Disparity and Multimorbidity in Heart Failure Patients Over the Age of 80

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Abstract

Background: Healthcare is currently struggling to provide access and coverage for an increasingly diverse aging population who frequently have multiple co-morbid conditions complicating their care and medical management. **Methods:** This retrospective study analyzed the prevalence and distribution of common co-morbid conditions (hypertension, dyslipidemia, dementia, and diabetes mellitus) in 316 elderly heart failure patients (age range 80–103; mean 87 ±4.9). **Results:** Chart review analysis showed a racial distribution of 65 African American versus 251 Caucasian patients (21 vs. 79%). Hypertension was comparable in both groups (98.5% African American vs. 92.4% Caucasian). Dyslipidemia, diabetes and dementia diagnoses were all approximately 20% higher in African American versus Caucasian patients. The concurrent presence of all four conditions was approximately three times more prevalent in African Americans (18.5%) versus Caucasians (7.2%). **Conclusion:** Our study is unique for studying disparity in octogenarian and nonagenarians residing in a rural setting. Our results also highlight the importance of making a special effort to engage older African American patients in seeking healthcare. In addition, strategies must be designed to reduce barriers that impede access and availability of resources and clinical care, especially in economically underserved regions of the country.

Introduction

Life expectancy in the United States has increased from 47 years in 1900 to 79 years in 2016 for both men and women (CDC/National Center for Health statistics/Division of analysis and Epidemiology, 2017, Centers for Disease Control and Prevention, 2020). The number of older adults between 2020 and 2060 is estimated to increase by 69% from 56 million to 94.7 million individuals (Mather & Kilduff, 2020). For the population aged 85 and older, the number is expected to triple in size from 6.7 million in 2020 to 19 million individuals by 2060 (Mather & Kilduff, 2020). This steady growth of the oldest segment of the older population will significantly increase the incidence and prevalence of age-associated diseases such as hypertension and heart failure (Azhar et al., 2017; Azhar & Wei, 2015; Saczynski et al., 2013; Wei, 1992). This burgeoning population, with complex conditions and frequent use of multiple medications

(polypharmacy), is progressively increasing in numbers; therefore, it is vital for physicians to prepare to care for increasingly older adults. In addition, it is estimated that within the next 35 years, non-Hispanic whites may no longer represent the majority of the US population (US Census Bureau, 2008). Working towards decreasing disparities in healthcare access and treatment of common multi-morbidities in these populations will support an improvement in quality

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of life while decreasing the overall costs to the healthcare system.

Heart failure is a common age-related condition found in the mature adult population. Socioeconomic factors, race, and conditions associated with heart failure such as hypertension, dyslipidemia, dementia, and diabetes may impact the development of heart failure and longevity (Greenlund et al., 2012; Tisminetzky et al., 2018). While mortality rates due to heart disease have declined over the past two decades, cardiovascular disease remains the most frequent cause of death in those over 65 (Mensah et al., 2017). Of the deaths with an underlying cause due to heart failure, 92% of those are among individuals 65 years and older (Greenlund et al., 2012). Heart failure is the leading cause of morbidity amongst older adults and accounts for a significant portion of healthcare costs and hospitalizations (Saczynski et al., 2013; Shah et al., 2020). Heart failure is estimated to affect approximately 6.2 million individuals in the United States (Virani et al., 2020). The healthcare cost of heart failure is estimated to increase from $30.7 billion in 2012 to $69.8 billion by 2030 (Heidenreich et al., 2013).

There are known disparities in diagnosis, treatment, and outcomes in heart failure patients of ethnic minorities. According to Nayak et al., heart failure-related death rates are approximately 2.6 and 2.97-fold higher in African American men and women respectively, compared to Caucasian men and women (Nayak et al., 2020). Studies have noted that race modestly influences the decision making of physicians when offering treatments to patients such as those who actually receive a heart transplant (Breathett et al., 2019; Young, 2020). The higher prevalence of cardiovascular risk factors in African Americans contributes to the higher prevalence of heart failure-associated mortality.

