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## Cardiometabolic Outcomes in the Obese African American Population with Rheumatoid Arthritis

Cecilia Jillo Walan  
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# Walden University

College of Health Sciences and Public Policy

This is to certify that the doctoral dissertation by

Cecilia Jillo Walan

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Walden University

2025

Abstract

Cardiometabolic Outcomes in the Obese African American Population with Rheumatoid  
Arthritis

by

Cecilia Jillo Walan

PhD, Walden University, 2025

MBA, South University, 2018

BSc, Njala University, 2008

Dissertation Submitted in Partial Fulfillment  
of the Requirements for the Degree of  
Doctor of Philosophy  
Public Health

Walden University

August 2025

## Abstract

Rheumatoid arthritis (RA) disproportionately impacts African American adults, particularly those with obesity, due to overlapping cardiometabolic risks and health care disparities. The intersection of RA, obesity, and chronic conditions such as cardiovascular disease (CVD) and hypertension underscores the need for targeted public health interventions. This study investigated the association between RA and cardiometabolic outcomes among African American adults with obesity, aiming to identify significant predictors within this high-risk population. This quantitative study employed a cross-sectional design to analyze data from the 1999–2018 National Health and Nutrition Examination Survey undergirded by the social ecological change framework with  $N=23644$  African American adults age 20 years and older. Logistic regression analyses were conducted, with adjustments made for age, gender, educational attainment, and socioeconomic status as measured by the poverty-income ratio. The findings revealed that individuals with CVD were 2.66 times more likely to have RA ( $OR = 2.66$ , 95% CI: 2.03–3.48,  $p < .001$ ), and those with hypertension had 1.89 times higher odds ( $OR = 1.89$ , 95% CI: 1.38–2.58,  $p < .001$ ). Sex and socioeconomic status also emerged as significant predictors of RA among African Americans with obesity. Men had higher odds of RA compared to women despite previous literature reporting a higher prevalence of RA among women. The study may contribute to health equity efforts by informing culturally responsive, evidence-based interventions to reduce disease burden and improve outcomes in underserved communities.

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## Dedication

To God Almighty for seeing me through.

My late mother, Mrs. Theresa J. Benjamin, BSN, RM. Your unwavering belief in the power of education and your tireless efforts to instill values and nurture my growth have shaped me into who I am today. Though you are no longer with us, your legacy lives on in every accomplishment, every lesson learned, and every value upheld. This dissertation is dedicated to you, my guiding light, whose love and sacrifices have paved the way for my journey through academia and beyond. Your spirit will forever inspire me to strive for excellence and to make a meaningful contribution to the world. Thank you for everything, Mom.

To my father, Emmanuel B. Benjamin, your steadfast support, prayers, and encouragement have been a cornerstone in my life. Your wisdom and guidance have propelled me forward, and I am deeply grateful for your presence and influence.

To my beloved children, Richard Jr., Bithyah, and Samantha Walan, your patience and understanding during the times I should have spent with you, which I devoted to studying, have not gone unnoticed. You missed a lot, and I am committed to making it up to you now. Your love and resilience have been a source of strength throughout this journey.

To my husband, Richard T. Walan, your unwavering love and support have been my anchor through the challenges of this academic pursuit. Your belief in me has been a constant source of motivation, and I am profoundly thankful for your presence in my life.

