Risk factors for chronic disease comorbidity: The health and social status of older persons in Jamaica

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Abstract*.* While globally, studies examining patterns of chronic disease comorbidity have been published, few, if any, of these have been based in Jamaica. This paper aimed to add to this sparse body of literature by identifying the chronic disease comorbidity patterns that exist among Jamaican seniors. Data from a population-based study was used in analyses and the socio-economic factors that influence the development of comorbid chronic conditions determined. Data was collected from participants ≥ 60 years of age from the *Health and Social Status of Older Persons in Jamaica Study*. 12 chronic conditions were selected for inclusion in this study (hypertension, coronary heart disease, stroke, arthritis, diabetes, glaucoma, cataracts, poor circulation, seizures, cancer, cognitive impairment and depression). Principal component analysis was used to detect underlying disease patterns using Stata version 14. Logistic regression analysis was performed to identify associations between comorbidity and key risk factors for disease. Approximately 80.0% of participants had 2 or more co-existing conditions. Comorbidity was defined as the co-occurrence of two or more of these conditions. Four disease patterns were extracted - a 'Metabolic and Inflammatory' disease pattern characterised by hypertension, arthritis, diabetes and poor circulation, a 'Cancer and Vision' pattern which included glaucoma, cataracts and cancer, a 'Psychological and Neurodegenerative' pattern which comprised of depression and cognitive impairment and a 'Brain Disturbance' pattern characterised by stroke and seizures.This study reveals that participants had comorbidities and several distinct patterns of disease. This has not only important healthcare expenditure implications but also greatly influences the type of health services that are needed.

Keywords: comorbidity, disease patterns, chronic disease, Jamaica, older adults.

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Introduction

Caribbean populations, like much of the rest of the world, are ageing and age is one of the strongest predictors of chronic disease (Prasad, Sung, & Aggarwal, 2012). Chronic disease refers to a group of illnesses with complex causality that are permanent, have developed over a long period of time, leave residual disability and either require specialised patient rehabilitation or a long period of care (Mills, 1982). These illnesses can range from mild to severe and have the potential to impair functional status (Mujica-Mota et al., 2015). Globally, chronic disease causes more deaths than all other causes combined (World Health Organization, 2014). In fact, deaths from chronic conditions, such as cardiovascular disease, cancer, diabetes, mental health, respiratory diseases and musculoskeletal conditions, are projected to increase from 38 million in 2012 to 52 million by 2030 (ibid.). Managing the burden of chronic disease and developing innovative health promotion and health service systems are therefore major challenges facing governments today (Banerjee, 2015). Research indicates that two or more chronic diseases often occur together as a result of shared risk factors and as such are referred to as being 'comorbid' or 'multimorbid' (Smith, Wallace, O'Dowd, & Fortin, 2016). Comorbidities are associated with poorer health and financial outcomes (Garin et al., 2016). In the United States for example, 6 in 10 adults have a chronic disease and the treatment and management of these are major drivers of the nation's US$3.5 trillion in annual health care costs (U.S. Centers for Disease Control and Prevention, 2020). Similar to the U.S., in Jamaica, chronic disease prevalence has increased steadily among the adult population and for the last 3 decades, non-communicable diseases (NCDs) have been responsible for the majority of illness and deaths. In addition, the total economic burden on individuals has been estimated at over US$600 million (Ministry of Health Jamaica, 2013).

Age is one of the strongest known risk factors for chronic disease and consequently comorbidity (Prasad et al., 2012). Worldwide rapid population ageing has therefore been linked to increased chronic disease prevalence (Hurst et al., 2018; World Health Organization, 2014). Other risk factors for chronic disease can be categorised as demographic, behavioural, biomedical, genetic, environmental, social or other factors, which can act independently or in combination (Australian Institute of Health and Welfare, 2015). Health promotion efforts have largely focused on modifiable risk factors such as smoking, excess alcohol intake, overweight and obesity, physical inactivity and poor nutrition since these can result in the development of chronic conditions such as cardiovascular disease, diabetes, cancer and mental health issues (Australian Institute of Health and Welfare, 2015).