Although there is evidence that the risk for metabolic multi-morbidities in heart failure patients increases with advancing age, there is a dearth of information comparing the disparity of co- and multi-morbidities among different ethnic groups, particularly in the rural South-Central United States. Therefore, we conducted a retrospective review of the electronic medical records (EMR) of community-dwelling older adults with heart failure and examined the prevalence of common conditions such as hypertension, dyslipidemia, diabetes, and dementia.

Methods

Study Population

A data warehouse search was performed for elderly heart failure patients, aged 80 or over, who attended the geriatric outpatient clinic from 2011 to 2016 at the University of Arkansas for Medical Sciences (UAMS). A total of 494 older adult subjects with a documented diagnosis of heart failure were identified. Chart review was conducted by two reviewers, who selected a final total of 316 heart failure patients for inclusion in this study. The remaining records were excluded for not meeting the inclusion criteria or for lacking relevant data. Charts excluded included those subjects under the age of 80, duplicated charts, and those without the formal diagnosis of heart failure. Data of the 316 remaining heart failure patients were collected from the most recent visit recorded in the EMR. Data included subject demographics, physiologic, metabolic, and biochemical information. This study proposal was approved by the UAMS Institutional Review Board (Protocol #134775).

Criteria and Definition

The inclusion criteria were: age ≥80 years, both genders, all ethnic groups, with a clinically documented diagnosis of any subtype of heart failure, including diastolic, systolic, combined heart failure, or heart failure with preserved ejection fraction. Data on co- and multi-morbidities included diagnoses of hypertension, dyslipidemia, diabetes mellitus, and dementia from the problem list. In addition, the medication list was reviewed in case the problem list was not comprehensive. If the medication list indicated the presence of one of the listed diagnoses, the condition was added to our analysis as if it were on the problem list.

Patients were grouped according to the number of comorbidities and multi-morbidities they were diagnosed with in addition to heart failure. Hypertension was defined as a need for anti-hypertensive medications or systolic ≥140 mmHg or diastolic ≥90 mmHg. Dyslipidemia was defined as a need for hypolipidemic medications or a total plasma cholesterol level over 200 mg/dl or LDL over 130 mg/dl or treatment with lipid-lowering agents. Diabetes mellitus was defined as either FPG ≥126 mg/dL (7.0 mmol/L), HbA1C ≥6.5%, or treatment with insulin and/or oral hypoglycemic medications. Dementia was defined as a clinical diagnosis of any subtype of dementia (vascular, Alzheimer, Lewy Body, post-traumatic, Parkinsonian, or documentation of cognitive impairment due to other causes) of any degree requiring treatment with dementia drugs.

Results

Chart review analysis of 316 patients showed a racial distribution of 251 Caucasian versus 65 African American patients (79% vs. 21%). The mean age was 87 ± 4.9 years old. Male patients were under-represented (AA = 13.8% and C = 26.3%), while female patients predominated (AA= 86.2% and C= 73.7%; Table 1). The proportion of African Americans and Caucasians with hypertension was comparable at 98.5 and 92.4%, respectively (Figure 1). Dyslipidemia was present in 84.6% African Americans versus 63.3% Caucasians. The diagnosis of dementia was higher in African Americans, 61.5%, compared to Caucasians, 44.6%. The greatest disparity was in the diagnosis of diabetes, which was higher in African Americans, 41.5%, versus Caucasians, 21.9%.

The Caucasian patients with heart failure were more likely to have one or two concurrent comorbid conditions, whereas

Table 1. Study demographics (*n* = 316). The majority of patients were Caucasian women, however, mean age was approximately the same for all demographic groups.

