being the cut-off for better prevalence estimates. The chronic health problems of interest were drawn from the 147 International Classification of Primary Care, Second edition (ICPC-2) rubrics list gathered by the Family Medicine Research Centre, University of Sydney [30]. Multi-morbidity impairs quality of life and functional ability, leading to frailty and dependency and massively escalating healthcare costs. Indeed, the burden of chronic disease is the biggest financial challenge to countries and healthcare systems world-wide [43]. Nigeria has a growing ageing population, as a result of decrease in mortality and fertility rates. Due to decline in mortality and fertility rates, there is a corresponding decline in dependency ratio (older person-support ratio) that is, less working-age adults to support a rapidly ageing population. This therefore negatively affects affordability of care in Nigeria because health care service still largely relies on out-of-pocket payments. The high prevalence of multi-morbidity in older people found in this study is likely to challenge health care service system because of increase preference for secondary and tertiary care which is more costly. The preference for secondary and tertiary care is expected because the current status and capabilities of primary health care in Nigeria can rarely take care of multiple chronic diseases that in most cases require highly specialized service.

This study showed that self reported morbidity is associated with higher household income which is in contrast to findings from developed countries [33,44,45]. This apparent paradox may be explained by the rapid escalation of medical care costs in Nigeria in the last ten years, during which people with lower income have lower rates of diagnosed conditions due to un-affordability and inadequate use of healthcare. Similar to previous studies [28,46-48], a significant association between age and prevalence of multi-morbidity, irrespective of the definitions used, was found in this study. The presence of multiple chronic health problems increased with age was highest among adults aged 65 and older. This is due to the accumulation of chronic health conditions during the ageing process [49].

The age-group specific prevalence of ≥ 3 multi-morbidities for 60-64 years, 65-69 years, 70-74 years, 75-79 years and 80 years and

above were 54.1%, 56.7%, 59.5%, 67.8% and 73.6% respectively. This is almost similar to the reported prevalence of 58.6% for a sample of people aged 65–94 years in Germany [50] and that of 59.4% prevalence in Ghana [51]. Due to the varying approaches adopted in different studies to explore multi-morbidity in different settings, any comparison of the findings of the present study with those of other studies should be made with caution. Among the socio-demographic factors affecting multi-morbidity, age was the most significant. More than 50% of the subjects in this study had multi-morbidity. Our findings are not only in line with previous studies [52,53]; but further support the evidence of positive association between prevalence of multi-morbidity and an increase in age [54].

The prevalence of multi-morbidity in each individual age group is close to those observed in a previous study, [46] they are higher than the ones obtained by the majority of the published studies [55]. Whether this is a real difference between the elderly Nigerians and those from other western countries, or the consequence of different methodologies of estimating multi-morbidity prevalence, will remain the subject of further research. In this study females were associated with increased risk of multi-morbidity. However, this gender effect, did not persist after adjusting for all socio-demographic variables. According to Krieger et al [56], level of education, occupational prestige and income are indicators of socioeconomic status. Lower socioeconomic status is a known determinant of multimorbidity, [29] and findings from this study agreed with this assertion. Previous study [57] therefore recommended that level of education and professional status of the patients with multi-morbidity should be taken into consideration when developing prevention strategies in primary care practice settings. Research findings have reported that, type of source of data collection interferes with the prevalence estimates of multi-morbidity [58]. In order to reduce this effect, three sources of data were simultaneously used for each patient in this study: self-reported health status, analyses of medical records and physician knowledge of the patient's history.

There is a reverse causality between health service utilization and prevalence of multi-morbidity. The more elderly used health services the higher the prevalence of multi-morbidity. Use of medical services increases the chance of medical diagnosis and is also an efficient way of quick screening elderly people with multi-morbidity during assessments by health workers. More than four-fifth (88.4%) of the elderly who used emergency services had ≥ 2 health problems. Also, the bedridden elderly had more multi-morbidity, reflecting the greater vulnerability of these individuals. Elderly people without private plans had more multi-morbidity. This agrees with assertion of previous study [59] that social inequities is associated poverty & less education as seen with the elderly in this study. The likelihood of having multiple chronic conditions increased with a positive family history of any chronic disease. This may be due to genetic, behavioural or environmental factors common to members of the same family.