While globally, studies examining patterns of comorbidity have been published, to the authors' knowledge none of these have been based in Jamaica (Britt, Harrison, Miller, & Knox, 2008; Garin et al., 2016; Goodman et al., 2016; Islam et al., 2014; Mujica-Mota et al., 2015). In addition, direct comparison of these studies is difficult due to methodological differences and the selection of diseases included in analyses (Islam et al., 2014). This study aimed to add to this sparse body of literature by identifying the comorbidity patterns among older Jamaicans utilising data from a population-based study and determining the socio-economic factors that influence the development of comorbidity. Further adding valuable contribution is that to the

authors' knowledge it is the only Jamaican study to include cognitive impairment, vision problems and depression in addition to cardiovascular, cancer, arthritis and circulatory problems, among the chronic diseases examined (Held et al., 2016). These diseases have been shown to be significantly affected by age and are worth considering when examining older adults (Kiely, Anstey, & Luszcz, 2013).

Method

Study design and sample

This study draws on data derived from the Health and Social Status of Older Persons in Jamaica Study. With approximately 3000 participants, the was considered as a large population-based cohort study which collected data on adults over age 60 across 4 Jamaican parishes (Kingston, St Andrew, St Thomas and St Catherine). The University of the West Indies Ethics Committee approved the study and written informed consent was received from all participants. Details about the design of this study have been published elsewhere (Eldemire-Shearer, James, Waldron, & Mitchell-Fearon, 2012).

Statistical analysis

A cross-sectional analysis among those ≥ 60 years of age was conducted. Twelve chronic conditions (heart trouble, cancer, arthritis, cataracts, asthma, diabetes, stroke, hypertension, depression, anxiety, overweight/obesity and cognitive impairment) were selected for inclusion in analyses in this study. Each disease examined was recoded to create a binary outcome variable – 'disease present' or 'disease absent'. Comorbidity was defined as the co-occurrence of two or more of these conditions (Smith et al., 2016). Principal component analysis was conducted to detect underlying disease patterns using Stata version 14. Similar to other studies, in determining the number of components to retain for further analysis, component eigenvalues greater than 1 was considered (Garin et al., 2016). Varimax rotation was performed in order to improve the comprehensibility and interpretability of the findings. Logistic regression analysis was performed to identify associations between comorbidity and key risk factors for chronic disease.

Results

Table 1 shows the descriptive characteristics of the participants. Worth noting is that among those with no comorbidities, a greater proportion were males who were single or married. A greater proportion of those without comorbidities were also unemployed, engaged in frequent physical activity and were not involved in volunteer work.

In contrast, among those with comorbidities, a greater proportion were females who were unemployed, engaged in infrequent physical activity and not involved in volunteer work.

Table 1: Descriptive statistics

| Variable	Without Comorbidities	With Comorbidities
Mean age, years [SD]	70.38[8.69]	73.66[8.72]
Female (%)	34.47	65.13
Single (%)	36.38	29.25
Married (%)	34.79	32.94
Divorced (%)	3.26	4.25
Widowed (%)	17.39	27.69
Common law (%)	4.61	2.50
Separated (%)	2.86	3.00
Other (%)	0.08	0.06
No formal school (%)	6.04	5.25
Primary school (%)	69.98	72.25
Secondary school (%)	12.07	12.50
Technical/Vocational (%)	4.85	4.56
Employed (%)	30.50	13.50
Unemployed (%)	67.83	83.88
Ever Smoker (%)	56.87	27.69
Never Smoker (%)	42.57	58.69
Frequent physical activity (%)	62.28	49.83
Infrequent physical activity (%)	37.72	50.11
Volunteering (%)	29.31	20.50
Not volunteering (%)	67.83	76.88

The proportion of participants with each of the chronic conditions examined is shown in Figure 1. The highest disease prevalence was recorded for hypertension (61.35%), arthritis (34.98%) and diabetes (26.22%). Overall, approximately 80.00% of participants had 2 or more chronic diseases.