	All	Caucasian	African American
Mean age ± SD	87 ± 4.9	87 ± 4.9	87 ± 5.0
Female, N (%)	240	185 (77)	56 (23)
Male, N (%)	75	66 (88)	9 (12)
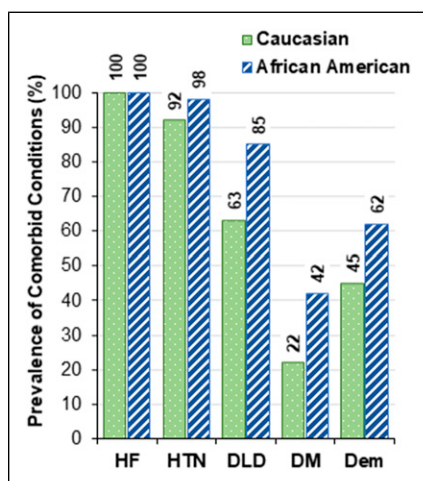
Figure 1. Each comorbid condition complicating heart failure. While African Americans only made up 21% of the study cohort, they had a higher prevalence of each comorbid condition studied than their Caucasian counterpart. (HF = Heart Failure, HTN = Hypertension, DLD = Dyslipidemia, DM = Diabetes, Dem = Dementia).

Figure 2. Comorbid conditions complicating heart failure categorized into number of diagnoses, 1-5. Race appeared to factor into increased numbers of multimorbidity; where Caucasians were more likely to have 1, 2, or 3 concurrent diagnoses, African Americans were more likely to have 4 or 5 concurrent conditions affecting their heart failure.

the African American patients were more likely to have three or four coexisting multimorbid conditions. Furthermore, African American patients were approximately three times more likely to have all four coexisting multi-morbidities (18.5%) when compared to Caucasian patients (7.2%).
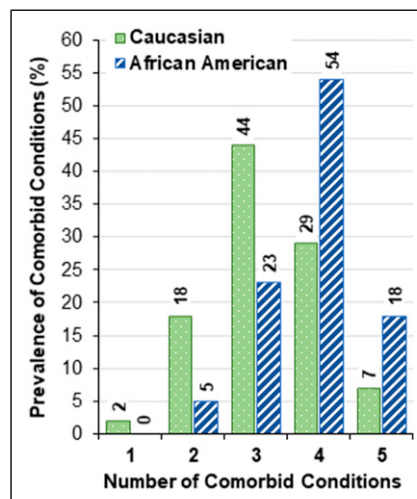
The most significant disparity between races was diabetes as a co-morbid condition, where the prevalence in African Americans was nearly twice that of their Caucasian counterparts. There were only four patients without any co-morbid conditions complicating their heart failure, all of whom were Caucasian (Figure 2).

In our study, 75% of patients had either three or four multi-morbidities complicating their heart failure. The percent differences between Caucasians and African Americans with comorbidities or multi-morbidities are shown in Figure 3.

Discussion

Hypertension

According to the CDC, nearly half of all adults in the United States (45.4%) have hypertension and the costs in the United

States are estimated at about $131 billion each year in healthcare expenditures (Ostchega et al., 2020). Additionally, hypertension prevalence increases with age, from 22.4% of adults 18–39 years of age to 74.5% of those 60 years and older (Ostchega et al., 2020). Our results continue this trend, with our population of patients over the age of 80 having a hypertension prevalence of 93.7% (AA = 98.5% vs. CC = 92.4%).

Hypertension is highly prevalent among both African Americans and Caucasians. However, even with effective pharmacotherapies, disease management is frequently less affective among African Americans, leading to higher rates of morbidity and mortality (Carnethon et al., 2017). African Americans are also more likely to develop hypertension at an earlier age, experience more severe high blood pressure, and are less likely to receive treatment (Satia, 2010). There is not one solitary known cause of the difference in hypertension prevalence between African Americans and Caucasians. Genetic factors, socioeconomic status, perceived daily stress, social network, and lack of access to effective medical treatment all interconnectedly potentiate this discrepancy between difference races.

It is also known that negative self-stereotypes and perceived negative racial and aging attitudes are potentially contributory (Levy et al., 2008). In a prospective study that was conducted in older African American women and men, the negative age self-stereotypes showed a significantly more elevated cardiovascular response in terms of elevated blood pressure, heart rate, and poorer cognitive response to mental and verbal challenges (Levy et al., 2008).