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## Table of Contents

List of Tables .....	vii
List of Figures .....	ix
Chapter 1: Introduction to Study.....	1
Background.....	4
Problem Statement.....	6
Purpose of the Study .....	9
Independent Variables .....	11
Controlling Variables.....	12
Research Questions and Hypotheses .....	14
Theoretical Framework.....	15
Individual or Intrapersonal Level.....	16
Cardiovascular Disease.....	18
Hypertension.....	18
Rheumatoid Arthritis .....	19
Nature of the Study .....	19
Definitions.....	21
Assumptions.....	22
Scope and Delimitations .....	24
Scope 24	
Delimitations.....	25
Limitations .....	28

Significance of the Study .....	29
Summary .....	31
Chapter 2: Literature Review .....	34
Definition and Epidemiology of RA.....	36
Literature Search Strategy.....	40
Theoretical Foundation .....	43
Socio-Ecological Model.....	45
Intrapersonal/Individual Level.....	46
Interpersonal/Community Level .....	46
Organizational Level.....	47
Environmental Level.....	47
Public Policy Level.....	48
Literature Review of Key Study Variables and Concepts .....	50
Overview of RA Within the Context of Existing Literature.....	50
Impact of Cardiovascular Disease on RA Among African Americans With Obesity .....	51
Impact of Hypertension on RA Among African Americans With Obesity .....	58
Age and Sex Effects on Cardiometabolic Outcomes of RA .....	66
Impact of Socioeconomic Status on Cardiometabolic Outcomes.....	71
Synthesis .....	72
Literature Gaps.....	73
Summary and Conclusions .....	77

Chapter 3: Research Method.....	80
Research Questions and Hypotheses .....	80
Research Design and Rationale .....	81
Methodology.....	83
Study Sample and Population Setting.....	84
Power Analysis .....	85
Instrumentation and Materials .....	85
Validity and Reliability of the Instrument .....	86
Study Variables.....	91
Covariates .....	92
Statistical Analyses .....	94
Data Collection and Analysis.....	96
Potential Threats to Validity .....	99
Sample Weights and Other Considerations .....	100
National Representativeness and Sampling Method.....	101
Recruitment and Participant Engagement.....	102
Summary .....	103
Chapter 4: Results .....	105
Data Collection .....	107
Results	107
Descriptive Statistics.....	107
Descriptive Statistics of Study Variables.....	109

Test for Multicollinearity .....	112
Complex Sample Logistics Regression Analysis .....	117
Sex as a Predictor of RA .....	119
Statistical Analysis.....	120
Differences in RA Risk Among African American Males and Females	
With Obesity .....	120
Odds Ratio Analysis for Socioeconomic Status .....	121
Odds Ratio for Education Level .....	121
Summary of Research Question 1.....	125
Research Hypotheses and Findings for RQ1: Association Between Gender	
and RA .....	125
Sex Differences of RA Among African American Adults With Obesity .....	126
Research Question 2 .....	126
Cardiovascular Disease and RA risk (Odds Ratio Analysis).....	127
Odds Ratio for Cardiovascular Disease .....	127
Odds Ratio for Gender .....	127
Odds Ratio for Socioeconomic Status .....	128
Pseudo R-Squared Analysis.....	129
Cardiovascular Disease as a Predictor of RA (Test of Model Effects).....	130
Analysis of Covariate Information.....	132
Summary of Research Question 2.....	132
Results Research Question 3.....	134

Model Fit and Overall Significance .....	138
Individual Predictor Variables .....	139
Odds Ratio Analysis for Research Question 3 .....	140
Logistics Regression Odds Ratio for RA (RQ3).....	140
Summary of Research Question 3.....	145
Summary and Conclusion .....	146
Chapter 5: Discussion, Conclusions, and Recommendations .....	149
Interpretation of the Findings.....	151
Strengths and Limitations of the Study.....	165
Study Limitations.....	165
Study Strengths .....	166
Recommendations.....	166
Targeted Screening and Early Intervention .....	166
Integrated Health Care Strategies .....	167
Population-Specific Interventions.....	167
Policy-Level Actions .....	168
Promote the Utilization of Family Health History Tools.....	168
Further Research .....	168
Implications.....	169
Public Health.....	169
Clinical Practice .....	169
Research and Epidemiology .....	170

Conclusions.....	171
References.....	173
Appendix: Multiple Regression Coefficient Table.....	188