Figure 1: Prevalence of chronic conditions among older adults in Jamaica
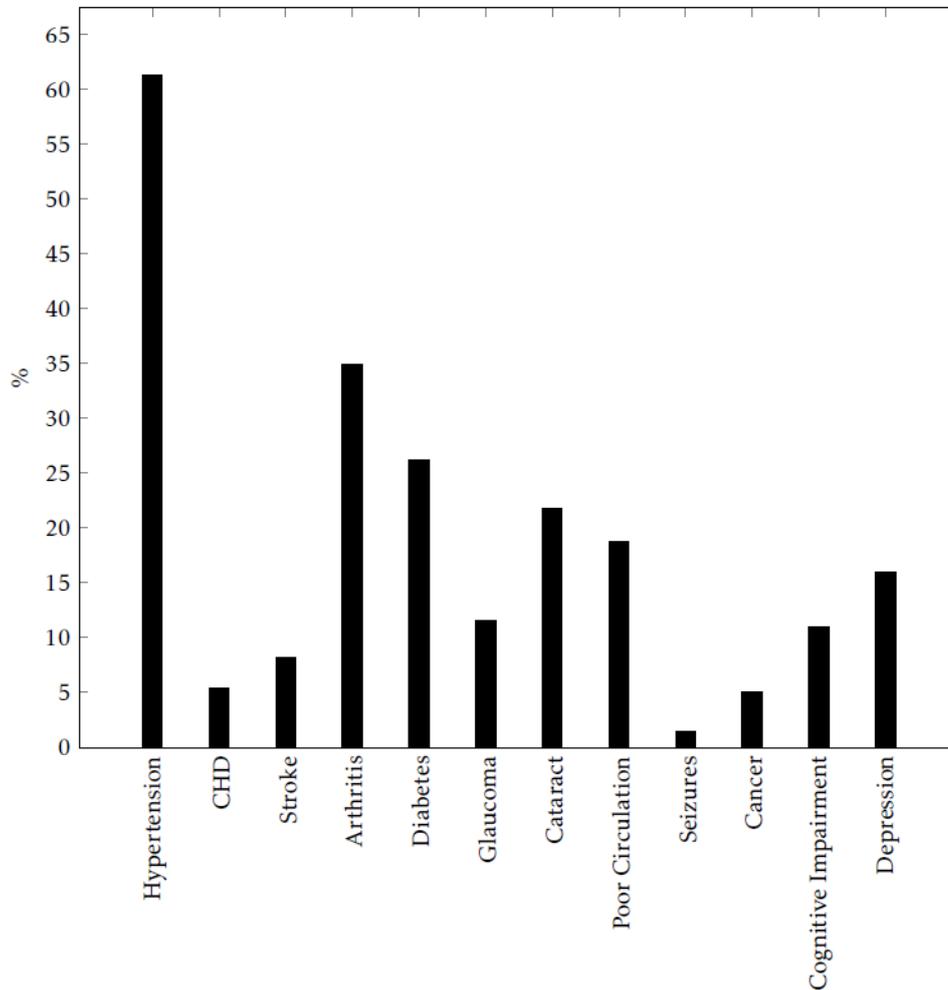
The total number of comorbidities reported by participants is presented in Figure 2. The greatest proportion of participants were recorded as having 2 or 3 chronic diseases (24.48% and 23.54% respectively). A relatively small proportion of participants were recorded as having between 6-8 co-occurring diseases.

