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Epidemiology of Multimorbidity in Older Adults with Cardiovascular Disease

Susan P. Bell, MBBS, MSCI^{1,2} and Avantika A. Saraf, MPH^{1,2}

¹Division of Cardiovascular Medicine, Department of Medicine, Vanderbilt University Medicine Center

²Center for Quality Aging, Division of Geriatric Medicine, Vanderbilt University Medical Center

Keywords

Older adults; Multimorbidity; Cardiovascular disease

Introduction

The proportion of adults aged 65 and over is rapidly increasing and will comprise approximately 19% of the US population by the year 2030 including 19 million adults over the age of 85.¹ The result of this remarkable demographic shift imposes significant implications for overall future health care management where age is a driving factor in a multitude of disease processes, including cardiovascular disease (CVD), and contributes the most substantial risk. In 2013, CVD was responsible for over 17 million deaths globally, an increase of 5 million (40%) annually since 1990, despite increasing advances in cardiovascular treatments and health care delivery.² The overwhelming driver of this increase can be attributed to population aging (55%) and to a lesser extent population growth (25%). In the US, CVD affects approximately 40 million individuals over the age of 65 and remains the leading cause of morbidity and mortality.^{3,4}

The increasing prevalence of co-existing disease processes in this aging population further adds to the complexity and challenges facing patients with CVD and the providers that care for them. The diagnosis and management of CVD in older adults requires an in-depth understanding of the interplay between patient heterogeneity, the accumulation and activity of chronic and acute conditions, functional status, pharmacology, and social factors. However, the utilization of single disease practice guidelines continues to remain the standard of care across health care settings irrespective of age and presence of multiple co-existing chronic conditions.^{5,6} In fact, the most common chronic co-existing condition in older adults is the presence of multimorbidity, the coexistence of 2 or more chronic conditions.⁷ The concept of multimorbidity differs from the familiar framework of co-morbidity in that at any one time several conditions may be equally important and overlapping in management strategies and require comparable intensity and simultaneous

management strategies to achieve optimal patient-centered outcomes and quality of life. This chapter will examine the epidemiological relationships and importance of multimorbidity in older adults with CVD.

Prevalence of Multimorbidity

Multimorbidity rapidly increases with age such that it is prevalent in over 70% of individuals 75 years or older.⁸ The accumulation of chronic conditions as a result of genetics, lifestyle choices, environmental factors, treatment of prior conditions (e.g. heart failure as an adverse consequence of chemotherapy regimens) and aging itself culminates in a vastly heterogenic older population of adults that require balancing the management of multiple medical problems. By the age of 65 years over 60% of adults will have 2 or more chronic conditions, >25% will have 4 or more chronic conditions and almost 10% will have 6 or more (Figure 1).⁸ These rates increase by each decade and result in >50% over individuals 85 years and older suffering from 4 or more chronic conditions and 25% with 6 or more chronic conditions.⁸ The prevalence is high across all racial and ethnic groups, however, the pattern of multimorbidity by race changes over the age spectrum.⁹ Through ages 50–59 years, multimorbidity is more common in Blacks as compared to Whites, and is higher in Whites as compared to Asians. Furthermore, the presence of significant multimorbidity (5 or more conditions) through ages 50–59 is higher in Blacks as compared to Whites and Asians. In adults 60 and older, the relationship of 5 or more conditions appears to change with multimorbidity being more common in Whites as compared to Blacks and Asians.⁹

Multimorbidity is extremely common and rapidly increases in a similar pattern with age in both men and women. Figure 2 demonstrates the patterns of increasing numbers of chronic conditions (2 conditions, 4 conditions, 6 conditions) in men and women below 65 years of age and 65 years and older.⁸ In one study, among community dwelling individuals, the prevalence of 5 or more conditions is more common in men over the age of 60 as compared to women⁹ but this finding is not consistent with other reported data that has demonstrated in Medicare Beneficiaries (Fee-for-service claims) the prevalence of multimorbidity is slightly higher in women compared to men.^{8,9} In addition, the combinations of chronic diseases are different in men and women with men more likely to have the presence of cancer, CVD and cardiovascular risk factors (HTN, DM, hyperlipidemia) as compared to women that had a higher prevalence of arthritis and depression.¹⁰