Genetic factors such as variations of the MYH9 gene on chromosome 22 and a higher prevalence of this gene in
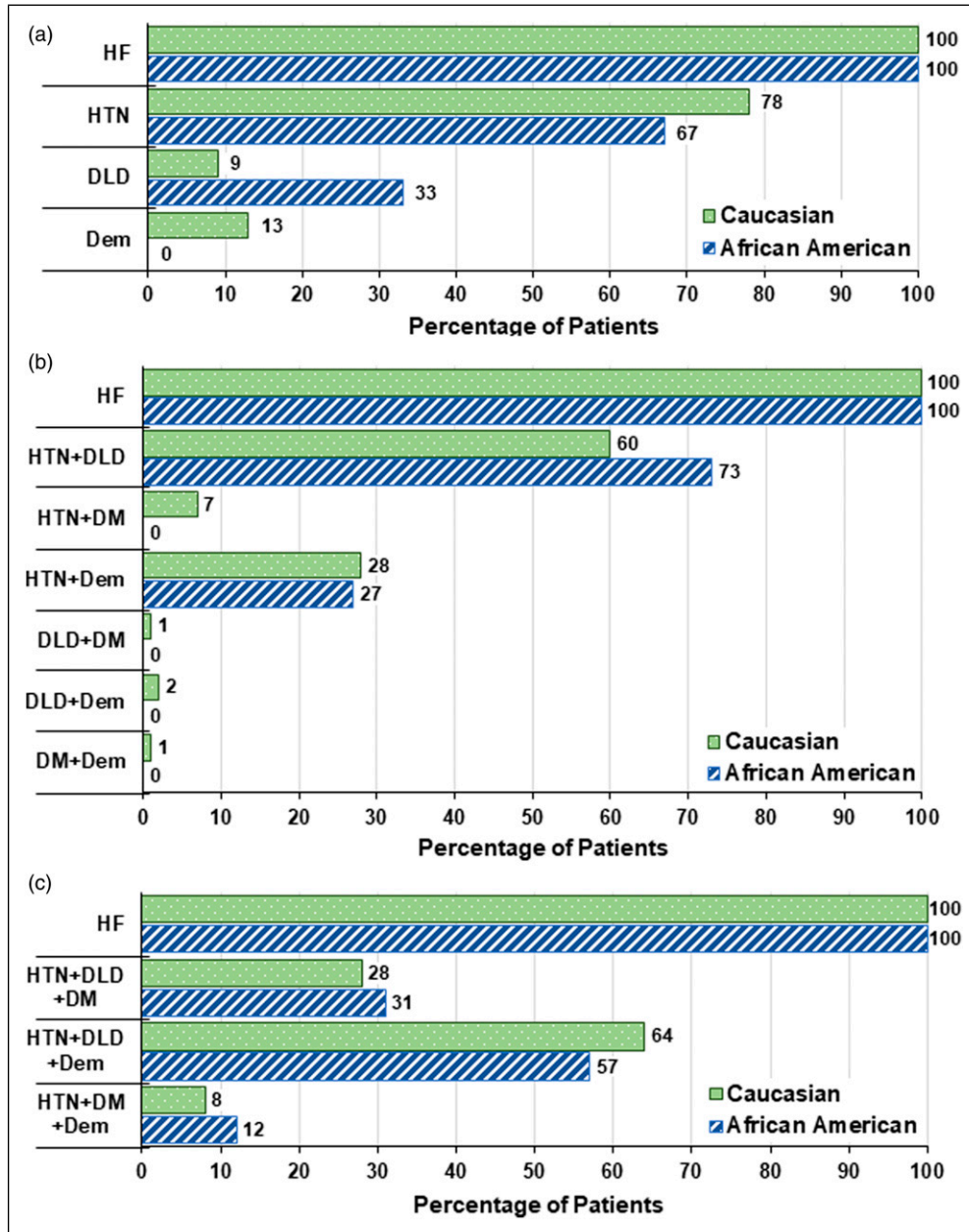
Figure 3. Multimorbidity distribution; all patients had a diagnosis of heart failure in addition to other diagnoses. **a:** Cohort percentages of each condition; **b:** Patients with two concurrent conditions in addition to heart failure; **c:** Patients with three concurrent conditions in addition to heart failure. (HF = Heart Failure, HTN = Hypertension, DLD = Dyslipidemia, DM = Diabetes, Dem = Dementia).