Figure 2: Total Number of Comorbidities among Older Adults in Jamaica
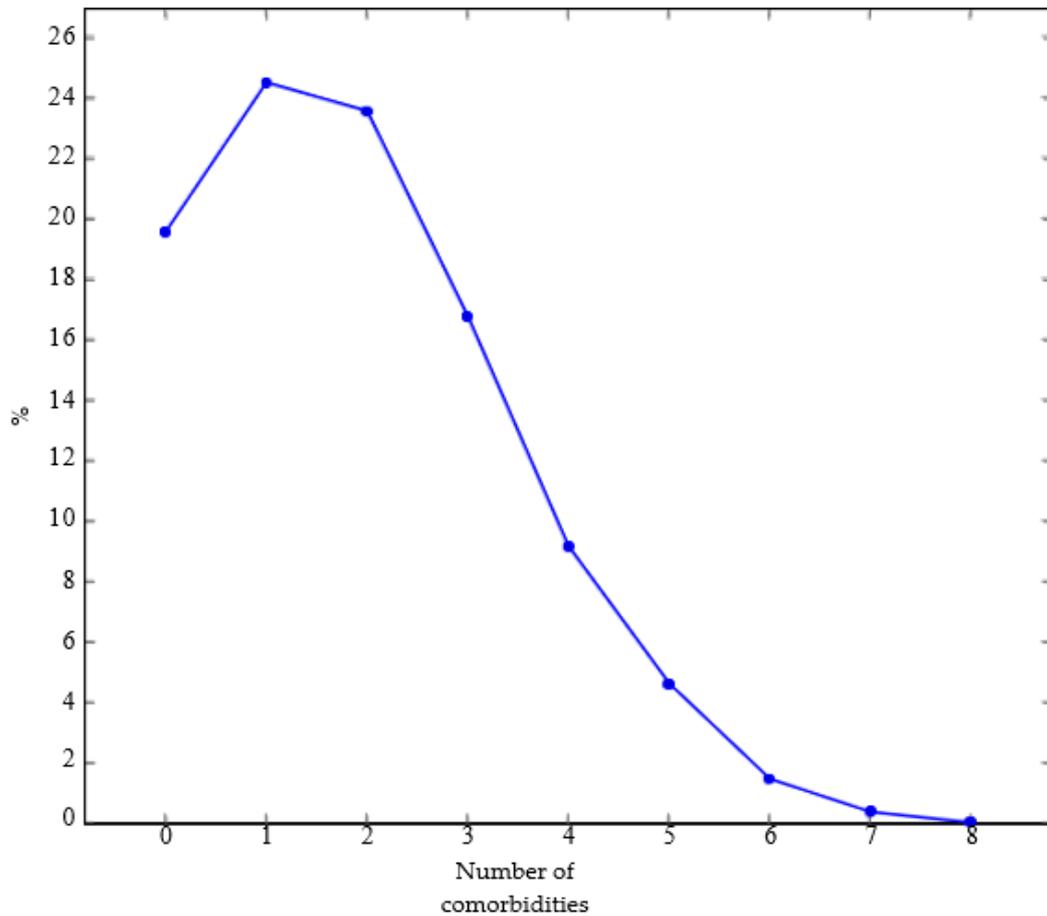
Four disease patterns were extracted. The first pattern identified was labelled 'Metabolic and Inflammatory' and was characterised by hypertension, arthritis, diabetes and poor circulation. The second disease pattern identified was called 'Cancer and Vision' with cataracts, glaucoma and cancer clustering together. Disease pattern 3 was characterised by depression and cognitive impairment and so was labelled 'Psychological and Neurodegenerative' and the final disease pattern was referred to as 'Brain Disturbance' as it was characterised by stroke and seizures.

Logistic regression analysis was conducted to determine the predictors of chronic disease comorbidity (see Table 2). Covariates considered for inclusion in the model included age, gender, marital status, employment status, education level, smoking status, physical activity level and participation in volunteer work. As age increased, the odds of chronic disease comorbidity also increased [Odds Ratio (OR) 1.03 (95% CI: 1.02 – 1.06), p-value = 0.00].

Table 2: Logistic regression: The effect of key risk factors on chronic disease comorbidity

Variable	Odds Ratio	95% CI	p-value
Age	1.04	1.02–1.06	0.00
Sex (Female)	3.69	2.87–4.75	0.00
Married	1.26	1.23–2.12	0.00
Divorced	1.96	1.11–3.47	0.02
Separated	2.00	1.08–3.70	0.03
Working	0.65	0.50–0.84	0.00
Physically active	0.69	0.55–0.86	0.00
Volunteer	0.77	0.61–0.87	0.03
Ever smoker	0.82	0.65–1.05	0.11

Females were more likely to have co-occuring conditions [Odds Ratio (OR) 3.69 (95% CI: 2.87 –4.75), p-value = 0.00]. Compared to those who engaged in regular physical activity, the odds of chronic disease comorbidity were greater in those who were less active [OR 0.69 (95% CI: 0. 55 – 0.86), p-value = 0.01]. Compared to those who were single, those who were married, divorced and separated had greater odds of having 2 or more chronic conditions [OR 1.26 (95% CI: 1.23 – 2.12), p-value = 0.01, [OR 1.96 (95% CI: 1.11 – 3.47), p-value = 0.02 and OR 2.00 (95% CI: 1.08 – 3.70), p-value = 0.03 respectively].

Discussion

In this study, the most prevalent diseases were hypertension, arthritis, diabetes and poor circulation. These findings are supported by data from the 'Statistical Institute of Jamaica' and the 'Ministry of Health and Wellness' which indicate that diseases of the circulatory system and metabolic diseases are among the leading causes of death in Jamaica (Ministry of Health Jamaica, 2013; Wilks, Younger, Tulloch-Reid, McFarlane, & Francis, 2008). Chronic diseases such as these, develop over a long period of time, share common risk factors, and have persistent effects (World Health Organization, 2020). Although it is generally accepted that many of these diseases often co-occur, most healthcare systems still focus on treating a single/primary disease (Britt et al., 2008). For researchers and policymakers to address comorbidity from a public health perspective, it is therefore critically important to examine the incidence and prevalence of key risk factors for chronic diseases, determine the most prevalent comorbid conditions that exist in populations under study, identify common comorbidity patterns and determine the implications of these on disease prevention and management, policy development and clinical practice (Held et al., 2016).