Multimorbidity and Geriatric Syndromes

Evaluation of the impact of multimorbidity should not only include the contributing effects of chronic co-existing diagnoses but also the prevalence of common and frequently under-reported geriatric syndromes. Geriatric syndromes represent a group of clinical conditions involving multiple organ systems and that sometimes share common causative factors.^{11,12} These include a number of conditions which unlike traditional syndromes do not fit a discrete metabolic, pathological or genetic disease category. Examples of which include falls, cognitive impairment, delirium, weight loss, anorexia, pressure ulcers, functional decline, frailty and depressive symptoms.¹³ Their impact on quality of life, dependence and

disability is considerable. The presence and number of geriatric syndromes are independently associated with a risk for adverse outcomes such as functional decline, the acquisition of additional syndromes, hospital admissions and mortality.^{14,15} Despite the contributing role of geriatric syndromes in the presentation, management and outcome of primary disease presentations, they are often under-recognized and seldom the focus of hospital and outpatient treatment.¹¹ In addition, geriatric syndromes may also impact compliance and tolerance of common therapies utilized in the management of CVD (i.e. diuretics and antihypertensive therapy in the management of heart failure may precipitate worsening of falls and incontinence).

- **Frailty**

Frailty encompasses a biological decline across multiple interrelated organ systems and a subsequent loss of reserve in response to stressors, such as acute illness, and can result in a poor tolerance to CVD and/or to CVD therapy. Estimated prevalence of frailty in community dwelling older adults 65 and older is approximately 7% but increases to 20% in individuals over 80.¹⁶ In older patients hospitalized with CVD, especially heart failure, it is estimated that the prevalence is over 50%.¹⁷ Frailty is an independent predictor of a wide range of CVD including subclinical CVD,¹⁸ coronary artery disease, congestive heart failure¹⁹ and CVD mortality²⁰ and confers a 2–3 increased risk of adverse events and mortality.

Multimorbidity and CVD

CVD affects approximately 40 million individuals in the US over the age of 65 and remains the leading cause of morbidity and mortality within that population both in the US and globally.^{2,4} Amongst Medicare beneficiaries with a diagnosis of CVD, the burden of multimorbidity is significant with over 50% of individuals that carry a diagnosis of heart failure or stroke also having 5 or more coexisting chronic medical conditions.⁸ Figure 3 shows the prevalence of coexisting chronic conditions in 6 of the most frequently managed diagnoses in cardiovascular medicine. It demonstrates the high prevalence (>50%) of 3 or more additional chronic conditions with each diagnosis highlighting the complexity of managing CVD in older adults.^{8,10} For example, in older adults with ischemic heart disease, heart failure, stroke and atrial fibrillation the most common concomitant conditions are arthritis, anemia and diabetes mellitus and rates range from 40–50%.¹⁰ Other common chronic conditions include chronic kidney disease, cognitive impairment, chronic obstructive lung disease and depression, each of which much be considered when developing individual treatment strategies for the management of CVD. In the case of coronary heart disease, common management strategies such as beta-blockade, anti-platelet therapy, anti-hypertensives and statin therapy²¹ may not be tolerated in an individual with chronic lung disease (25%), anemia (39%), dizziness and falls (35%), and mobility difficulties (40%).²² Table 1 highlights a few of the complexities and considerations managing an individual with systolic heart failure and a number of cardiac (hypertension, ischemic heart disease and atrial fibrillation), non-cardiac (chronic obstructive pulmonary disease, chronic kidney disease) coexisting conditions and a number of common geriatric syndromes (incontinence, falls and mobility impairment).

Fundamental knowledge gaps in management of CVD in older adults in the context of multimorbidity lies in our reliance on evidence based guidelines derived from clinical trials that have largely recruited participants that are not proportionately representative of the majority of older patients managed by medical providers. Over half of clinical trials focused on the management of coronary artery disease failed to include any participant over the age of 75 years.²³ Furthermore, individuals over the age of 75 make up less than 10%²³ of those included in any of the trials despite representing 25–32% of the population included in registries.²⁴ Table 2 shows baseline patient characteristics of individuals from the Global Registry of Acute Coronary Events (GRACE) registry, a multinational, prospective registry that describes the epidemiology, management practices, and in-hospital outcomes and changes over time therein, of patients with the entire spectrum of acute coronary syndromes (ACSs). In comparison the corresponding baseline characteristic prevalence is shown for 3 ACS focused clinical trials (CAPTIM,²⁵ CURE²⁶ and GUSTO IV ACS²⁷). The comparison demonstrates that on average individuals in clinical trials are younger with a much smaller proportions >65, and >75, as compared to the ACS registry. They also have much lower prevalence of significant risk factors for adverse events such as the presence of heart failure, diabetes mellitus and prior stroke. In addition, there is no report and a low anticipated prevalence of significant risk factors such as falls, cognitive impairment, disability, and functional decline.