Cardio metabolic disorders were the most common chronic health problems in this study and this agrees with findings from previous study [60]. The cardio-metabolic pattern (diabetes and hypertension) found in this study is 67% reflective of the three main features of the metabolic syndrome [61]: diabetes, obesity and hypertension. The percentage difference could be as a result of difference in the

study area. This clustering of illness and risk factors is considered to be the agent of a new epidemic of cardiovascular disease [62]. A high prevalence of depressive disorder was reported in this study, this may be due to the worsening of the socioeconomic conditions that Nigeria faced as a result of economic recession. The prevalence of depressive disorder is higher in females which are in support of what previous literature [63] reported. The main chronic diseases are hypertension (84.2%), malnutrition (33.3%), diabetes (26.8%) and visual impairment (25.5%). These findings are similar to that from study in Bukinafaso [32]. The prevalence of multi-morbidity among the elderly in this study is 68.4%. However, this is contrast to findings from other studies, 55% in Sweden [54], 75% in Australia, 95% in Spain, 83% in India and 21.7% in China.

Differences of prevalence result from different methods to screen chronic diseases (reported disease, from medical records in hospitals), diversity of chronic diseases included in the analysis and different definitions of multi-morbidity. Multi-morbidity is more frequent among females. This is because most of them are widows, illiterates and are without retired pension. In view of these, they are vulnerable and exposed to diseases. This study showed malnutrition to be common (prevalence =33.3%). This may be due to the fact that with age food digestion and absorption is reduced and possibly because insufficient balance diet is common in Africa as also stated in Bukinafaso study [32].

It is important to note that, any comparison of the prevalence of multi-morbidity at different sites is limited by differences in methods employed and the age structure of the populations surveyed. Despite these difficulties in making comparisons, this study has provided evidence that, multi-morbidity is an important challenge that both health practitioners and the health system as a whole urgently need to address this obvious reality. The findings from this study therefore call for a case for consideration of multi-morbidity in medical training, and in designing guidelines and strategies for prevention and care. This study is community based in approach; therefore the research implication is that it helps to determine the prevalence and pattern of multi-morbidity which are accurate estimates of the burden of disease at population level.

Population-based prevalence estimates of multi-morbidity are essential for understanding the true health status of the community. This is especially important in the Nigerian context, where awareness of specific diseases among the general population has been described to be low. While this study emphasized the importance of giving increased consideration to elderly with multi-morbidity, providing a continuum of care and integration should be considered a priority. Worldwide, health systems are still unprepared for the management of individuals with multiple health problems and most guidelines are oriented towards a single disease despite the occurrence of multi-morbidity.

Strength

This is a population-based study with low probability of selection bias in virtue of the low number of losses and refusals. The large randomly selected representative sample of Nigerian population allows for greater generalization of results. Reporting the findings in accordance with recommendations in the literature may have contributed to increasing comparability between studies.

Limitations

1. This study is cross-sectional in design. It is unable to establish temporal associations between the socio-demographic factors studied and the occurrence of multiple chronic conditions. However, it is important to note that factors such as sex and family history are not influenced by temporality as they do not change with time. With this study design, no causal relationship could be proven.

2. Inability to develop standard criteria for proper validation of self-reported chronic diseases diagnosed by various healthcare providers, due to lack of an electronic medical record system at the health facilities. This was a big challenge. Therefore, the possibility of under-diagnosis or misclassification of diseases cannot be ruled out.

3. Information from medical records may be subject to local diagnosing patterns and practices.

4. Respondents from lower socioeconomic background are less likely to report their health condition either due to limited access to healthcare or under diagnosis. This may result in under diagnosis.

4. Some chronic morbidity might have been missed because of method of data collection (self report and medical conditions documented).