## List of Tables

Table 1. Data Categorization and Analysis.....	94
Table 2. Descriptive Statistics for Study Variables .....	108
Table 3. Prevalence of RA Among African American Adults With Obesity.....	109
Table 4. Collinearity Diagnostics <sup>a</sup> .....	115
Table 5. Logistic Regression Analysis: Odds Ratios, 95% Confidence Intervals, and P-values for Sex, Socioeconomic Status, and Education Level.....	119
Table 6. Test on Model Effects.....	122
Table 7. Pseudo R Squares.....	123
Table 8. Covariate Information.....	124
Table 9. Logistic Regression Results: Odds Ratios, 95% Confidence Intervals, and P Values for Cardiovascular Disease, Gender, and Socioeconomic Status .....	127
Table 10. Pseudo R Squares.....	129
Table 11. Tests of Model Effects .....	130
Table 12. Covariate Information.....	132
Table 13. Weighted Distribution of Selected Categorical Variables Among Non-Hispanic Black Adults in the United States .....	135
Table 14. Covariate Information.....	137
Table 15. Pseudo R Squares.....	137
Table 16. Tests of Model Effects .....	138
Table 17. Logistic Regression Analysis: Association Between Hypertension and Predictor Variables .....	140

Table 18. Sample Table Title..... 144

Table 19. Percentages of Each of the Covariates Within the African American Adults  
With Obesity Sample for RA ..... 144

## List of Figures

Figure 1. SEM Diagram..... 45

Figure 2. Distribution of Males and Females Among the Study Participants ..... 110

## Chapter 1: Introduction to Study

Rheumatoid arthritis (RA) is a chronic, systemic autoimmune disease characterized by joint inflammation and various clinical manifestations (Zhu et al., 2024). If left untreated, RA can lead to immediate and long-term complications. In the short term, individuals may experience joint pain, stiffness, and limited mobility, which can interfere with daily activities and overall quality of life. Over time, RA may result in permanent joint damage, deformities, and the development of additional health conditions including depressive disorders, infections, premature mortality, osteopenia, osteoporosis, and venous thromboembolic disease (Chauhan et al., 2023).

According to the Global Burden of Disease (GBD) 2021 RA Collaborators (2023), in 2020, approximately 17.6 million people worldwide were diagnosed with RA, with a prevalence rate of 208.8 cases per 100,000 population (GBD 2021 RA Collaborators, 2023). RA disproportionately affects various demographic groups, with significant implications for racial minority populations, such as African American. Alawneh et al. (2020) conducted a cohort study exploring RA prevalence in these communities, contributing valuable data on gender distribution and age characteristics within affected groups. Their findings highlighted gender-specific trends and age patterns and provide evidence of RA's impact on racial minority populations and helping inform targeted health care strategies.

Mortality measures the number of deaths due to a specific disease within a population, often age-standardized to allow comparisons across groups, highlighting the disease's fatal impact and the effectiveness of health interventions. In 2020, RA had a

## Research results

global age-standardized death rate of 0.47 per 100,000, marking a 23.8% decline since 1990, with an estimated 38,300 global deaths (Black et al., 2023). Years of life lost, based on life expectancy at the time of death, reflect the disease's impact on lifespan. Years lived with disability (YLDs) capture the nonfatal burden by assessing years spent with impairments weighted by severity. In RA, YLDs accounted for 76.4% of disability-adjusted life years (DALYs) in 2020, underscoring the significant disability burden associated with this condition (Black et al., 2023).

The rate of occurrence of RA increased by 14.1% since 1990. The prevalence was notably higher in females, with a female-to-male ratio of 2.45. The death rate from RA decreased by 23.8% from 1990 to 2020, with an estimated 38,300 global deaths in 2020. The total DALYs in 2020 were 3,060,000, with YLDs accounting for 76.4% of the total DALYs. Projections suggested that by 2050, the number of individuals living with RA will increase to 31.7 million (Black et al., 2023).