Impact of multimorbidity and CVD

While the incidence of multimorbidity in older adults increases, there remains very little data to inform clinicians on how to best care for older adults with multimorbidity and CVD. Advances in medical research and technology have evolved around the single-disease focused model resulting in significant reduction in morbidity and mortality from those specific disease processes (i.e. reduction in mortality following an acute myocardial infarction). However, in comparison very little attention has been devoted to coexisting and equally important multiple chronic conditions in a single patient. Figure 4 compares the traditional single disease focused conceptual framework with a more patient centered multimorbidity model.²⁸ In the comorbid model approach, a single CVD diagnosis is the primary and index disease and all other conditions are viewed as secondary and less significant processes to be considered in the management. As a consequence, clinical practice guidelines focus mainly on treating the primary CVD and when comorbid conditions are considered, recommendations highlight pairs of disease processes such as atrial fibrillation and diabetes mellitus or heart failure and chronic kidney disease. Moreover, standard practice guidelines do not provide specific guidance to a provider managing an acute exacerbation of heart failure with acute on chronic kidney disease, poorly controlled diabetes mellitus, atrial fibrillation with recurrent falls and inadequate social support. The multimorbid conceptual framework demonstrates a more patient-centric approach to managing CVD in the context of multiple chronic conditions, geriatric syndromes, functional status and social determinants of health. In this framework, the presenting CVD represents the smallest component of managing the patient with increasing complexity with each layer of impacting factors.

Older adults with multimorbidity are frequently seen by numerous general and specialist providers and utilize many services to manage individual diseases that may be inefficient, burdensome and duplicative. Increasing multimorbidity is associated with higher 30-day readmission rates. Despite contributing to only 14% of the Medicare population, individuals with 6 or more chronic conditions have 30-day hospital readmission rates >25% and make up 70% of the population that is readmitted. Figure 5 shows the impact of multimorbidity on rates of readmissions in Medicare beneficiaries by increasing number of chronic conditions.⁸ Further, multimorbidity is also associated with much higher levels of per capita Medicare spending (Figure 5b) where individuals with 6 or more chronic conditions cost more than 3 times the average per capita spending.⁸

Poor care coordination and integration of care can also result in unsafe and competing management strategies by providers that may lead to multiple prescriptions for medications. Each provider will frequently adhere to standard of care clinical practice guidelines for individual chronic diseases which frequently leads to burdensome monitoring regimens and significant polypharmacy.²⁹ As a consequence the patient becomes at risk for drug-drug interactions, drug-disease interactions and therapeutic competition (the recommended treatment for one condition may adversely affect and/or compete with another coexisting).³⁰ Adverse consequences including poor adherence, adverse drug events, hospitalization and mortality are not only related to the number of medications but also to the regimen complexity.^{31,32} Studies have estimated that 50% of older adults are taking at least one medication with no ongoing indication, and many of these drugs are initiated during hospitalization, such as stress ulcer prophylaxis and antipsychotics for delirium.³³

Summary

Multimorbidity is the most significant and common condition affecting older adults and impacts every component of health care management and delivery. The prevalence of multimorbidity significantly increases with age and is prevalent in over 70% of individuals 75 years or older. It represents the most common co-existing disease process in older adults and impacts the complexity of all aspects of disease management. For individuals with a diagnosis of CVD, multimorbidity has a significant effect on the presentation of the disease, the diagnosis, management and the patient-centered preferences in care. Conventional assessment of cardiovascular and therapeutic risk is based on extrapolation of guidelines developed from evidence demonstrated in younger individuals and fails to weight the increased burden of complications and multimorbidity. In addition, evidence based therapeutics have focused almost solely on cardiovascular focused morbidity (i.e. changes in ejection fraction, number of reperfusion events) and whilst excluding outcomes such as functional status, maintenance of independence and quality of life that may be of equal or more importance to an older adult. Over the next 25 years, the proportion of adults aged 65 and older is estimated to increase 3 fold, and with that remarkable change will come the complexities of managing this population. The resulting needs of these patients will require a fundamental shift in traditional care from single disease practices to a more patient-centered framework.

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Key Points

- Multimorbidity, the presence of 2 or more chronic conditions, is the most common disease process impacting older adults
- The prevalence of multimorbidity increases with age such that it is prevalent in >70% of adults aged 75 years and older
- Assessment of multimorbidity should also include presence of geriatric syndromes
- Multimorbidity is common in the presence of CVD especially heart failure where 50% of Medicare beneficiaries have 5 or more coexisting chronic conditions
- Multimorbidity has a substantial impact on disease management, quality of life, health care costs and health care utilization.