5. Use of self-reported data may introduce some misclassification bias.

6. Lack of disease severity score. Multi-morbidity operationalization did not take into account the severity of the diseases, which could contribute to the identification of priorities in the appropriate management of multiple health problems.

Conclusion

This study is the first to explore multi-morbidity prevalence and pattern in Nigeria, and its results will be of importance to health managers and policy makers in adapting medical education curricula, clinical case management guidelines and the structure of the health system in general to respond to the emerging multi-morbidity currently taking place in Nigeria. This study provided information on the prevalence, pattern and associated factors of Multi-morbidity in Nigerian Elderly and its Implications for health care system, research and medical education, which in general, similar to other developing countries but differs from developed countries. Information about the complications and quality of care of individuals with multi-morbidity will be key to ensuring the quality of life for people suffering from different chronic conditions. This study contributes to an increase in the understanding of multi-morbidity and chronic health problems of the Nigerian population aged 60 years and above. The high prevalence of multi-morbidity among the elderly in this study requires a re-think in the management of geriatric age group in Nigeria and there is a need for primary health care policy direction to reflect this obvious reality. The highest levels of multi-morbidity were identified among some vulnerable groups: the aged, oldest old, the less educated, unemployed and the pensioners/retirees, which make them the target audience to be considered in terms of public policies in the fields of health promotion and disease prevention. Interventions for addressing multi-morbidity should target strategies that are appropriate for patients with multiple diseases rather than individual

diseases. The findings from this study will provide the policy makers and planners with the information required for future health plans on the provision of services for elderly with multi-morbidities. The findings from this study challenge the single-disease framework by which most health care, medical research, and medical education is configured.

Considering the socio-economic development in Nigeria, developing a high quality primary care-based approach built on good coordination, monitoring and supervision focusing on healthy lifestyle would help to resolve the growing issue of multi-morbidity due to the rapidly ageing population.

High prevalence of multi-morbidity in Nigeria revealed the social inequities that are challenging the health services and health professional training to the adequate management of multi-morbidity and its complications. In order to overcome the challenge of multi-morbidity, the current non existing or fragmented health care system for the elderly in Nigeria should be looked into and serious consideration should be given to develop one and possibly advance it to a more comprehensive and multidimensional care. However, the delivery of primary healthcare in Nigeria is principally built around the management of single diseases and therefore a greater focus on the development of contextualized treatment protocols for the management of co-morbid conditions is needed. Given the paucity of data on the predictors and patterns of multi-morbidity in Nigeria findings from the current study are timely and provide novel insights into the burden of multi-morbidity.

References

- Bakare OE, Ojofeitimi EO, Akinyemi A. Nutritional assessment and health status of the elderly in southwestern Nigeria. Paper presented at: African Conference on ageing. 2004; 18-20.
- Adebusoye LA, Ladipo MM, Owoaje ET, Ogunbode AM. Morbidity pattern amongst elderly patients presenting at a primary care clinic in Nigeria. *Afr J Prim Health Care Fam Med.* 2011; 3: 211.
- Clausen F, Sandberg E, Ingstaad B, Hjortdan P. Morbidity and healthcare utilization among the elderly people in Mmankgodi village. *J Epidemiol Community Health.* 2000; 54: 58-63.
- van den Akker M, Buntinx F, Metsemakers JFM, Roos S, Knottnerus JA. Multimorbidity in general practice: prevalence, incidence, and determinants of co-occurring chronic and recurrent diseases. *J Clin Epidemiol.* 1998; 51: 367-375.
- Salisbury C, Johnson C, Purdy S, Valderas JM, Montgomery A. Epidemiology and impact of multimorbidity in primary care: a retrospective cohort study. *Br J Gen Pract.* 2011; 582: e12-21.
- Wolff J, Starfield B, Anderson G. Prevalence, expenditures, and complications of multiple chronic conditions in the elderly. *Arch Intern Med.* 2002; 162: 2269-2276.
- Mercer SW, Smith SM, Wyke S, O'Dowd T, Watt G, et al. Multimorbidity in primary care: developing the research agenda. *Fam Pract.* 2009; 26: 79-80.
- Khanam MA, Streatfield PK, Kabir ZN, Qiu C, Cornelius C, Wahlin Å. Prevalence and patterns of multimorbidity among elderly people in rural Bangladesh: a cross-sectional study. *J Health Popul Nutr.* 2011; 29: 406-414.
- Jerliu N, Toci E, Burazeri G, Ramadani N, Brand H. Prevalence and socioeconomic correlates of chronic morbidity among elderly people in Kosovo: a population-based survey. *BMC Geriatr.* 2013; 13: 22.
- de S Santos Machado V, Valadares AL, Costa-Paiva LH, Osis MJ, Sousa MH, Pinto-Neto AM. Aging, obesity, and multimorbidity in women 50 years or older: a population-based study. *Menopause.* 2013; 20: 818-824.