African Americans play a role in the development of focal segmental sclerosis of the kidney (Kopp et al., 2010). These genetic variations could possibly lead to the development of end-stage renal disease which may then lead to hypertension development (Fuchs, 2011). Along with genetics, behavioral and environmental habits also impact the prevalence of hypertension. Lifestyle choices such as smoking, adherence to medication, and nutritional differences between Caucasians and African Americans might also influence hypertension prevalence as well as

dyslipidemia, diabetes mellitus, and dementia. Inadequate nutrition leading to the development of various conditions such as hypertension, dyslipidemia, and diabetes could also be a result of a lack of knowledge of what a proper nutritious diet looks like. Recipes for traditional southern "soul" food have substantial amounts of sugar, fats, and processed meats and have been passed down from generation after generation in African American culture (Belle, 2009; Webb et al., 2014). Food groups such as these, consumed on a regular basis with a decreased level of

physical activity, increase the likelihood of developing hypertension.

While some nutritional factors are cultural, there are socioeconomic factors independent of race that impact lifestyle choices, such as the ability to leave home due to a disability, or the availability of healthy, affordable food options in those rural areas considered food deserts (Satia, 2010). In a study examining food deserts, patients in neighborhoods with limited access to fresh produce and healthy foods were more often African American, who also had lower education levels, higher BMI, and increased rates of hypertension compared to individuals living in favorable food access areas (Kelli et al., 2017). Similar findings, in addition to higher prevalence of diabetes, smoking, and dyslipidemia were observed in subjects living in low income as compared to high income areas (Kelli et al., 2017).

Dyslipidemia

In the general population, dyslipidemia is a known co-morbidity that increases morbidity and mortality related to cardiovascular diseases such as coronary artery disease, atherosclerosis, and heart failure. In our study, dyslipidemia was present in over 20% more of the African American patients as compared to the Caucasian patients (AA = 84.6% vs. CC = 63.3%). This rate discrepancy is concerning considering that African Americans with dyslipidemia have higher rates of acute coronary syndrome (Graham, 2015). Furthermore, they are more likely to experience increased complications such as myocardial ischemia, increased re-hospitalization and mortality rates, and less likely to receive potentially beneficial treatments (Graham, 2015).

Obesity is one risk factor for development and potentiation of dyslipidemia. African American women have a higher prevalence of being overweight or obese (BMI ≥25) than white women (82.0 vs. 63.2%, respectively) (Dodgen & Spence-Almaguer, 2017). Overweight and obese patients have increased risk of developing long-term health consequences, such as dyslipidemia, hypertension, diabetes, obstructive sleep apnea, and heart disease (Bland & Sharma, 2017). There is also an increased morbidity burden and decreased quality of life from ailments that impact mobility, subsequently leading to decreased physical activity and weight gain exacerbation (Bland & Sharma, 2017; Tisminetzky et al., 2020).

While studies have shown that dyslipidemia increases the risk of non-ischemic heart failure, decreasing lipids in the serum can reverse heart dysfunction (Yao et al., 2020). Rosada et al. studied older adults with dyslipidemia and showed that treatment with statins could reduce cardiovascular events by approximately 20% (Rosada et al., 2020). However, several analyses have demonstrated that patients with established heart failure show an inverse relationship between cholesterol levels and outcomes (Bozkurt et al., 2016). Very low levels of LDL cholesterol have been associated with a poorer prognosis (Casiglia et al., 2003). This association was noted by Casiglia et al., who showed a discrepancy in mortality risk between genders. A high total cholesterol was a large risk factor for coronary mortality in elderly men, while low cholesterol predicted neoplastic mortality in women and other non-cardiovascular mortalities in both genders (Casiglia et al., 2003).