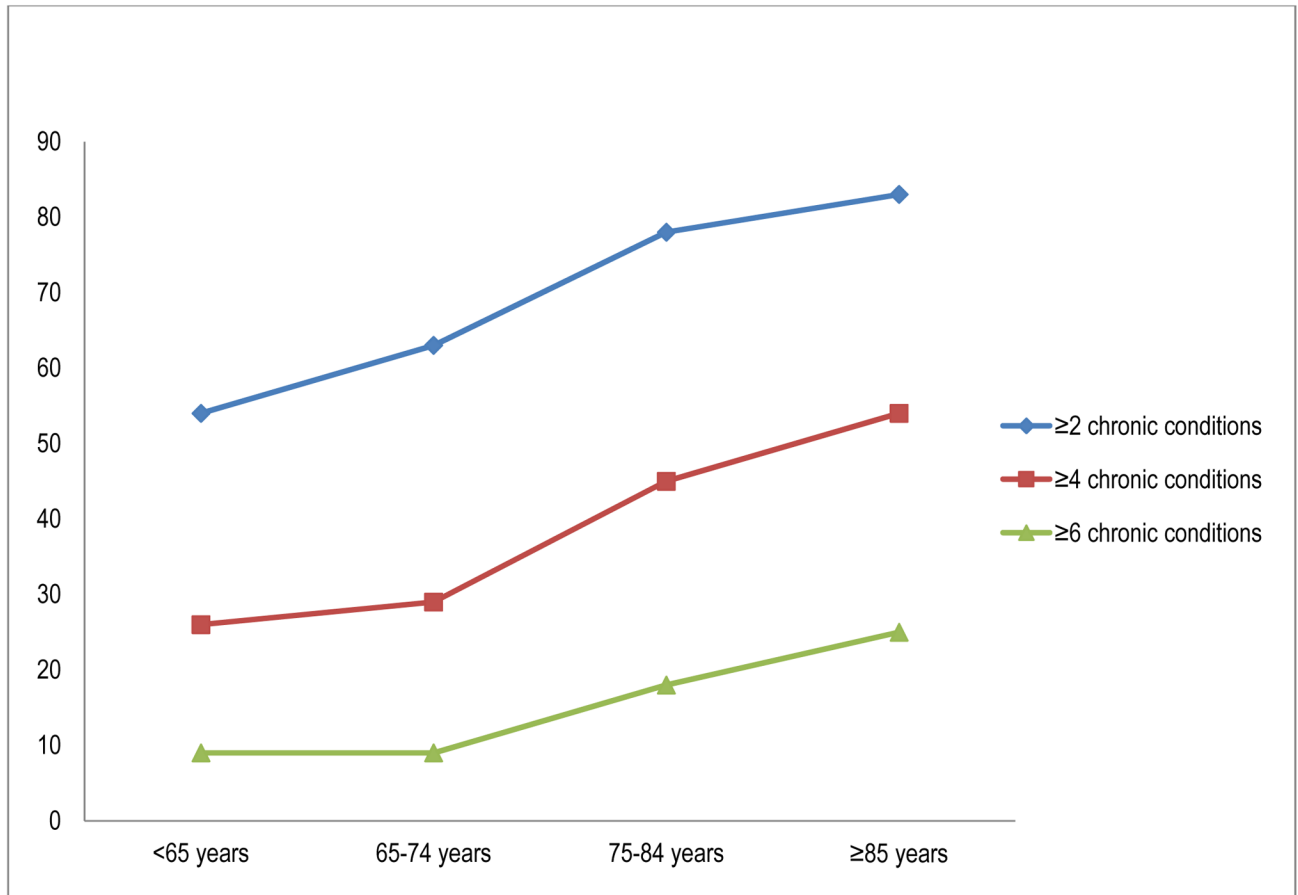


Figure 1. Percentage of Medicare Fee-for Service Beneficiaries by Number of Multiple Chronic Conditions and Age (2010) showing increasing prevalence of multimorbidity with increasing age