11. Arokiasamy P, Uttamacharya P, Jain K. Multi-morbidity, functional limitations, and self-rated health among older adults in India: cross-sectional analysis of LASI pilot survey, 2010. *SAGE Open*. 2015; 5.
12. Dias da Costa JS, Victora CG. [What's "a public health problem"?]. *Rev Bras Epidemiol*. 2006; 9: 144-146.
13. Gijzen R, Hoeymans N, Schellevis FG, Ruwaard D, Satariano WA, van den Bos GA. Causes and consequences of comorbidity: a review. *J Clin Epidemiol*. 2001; 54: 661-674.
14. Fortin M, Lapointe L, Hudon C, Vanasse A, Ntetu AL, Maltais D. Multimorbidity and quality of life in primary care: a systematic review. *Health Qual Life Outcomes*. 2004; 2: 51.
15. Salisbury C. Multimorbidity: redesigning health care for people who use it. *Lancet*. 2012; 380: 7-9.
16. Moraes EN. Health care for the elderly: conceptual aspects. Brasília: Pan American Health Organization. 2012: 98.
17. Veras RP, Caldas CP, Motta LB, Lima KC, Siqueira RC, Rodrigues RTSV. Integration and continuity of Care in health care network models for frail older adults. *Rev Saude Publica*. 2014; 48: 357-365.
18. Valderas JM, Starfield B, Sibbald B, Salisbury C, Roland M. Defining comorbidity: implications for understanding health and health services. *Ann Fam Med*. 2009; 7: 357-363.
19. Kadam U, Croft P, for the North Staff ordshire GP Consortium Group. Clinical multimorbidity and physical function in older adults: a record and health status linkage study in general practice. *Fam Pract*. 2007; 24: 412-419.
20. Higashi T, Wenger NS, Adams JL, Fung C, Roland M, McGlynn E, et al. Relationship between number of medical conditions and quality of care. *N Engl J Med*. 2007; 356: 2496-2504.
21. Schoen C, Osborn R. Commonwealth Fund international health policy survey. 2010.
22. Guthrie B, Saultz JW, Freeman GK, Haggerty JL. Continuity of care matters. *BMJ*. 2008; 337: a867.
23. Starfi eld B, Shi L, Macinko J. Contribution of primary care to health systems and health. *Milbank Q*. 2005; 83: 457-502.
24. WHO. The World Health Report 2008: primary healthcare, now more than ever. Geneva, Switzerland: World Health Organization. 2008.
25. Barnett K, Mercer SW, Norbury M, Watt G, Wyke S, Guthrie B. Epidemiology of multimorbidity and implications for health care, research, and medical education: a cross-sectional study. *Lancet*. 2012; 380: 37-43.
26. The United Nations Statistics Division: Designing Household Survey Samples: Practical Guidelines, Volume 98. New York, USA. 2008.
27. O'Halloran J, Miller GC, Britt H. Defining chronic conditions for primary care with ICPC-2. *Fam Pract*. 2004; 21: 381-386.
28. Nunes BP, Thume E, Facchin LA. Multimorbidity in older adults: magnitude and challenges for the Brazilian health system. *BMC Public Health*. 2015; 15: 1172.
29. Harrison C, Britt H, Miller G, Henderson J. Examining different measures of multimorbidity, using a large prospective cross-sectional study in Australian general practice. *BMJ Open*. 2014; 4: e004694.
30. Hien H, Berthé A, Drabo MK, Meda N, Konaté B, Tou F. Prevalence and patterns of multimorbidity among the elderly in Burkina Faso: cross-sectional study. *Tropical Medicine and International Health*. 2014; 19: 1328-1333.
31. Violan C, Foguet-Boreu Q, Flores-Mateo G, Salisbury C, Blom J, Freitag M, et al. Prevalence, determinants and patterns of multimorbidity in primary care: a systematic review of observational studies. *PLoS One*. 2014; 9: e102149.
32. Hunt K, Adamson J, Galdas P. Gender and Help-Seeking: Towards Gender-Comparative Studies. In *The Palgrave Handbook of Gender and Healthcare*. Edited by Kuhlmann E, Annandale E. Basingstoke, UK: Palgrave Macmillan. 2010: 207-222.
33. Malmusi D, Artazcoz L, Benach J, Borrell C. Perception or real illness? How chronic conditions contribute to gender inequalities in self-rated health. *Eur J Public Health*. 2012; 22: 781-786.