Overall, it was found that compared to those with no comorbidity, participants with comorbid chronic conditions were more likely to be older, not in the labour force, be less physically fit, be married, divorced or separated and do not partake in volunteer work. Despite differences in methodology and diseases examined, our comorbidity findings can be compared to those published for other parts of the world (Garin et al., 2016; Goodman et al., 2016). This study,

reported the identification of a 'Psychological and neurodegenerative' disease pattern characterised by depression and cognitive impairment, a 'Metabolic and inflammatory' pattern which included hypertension, arthritis, diabetes and poor circulation, a 'Cancer and vision' pattern comprised of cataracts, glaucoma and cancer and a 'Brain disturbance' pattern characterised by stroke and seizures. These findings share some similarities to comorbidity patterns which have been reported in a multi-country study examining Europe, Africa, Asia and South Africa (Garin et al., 2016). Several distinct patterns were frequently observed across these countries including a 'Cardio-respiratory' (angina, asthma and chronic obstructive pulmonary disease), 'metabolic' (diabetes, obesity and hypertension) and 'mental-articular' (arthritis and depression) pattern (Goodman et al., 2016). The most prevalent dyad patterns were high cholesterol + high blood pressure (52.9%), high cholesterol + ischemic heart disease (36.2%), high cholesterol + diabetes (32.3%), high cholesterol + arthritis (31.1%) and ischemic heart disease + high blood pressure (29.6%). The most prevalent triad patterns recorded were high cholesterol, high blood pressure + ischemic heart disease (33.7%), high cholesterol, high blood pressure + diabetes (29.9%), high cholesterol, high blood pressure + arthritis (25.7%), high cholesterol, diabetes + ischemic heart disease (21.5%) and high cholesterol, ischemic heart disease + arthritis (19.3%) (Goodman et al., 2016). As this study did not examine cholesterol, the prevalence of high cholesterol was omitted. High cholesterol however has been well established as a component of metabolic syndrome and it is likely that it may be reflected in the 'Inflammatory and Metabolic' disease pattern. The results of these studies conducted all over the world which showcase disease pattern similarities supports the notion that a common underlying aetiologic relationship, which trumps the effect of geographical region and culture, may exist that influences patterns of disease and that some chronic diseases may be risk factors for each other.

Strengths of this study centre on the inclusion of cognitive impairment and vision problems. Age is a key risk factor for such declines which have been shown to have significant psycho-social implications in the quality of life of older adults. These include loss of independence, increased risk of falls, fractures and hospitals stays, loneliness, impaired communication ability and greater risk of depression and anxiety (Kiely et al., 2013). To the authors' knowledge this study is the only one to examine chronic disease comorbidity in the Jamaican setting using such a wide range of conditions and so makes a valuable contribution to the literature. In addition, the chronic disease prevalence data presented are supported by other survey data (Wilks et al., 2008). Limitations of the study include the inability to include high cholesterol and overweight/obesity in the list of chronic diseases examined as weight and height data was only collected from a small subset of the cohort.

The findings of high chronic disease and comorbidity prevalence has significant implications not only for the delivery of healthcare services but also for the development of infrastructure to create supportive environments that promote behaviour change. As it pertains to clinical treatment of patients with coexisting conditions, evidence is limited as research studies often have as an exclusion criterion the presence of a comorbid condition (Boyd, Vollenweider, & Puhan, 2012).

Prior research has aimed to evaluate the applicability of clinical practice guidelines to the care of older adults with comorbidity and highlighted the issue of polypharmacy, medication side-effects and drug interactions which is a real concern for patients with multiple conditions. While beyond the scope of this study, it was acknowledged that there is a need for greater research which provides clear options about how to inform the reformation of primary healthcare services and the development of sophisticated algorithms to examine complex patients using a patient-centred approach (Salisbury, 2012).

Conclusion

The vast majority of older adults in this study had 2 or more coexisting chronic diseases and four distinct disease patterns were observed. While those with chronic disease comorbidity require greater medical care and support, the dialogue needs to not only focus on the financial implications of comorbidity but also the need for research on how such patients should be effectively managed. Future studies would better inform health service providers and policymakers about the specific changes needed to improve healthcare service and delivery.

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