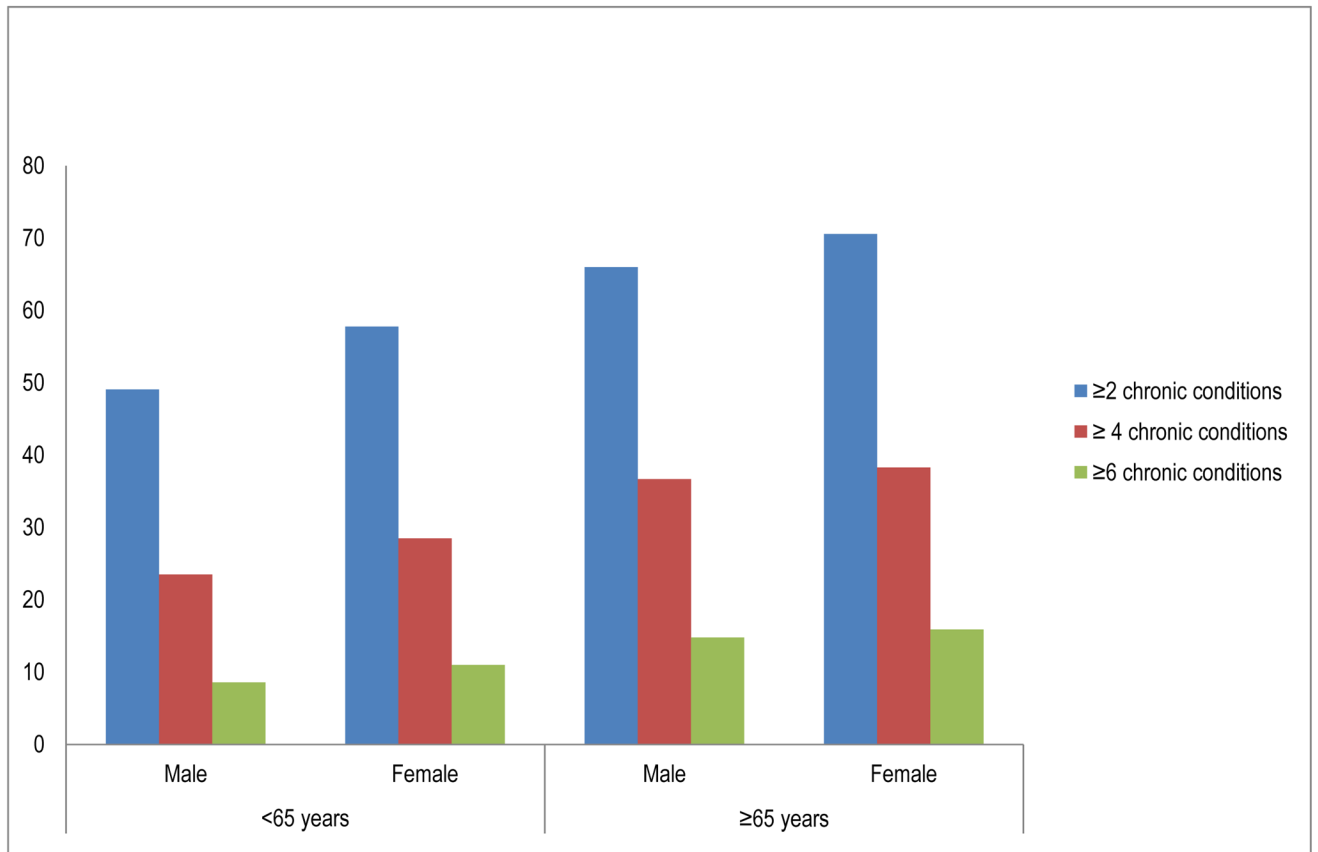


Figure 2. Age and sex associated prevalence of multimorbidity by number of chronic conditions demonstrating the higher prevalence of number of chronic conditions above 65 as compared to below 65 and the higher prevalence of multimorbidity in women as compared to men.