34. Healthy life expectancy for 187 countries, 1990-2010: a systematic analysis for the Global Burden Disease Study 2010. *Lancet*. 2012; 380: 2144-2162.
35. Mendoza-Sassi R, Béria JU. Health services utilization: a systematic review of related factors. *Cad Saude Publica*. 2001; 17: 819-832.
36. Marengoni A, Angleman S, Melis R, Mangialasche F, Karp A, Garmen A, et al. Aging with multimorbidity: a systematic review of the literature. *Ageing Res Rev*. 2011; 10: 430-439.
37. Huntley AL, Johnson R, Purdy S, Valderas JM, Salisbury C. Measures of multimorbidity and morbidity burden for use in primary care and community settings: a systematic review and guide. *Ann Fam Med*. 2012; 10: 134-141.
38. Fortin M, Stewart M, Poitras ME, Almirall J, Maddocks H. A systematic review of prevalence studies on multimorbidity: toward a more uniform methodology. *Ann Fam Med*. 2012; 10: 142-151.
39. Wang HH, Wang JJ, Wong SY, Wong MC, Li FJ, Wang PX, et al. Epidemiology of multimorbidity in China and implications for the healthcare system: cross-sectional survey among 162,464 community household residents in southern China. *BMC Medicine*. 2014; 12: 188.
40. Mercer SW, Watt GC. The inverse care law: clinical primary care encounters in deprived and affluent areas of Scotland. *Ann Fam Med*. 2007; 5: 503-510.
41. Fortin M, Bravo G, Hudon C, Vanasse A, Lapointe I. Prevalence of multimorbidity among adults seen in family practice. *Ann Fam Med*. 2005; 3: 223-228.
42. Van Oostrom SH, Picavet HS, van Gelder BM, Lemmens LC, Hoeymans N, Verheij RA, et al. Multimorbidity and comorbidity in the Dutch population-data from general practices. *BMC Public Health*. 2012; 12: 715.
43. Glynn LG, Valderas JM, Healy P, Burke E, Newell J, Gillespie, et al. The prevalence of multimorbidity in primary care and its effect on health care utilization and cost. *Fam Pract*. 2011; 28: 516-523.
44. Rizza A, Kaplan V, Senn O, Rosemann T, Bhend H, Tandjung R, et al. Age- and gender-related prevalence of multimorbidity in primary care: the swiss fire project. *BMC Fam Pract*. 2012; 13: 113.
45. Kirchberger I, Meisinger C, Heier M, Zimmermann AK, Thorand B, Autenrieth CS, et al. Patterns of multimorbidity in the aged population Results from the KORA-Age study. *PLoS One*. 2012; 7: e30556.
46. Amoah AG, Owusu SK, Adjei S. Diabetes in Ghana: a community based prevalence study in Greater Accra. *Diabetes Res Clin Pract*. 2002; 56: 197-205.
47. Uijen AA, van de Lisdonk EH. Multimorbidity in primary care: prevalence and trend over the last 20 years. *Eur J Gen Pract*. 2008; 14: 28-32.
48. Marengoni A, Winblad B, Karp A, Fratiglioni L. Prevalence of chronic diseases and multimorbidity among the elderly population in Sweden. *Am J Public Health*. 2008; 98: 1198-1200.
49. Krieger N, Williams DR, Moss NE. Measuring social class in US public health research: concepts, methodologies, and guidelines. *Annu Rev Public Health*. 1997; 18: 341-378.
50. Nagel G, Peter R, Braig S, Hermann S, Rohrmann S, Linseisen. The impact of education on risk factors and the occurrence of multimorbidity in the EPIC-Heidelberg cohort. *BMC Public Health*. 2008; 8: 384.
51. Violan C, Foguet-Boreu Q, Hermsilla-Perez E, Valderas JM, Bolívar B, Fàbregas-Escuriola M, et al. Comparison of the information provided by electronic health records data and a population health survey to estimate prevalence of selected health conditions and multimorbidity. *BMC Public Health*. 2013; 13: 251.
52. Thumé E, Facchini LA, Wyshak G, Campbell P. The utilization of home care by the elderly in Brazil's primary health care system. *Am J Public Health*. 2011; 101: 868-874.
53. Violan C, Foguet-Boreu Q, Roso-Llorach A, Rodríguez-Blanco T, Pons-Vigués M, Pujol-Ribera E, et al. Burden of multimorbidity, socioeconomic