Despite the substantial global impact of RA (Finckh et al., 2022), there remains a significant gap in the epidemiological literature regarding RA among African Americans. This gap hinders the development of effective public health policies and interventions, affecting overall health outcomes in this population. RA disproportionately impacts African American adults in the United States, exacerbating existing health disparities and significantly affecting their personal and professional lives RA (Finckh et al., 2022). Research indicated that non-Hispanic African Americans have a higher prevalence and risk of RA compared to non-Hispanic Whites (Ciofoaia et al., 2022). This disparity is

influenced by factors such as lower socioeconomic status (SES), limited access to health care, and higher stress levels associated with poverty (Black et al., 2023). These disparities not only lead to increased physical disability but also hinder employment opportunities and overall quality of life for African American individuals with RA. Addressing these issues requires targeted public health interventions and policies to improve access to care, early diagnosis, and equitable treatment options for this vulnerable population. Although the global burden of RA has been well-documented, specific populations, such as African American adults, face unique challenges related to this condition (Zhu et al., 2024).

RA is a chronic, inflammatory autoimmune disease that affects joint function and can lead to systemic complications, including cardiovascular and metabolic disorders. Its progressive nature and associated comorbidities pose significant clinical and public health challenges. Although RA affects individuals across all populations, African American adults with obesity face a disproportionate burden due to a combination of genetic, environmental, and socioeconomic factors (Baker et al., 2024). The current study examines the cardiometabolic outcomes of RA within this population, focusing on variables such as gender, cardiovascular disease, and hypertension while controlling for age and socioeconomic status. This research aims to deepen understanding of RA's complexity in underserved communities and underscores the urgent need to address health disparities through targeted public health interventions (Baker et al., 2024).

## **Background**

RA significantly affects the general population, with a profound impact on African Americans, who face unique health disparities. RA's systemic nature leads to various symptoms beyond joint pain, including fatigue, organ dysfunction, and an increased risk of cardiovascular disease, contributing to decreased quality of life and work productivity (Smolen et al., 2018). The implications of RA necessitate comprehensive management strategies beyond pharmacologic treatment. A multidisciplinary approach, integrating medical treatment, physical therapy, psychological support, and lifestyle adjustments, is essential to address the complex needs of individuals with RA (Wagenaar et al., 2025). This collaborative care model is particularly critical for African Americans, who often face additional challenges related to healthcare access, socioeconomic factors, and comorbidities (Santos-Moreno et al., 2022). Addressing these issues is crucial for improving health outcomes and reducing the disproportionate burden of RA in this population (Fautrel & Guillemin, 2018; Zhu et al., 2022)

African American adults, due to various social, environmental, and occupational factors, may face an increased risk of developing RA (Ciofoaia et al., 2022). A review by Yip et al. (2021) highlighted racial and ethnic disparities in the treatment and outcomes of RA. It notes that there is limited data on RA prevalence among African Americans and other minority groups, making it difficult to definitively state the extent to which African Americans are affected compared to other racial groups. Yip et al., 2021 further addresses the disparities African Americans face in accessing effective treatments, such as

biologics, disease-modifying antirheumatic drugs (DMARDs), which are medications used to treat autoimmune conditions like rheumatoid arthritis (RA) by slowing disease progression and preventing joint damage (Araet al., 2024). They are categorized into conventional synthetic DMARDs (csDMARDs), such as methotrexate and sulfasalazine; DMARDs (bDMARDs), which target specific components of the immune system; and targeted synthetic DMARDs (tsDMARDs), like Janus kinase (JAK) inhibitors, which block specific pathways involved in inflammation (Araet et al. 2024). These treatments are essential for managing RA symptoms and improving long-term outcomes. (bDMARDs) and mentions that African American patients with RA tend to experience higher levels of disability and different coping mechanisms, potentially influenced by socioeconomic and racial factors (Araet et al., 2024).