Diabetes

In the United States, diabetes is a continuously growing public health problem. In 2012, approximately 21 million people were diagnosed with diabetes, with an estimated additional eight million with undiagnosed diabetes (Canedo et al., 2018). In 2018, approximately 34.2 million people, or 10% of the United States population, had both diagnosed and undiagnosed diabetes mellitus. (Centers for Disease Control and Prevention, 2020).

The second-largest category of multi-morbidities complicating both Caucasian and African American heart failure patients in our study was the trifactor of hypertension, dyslipidemia, and diabetes. Over the past few decades, multitudinous studies have shown increased prevalence and poorer prognosis of heart failure patients with diabetes (Lehrke & Marx, 2017; Matsue et al., 2011).

Many studies have shown that diabetes disproportionately affects ethnic minorities and create a higher complication burden in these populations. In a study by Cheng et al. examining diabetes in the United States from 2011–2016, the prevalence of diabetes in African Americans was 20.4% compared to non-Hispanic Caucasians at 12.1% (Cheng et al., 2019). African American women were also 1.9 times more likely to develop diabetes, 2.3 times as likely to develop end-stage renal disease, and 2.4 times more likely to die of diabetes complications when compared to white women (Dodgen & Spence-Almaguer, 2017).

Dementia

In 2020, the United States had approximately 6.1 million adults ages ≥65 with clinical Alzheimer's disease. This number is expected to increase 18% to 7.2 million in 2025 and 128% to 13.8 million in 2060 (Rajan et al., 2021). Cardiovascular disease is one known risk factor for the development of dementia later in a person's life. Our results showed that in both African Americans and Caucasians, the concurrent combination of hypertension, dyslipidemia, and dementia accounted for 62% of patients with three multi-morbidities complicating heart failure. Additionally, the second most common single comorbidity was dementia (13%).

There have been numerous studies describing the inequality seen in dementia incidence and diagnosis among ethnic minorities. While Rajan et al. estimated the prevalence of people with dementia in 2020 was 70.8% Caucasian and 17.5% African American, Mayeda et al. showed that the

incidence of dementia in African Americans was higher at 26.6/1000 compared to 19.3/1000 in Caucasians (Rajan et al., 2021; Mayeda et al., 2016). Wilson et al. also noted a significant difference ($p < 0.001$) in the dementia rates between African American and Caucasian subgroups, 55.0% versus 31.0%, respectively (Wilson et al., 2020). In our study of patients over the age of 80 years this discrepancy was supported, as over 60% of African American patients had dementia versus less than half of Caucasian patients. By 2060, the proportions of persons with dementia who are African American are expected to increase by 1.4 fold, while decreasing 25% in Caucasians (Rajan et al., 2021).

One hypothesis for this discrepancy is that African Americans are 1.4 times more likely to carry the APOE ε4 allele than European Americans (Sinha et al., 2018). Homozygotes for the apolipoprotein E (APOE) ε4 allele have an increased risk of developing Alzheimer's disease (Sinha et al., 2018). African Americans with the APOE ε4 allele are at higher odds of moderate to rapid cognitive decline compared with slower cognitive decline in European Americans carrying the allele (Rajan et al., 2019).

Due to the complexity of multiple risk factors and the associated high morbidity and mortality rates, further research is needed that includes self-stereotypes and perceived stress, as well as life-course perspectives to account for many environmental and sociocultural factors that may put disproportionately affected populations at increased risk for dementia (Alzheimer's Association, 2022). Physicians must be aware of the trends in dementia incidence between different ethnicities and social disparities that contribute to it. By being aware of this, physicians can monitor patients' physical and mental health while diminishing that discrepancy.