- status and use of health services across stages of life in urban areas: a cross-sectional study. *BMC Public Health*. 2014; 14: 530.
54. Schafer I, von Leitner EC, Schon G, Koller D, Hansen H, Kolonko T, et al. Multimorbidity patterns in the elderly: a new approach of disease clustering identifies complex interrelations between chronic conditions. *PLoS ONE*. 2010; 5: e15941.
55. IDF. The IDF consensus worldwide definition of the metabolic syndrome. 2006.
56. Baxter AJ, Scott KM, Ferrari AJ, Norman RE, Vos T, Whiteford HA. Challenging the myth of an "epidemic" of common mental disorders: trends in the global prevalence of anxiety and depression between 1990 and 2010. *Depress Anxiety*. 2014; 31: 506-516.
57. Britt HC, Harrison CM, Miller GC, Knox SA. Prevalence and patterns of multimorbidity in Australia. *The Medical Journal of Australia*. 2008; 189: 72-77.
58. Formiga F, Ferrer A, Sanz H, Marengoni A, Alburquerque J, Pujol R. Octabaix study members Patterns of comorbidity and multimorbidity in the oldest old: the Octabaix study. *European Journal of Internal Medicine*. 2013; 24: 40-44.
59. Joshi K, Kumar R, Avasthi A. Morbidity profile and its relationship with disability and psychological distress among elderly people in northern India. *International Journal of Epidemiology*. 2003; 32: 978-987.
60. Zhou B, Chen K, Wang J, Wang H, Zhang S & Zheng W. Quality of life and related factors in the older rural and urban Chinese populations in Zhejiang province. *Journal of Applied Gerontology*. 2011; 30: 199-225.
61. Dewhurst F, Dewhurst MJ, Gray WK, Orega G, Howlett W, Chaote P, et al. The prevalence of disability in older people in Hai, Tanzania. *Age and Ageing*. 2012; 41: 517-523.
62. Salisbury C. Multimorbidity: redesigning health care for people who use it. *Lancet*. 2012; 380: 7-9.
63. Guthrie B, Payne K, Alderson P, McMurdo MET, Mercer SW. Adapting clinical guidelines to take account of multimorbidity. *BMJ*. 2012; 345: e6341.