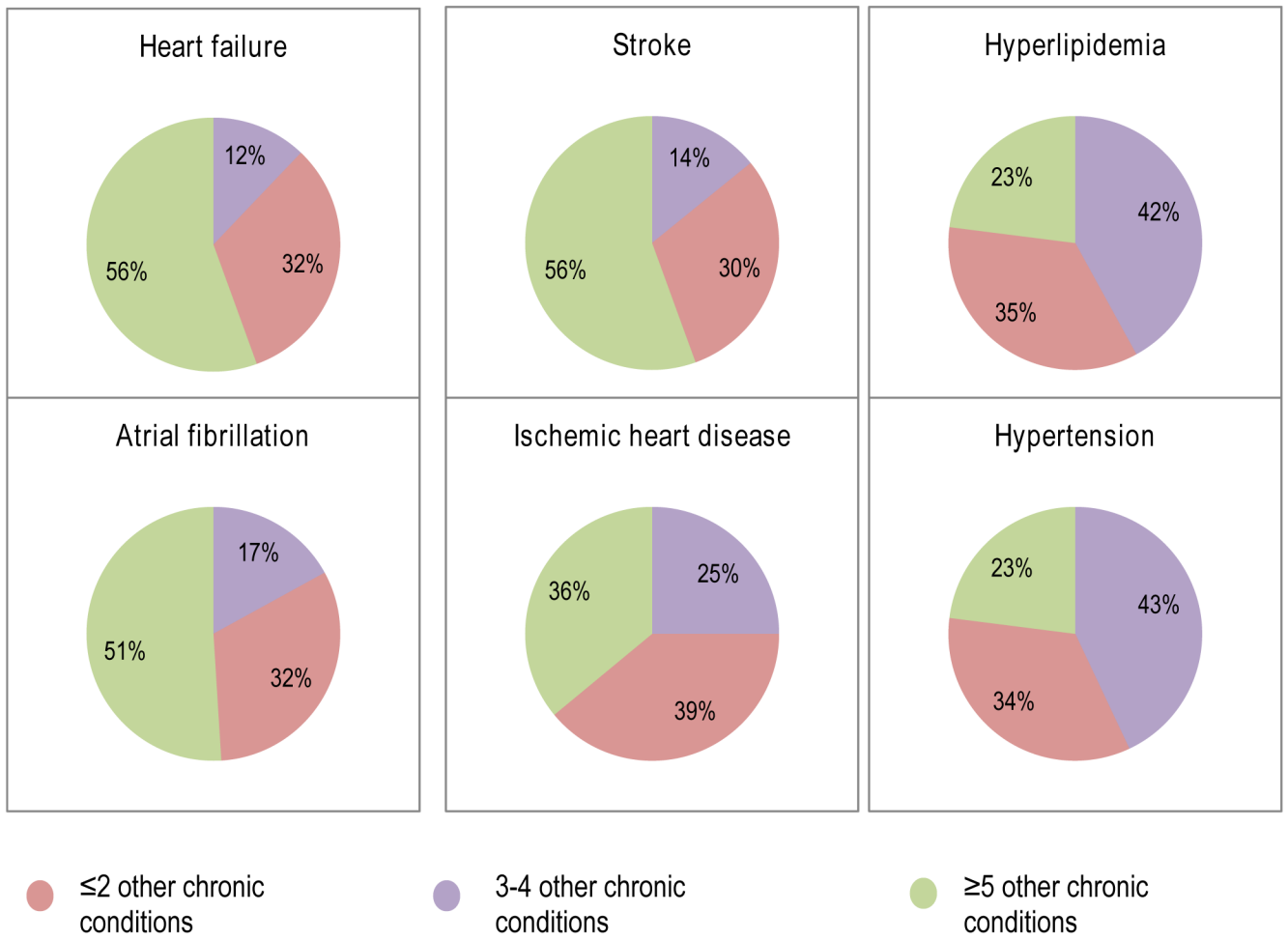


Figure 3. Number of co-existing chronic conditions amongst Medicare Fee for Service Beneficiaries with common cardiovascular diagnoses