The high prevalence of the multi-morbidity burden suggests these conditions might have contributed to the development of complications and potentially worse clinical outcomes (Tisminetzky et al., 2018). In studies of diabetes and heart failure, the rate of diabetic heart failure patients hospitalized for complications was nearly double that of heart failure patients without diabetes (Bozkurt et al., 2016; Braunstein et al., 2003). In addition, decreased quality of life and increased mortality have been seen with increased morbidity burden in heart failure patients.

The discrepancy seen between rates of comorbidity and multi-morbidity development among different ethnicities may not be solely due to race. In addition to race, accumulated socioeconomic factors such as poverty, low health literacy, and decreased access to affordable healthy food choices potentiate the disparity in accessing healthcare, timely diagnoses, and ultimately the treatment received. These minorities may also encounter implicit bias from the provider based on race and other factors. The biases of the providers can lead to decreased patient education, decreased treatment options, and an overall lack of care to those patients.

Study Limitations

Our study results were gathered from patients attending the University of Arkansas for Medical Sciences, the only university hospital in the state of Arkansas, which receives patients from zip codes representative of South-Central Arkansas and therefore might not be generalizable. Another limitation of this study was that men were under-represented, accounting for only 24% of the total heart failure patients, as compared to 38% of the general population of Arkansans over the age of 80 years (U.S. Census Bureau, 2015-2019). Caucasian men accounted for 26% of total Caucasian patients, while African American men accounted for only 14% of all African American patients.

Furthermore, due to the retrospective analysis method of this study, the health condition of each patient could not be independently verified by a study physician. For example, it could not be determined whether the diagnosis of dementia was based on appropriate examination and the use of standard screening tools for cognitive impairment. Hence dementia might be underdiagnosed or misdiagnosed. This same limitation was present for the other three comorbidities examined, as well as for the inclusion criteria of heart failure.

Another factor that we were not able to elucidate in this study were the specific barriers to healthcare the patients may have experienced earlier in life. We know from the literature that there has often been an implicit bias as to where the care is delivered. Rural areas and regions with high poverty levels commonly have a dearth of healthcare providers. Over 40% of Arkansas's population lives in rural areas, and the state is #5 in the list of 10 most impoverish states in the US (Mumford et al., 2020). Additionally, nearly 40% of Arkansans have low health literacy (Mumford et al., 2020). A 2022 report from the Alzheimer's Association lists a total of 55 geriatricians in the state of Arkansas (Alzheimer's Association, 2022). Coupled with personal transportation issues and low socioeconomic status, health conditions may go undiagnosed and untreated for many years. Racial and ethnic health disparities further impact the ability of many to find accessible health education and healthcare.

Conclusion

This study focuses on racial disparities observed in multi-morbidities documented in patients with heart failure over the age of 80 years at the University of Arkansas for Medical Sciences in Little Rock, Arkansas. Analysis of our retrospective data showed that African American patients bore a more substantial portion of the included morbidities than Caucasian patients, both in higher prevalence of each condition examined, as well as a higher likelihood of having four or more multi-morbidities.

The higher prevalence of these conditions in African Americans might indicate poorer healthcare received by this demographic, although in this study we did not directly compare healthcare disparity. However, we could infer from the lack of resources in this rural state, in particular availability of public transport, lower socio-economic status, and the dearth of primary care providers, that African Americans might have encountered more difficulty receiving appropriate management of these conditions. Furthermore, with the lack of healthcare access, there is also reduced access to health education, perpetuating low health literacy levels among the rural and impoverished communities.

The barriers that impede access and availability of resources and healthcare play a significant role in the potentiation of heart failure in elderly patients, especially in the economically underserved regions of the country. This recently analyzed data provides insight into the vast need for clinicians and other healthcare providers to develop strategies to reduce those barriers while engaging and maintaining relationships with older African American patients seeking healthcare.

Due to the significant and ever-increasing growth in the older adult demographic groups, the more rapidly we gain and disseminate knowledge about potential connections between cardiovascular health and comorbidities, the better able the clinicians will be to serve patients while working to mitigate the disability and tremendous economic burden of heart failure.

Declaration of Conflicting Interests

Funding

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