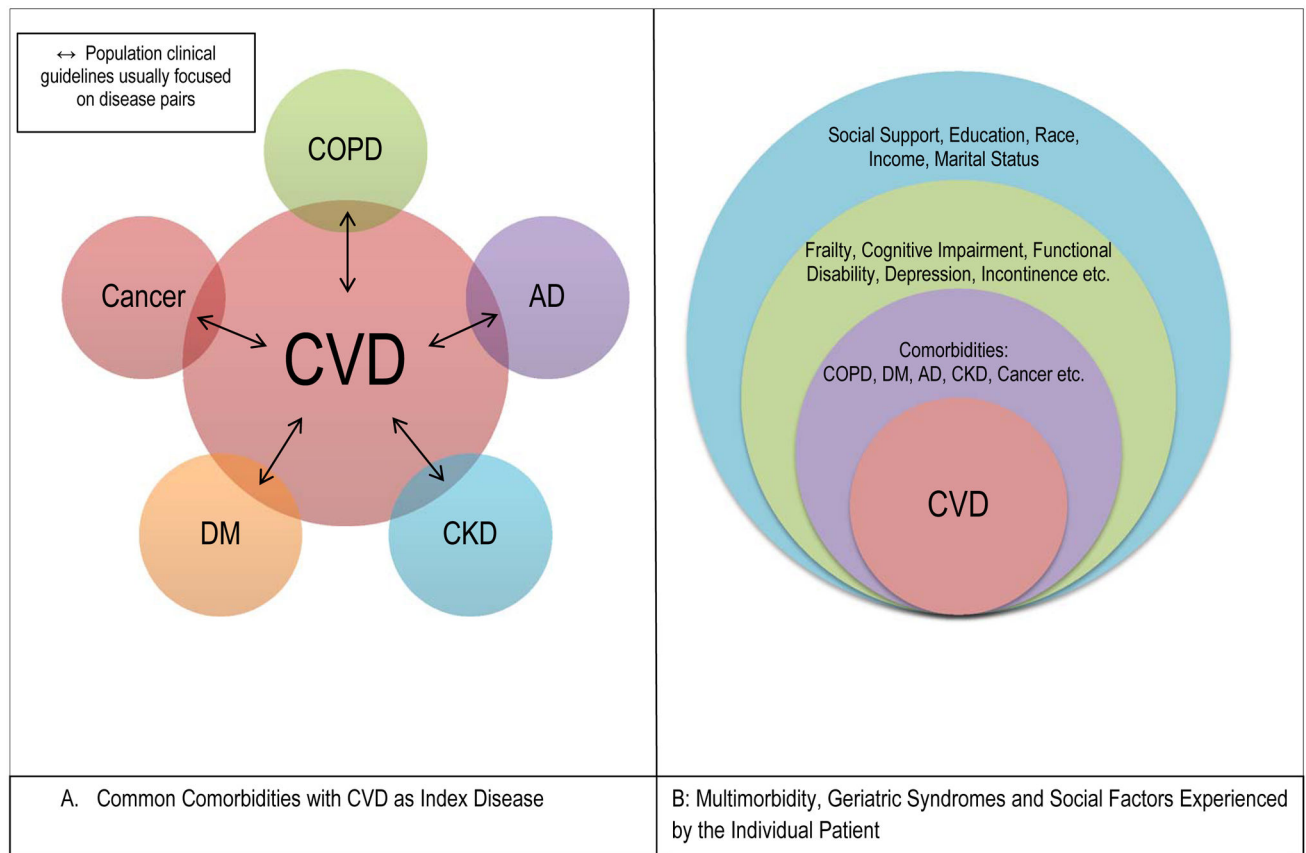


Figure 4. Conceptual model of comorbidity vs. multimorbidity in the context of CVD. A: Comorbid conceptual framework demonstrating the traditional disease-centered approach to understanding disease processes. Clinical practice guidelines are based on this framework where at most when comorbid conditions are considered they focus on disease pairs, such as CVD and diabetes mellitus or CVD and chronic kidney disease. B: Multimorbid conceptual framework demonstrating a more patient-centric approach to managing CVD in the context of multiple chronic conditions, geriatric syndromes, functional status and social determinants of health.

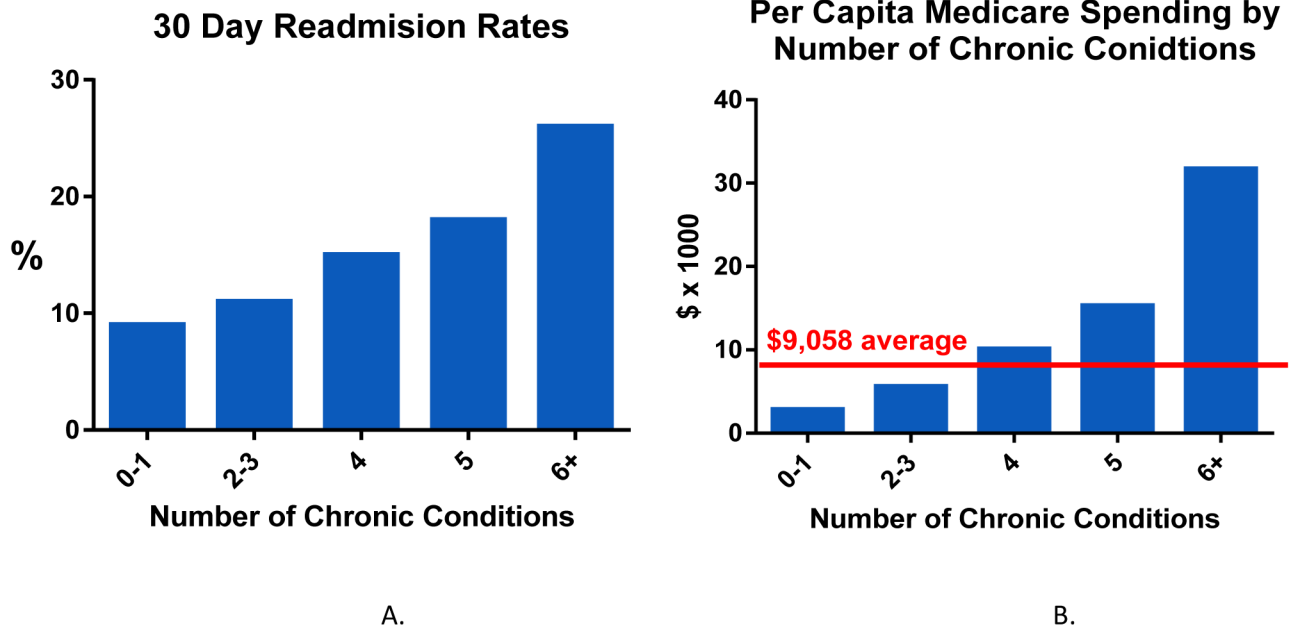


Figure 5.
 A: Readmission rates for Fee-for-Service Medicare beneficiaries by number of chronic conditions showing that readmission rates increase with increasing number of chronic conditions. B: Per Capita spending for Medicare beneficiaries by number of chronic conditions showing that individuals with 6 or more chronic conditions cost over 3 times the average spending rate.

Table 1

Factors Affecting Management of Heart Failure with Significant Multimorbidity

<i>CVD Coexisting Conditions</i>		
	Estimated prevalence	Drug-disease, drug-drug, disease-disease interactions
Hypertension	85.6% ¹⁰	<ul style="list-style-type: none"> • Orthostatic hypotension • Increased risk of falls with treatment • Optimal tolerated medical therapy limited with chronic kidney disease
Ischemic Heart Disease	72.1% ¹⁰	<ul style="list-style-type: none"> • Intolerance of beta-blocker therapy due to fatigue • Reduced exertional symptoms due to mobility impairment • Intolerance of statins due to muscle aches • Heart healthy diet may increase unintentional weight loss
Atrial Fibrillation	28.8% ¹⁰	<ul style="list-style-type: none"> • Anticoagulation monitoring • Toxicity with impaired renal or hepatic clearance • Anticoagulation and antiplatelet therapy increases bleeding risk • Increased dizziness from medications (Propafonone, Flecainide) • Nausea and reduced appetite (Amiodarone) • Adherence to diet for Coumadin therapy may reduce compliance with heart healthy diet
<i>Chronic Non Cardiac Coexisting Conditions</i>		
Chronic Kidney Disease	44.8% ¹⁰	<ul style="list-style-type: none"> • Diuretic resistance • Increase risk of contrast induced nephrotoxicity with angiography • Increased bleeding risk with antiplatelet therapies • Increased stroke risk • Advanced kidney disease will limit heart failure therapies and increase volume retention • General fatigue, vomiting and loss of appetite will increase weight loss and sarcopenia
Chronic Obstructive Pulmonary disease (COPD)	30.9% ¹⁰	<ul style="list-style-type: none"> • Intolerance of beta-blockers • Beta agonist therapy may increase heart rate • Steroid treatment may promote fluid retention • Exacerbation of COPD and heart failure common and difficult to discriminate primary trigger

<i>Geriatric Syndromes</i>		
	Estimated prevalence	Drug-disease, drug-drug, disease-disease interactions
Incontinence	50% ³⁴	<ul style="list-style-type: none"> • Anticholinergic effects of incontinence treatment may increase confusion and impair cognition • Medications may increase dry mouth leading to increased PO intake • Assessment of fluid balance utilizing input: output ratio impaired • Reduced compliance with diuretic therapy through fear of incontinence • Reduced social activities and physical activity • Increased risk of falls due to urgency
Mobility Impairment	> 57% ³⁵	<ul style="list-style-type: none"> • Reduced physical activity increases cardiovascular risk, increased frailty, and increased risk of falls • Reduced mobility impairs compliance with daily weights and access to heart healthy diet
Falls	35% ³⁶	<ul style="list-style-type: none"> • Reduced mobility due to fear of falls • Increased risk of injury with antiplatelet and anticoagulation therapy
Weight loss	7 – 9% ³⁷	<ul style="list-style-type: none"> • Side effects of medications may reduce caloric intake (metallic taste, nausea, vomiting, GI upset) • Impaired pharmacodynamics leading to overdosing of standard medications and increased side effects

Table 2 Comparison of baseline characteristics in GRACE ACS registry and ACS focused clinical interventional trials

Patient Characteristics	GRACE registry ²⁴			Clinical Trials		
	STEMI	NSTEMI	Unstable Angina	CAPTIM Study ²⁵	CURE trial ²⁶	GUSTO IV ACS trial ²⁷
Age Median (mean)	64	68	66	58	(64)	(65)
>65 years	51%	60%	57%	--	49%	--
>75 years	25%	32%	27%	10%	--	22.7%
Men	72%	67%	62%	82.5%	62%	62%
Prior Myocardial Infarction	19%	33%	41%	8.2%	32%	30%
Heart Failure	7%	14%	14%	Not reported	7.4%	8%
Diabetes Mellitus	21%	27%	25%	11.1%	22.8%	22%
Hypertension	50%	59%	65%	33.9%	59%	51%
Hypercholesterolemia	35%	42%	51%	51%	Not reported	30%
Body Mass index	27	27	27	Not reported	Not reported	Mean weight 77 Kg
Prior Stroke	6%	10%	9%	Not reported	4.4%	3%