The risk factors for RA in this population include, but are not limited to, socioeconomic stress, occupational hazards, limited access to healthcare, and a higher prevalence of comorbidities such as obesity and cardiovascular disease (Butler et al., 2023). Despite the growing awareness of RA among African Americans, there remains a notable gap in the literature regarding the epidemiology of RA in this community, with limited data on specific risk factors, prevalence, and the impact of the disease on quality of life.

Obesity, defined by the World Health Organization (WHO) as a body mass index (BMI) of 30 or higher, significantly influences the development and progression of rheumatoid arthritis (RA). Excess adipose tissue secretes pro-inflammatory cytokines, exacerbating systemic inflammation and leading to more severe RA symptoms (Schäfer

et al., 2020). Moreover, obesity is associated with reduced efficacy of disease-modifying antirheumatic drugs (DMARDs) and a lower likelihood of achieving disease remission (Schäfer et al., 2020) Addressing obesity is crucial in managing RA to improve treatment outcomes and patient health.

The unique social and economic challenges faced by African Americans, including systemic inequalities in healthcare access and broader health disparities, emphasize the need for targeted interventions (Macias-Konstantopoulos et al., 2023) Understanding the prevalence and risk factors of RA among African Americans is crucial for developing strategies to reduce the burden of the disease, improve patient outcomes, and address the underlying health inequities that contribute to the higher rates of RA in this population (Zhu et al., 2022).

### **Problem Statement**

RA is a multifaceted condition that brings challenges that go beyond physical symptoms, impacting social and professional aspects of life, particularly for African American adults with obesity. The impact of RA is not limited to debilitating physical constraints but also includes significant implications for mental health, often exacerbated by occupational stress, and profoundly affects overall quality of life (Roodenrijs et al., 2021). The severe consequences of RA become even more significant when considering its impact on African American adults with obesity, a population already facing elevated risks for cardiometabolic conditions. As per the findings of Roodenrijs et al. (2021), individuals in this demographic are at an elevated risk for heart disease, with molecular alterations such as changes at the molecular level within cells that contribute to the onset

and progression of the disease. These alterations typically involve changes in genes, proteins, and cellular signaling pathways that drive the immune system's attack on joint tissues, causing inflammation, pain, and tissue damage. And disabilities that can result from the combined effects of rheumatoid arthritis and obesity. These overlapping conditions exacerbate health outcomes, making it critical to understand the cardiometabolic outcomes specific to African Americans living with both RA and obesity.

Untreated RA not only leads to joint destruction and disability but also increases the risk for cardiovascular diseases, osteoporosis, and mental health disorders, making a comprehensive treatment approach essential (Smolen et al., 2018). Reports from the Johns Hopkins Arthritis Center reveal that RA causes joint damage in 80% to 85% of patients, with the most significant damage occurring within the first two years of the disease. This underscores the urgency of early diagnosis and intervention, particularly in vulnerable populations like African Americans, to prevent long-term complications and improve overall quality of life among African Americans. (Johns Hopkins Arthritis Center, n.d.)

African American adults often face significant barriers to healthcare access, which can delay critical diagnosis and timely treatment, ultimately leading to worse health outcomes. These disparities stem from various factors, including socioeconomic obstacles like lower insurance coverage, limited financial resources, and employment instability, which make it challenging to afford or prioritize healthcare. Additionally, many African American communities are situated in areas with fewer healthcare facilities

or providers, creating geographic barriers that hinder access to primary and specialty care. When healthcare is accessible, African American patients may still encounter biases or a lack of culturally competent care, which can impact the quality of interactions and the likelihood of receiving early interventions (Soliman et al., 2023). This combination of factors can delay the detection and management of chronic conditions, often leading to disease progression and more severe health complications that could have been mitigated with timely care (Hill-Briggs et al, 2022).

In summary, this research represents a significant step toward addressing the complex challenges RA poses for African American adults. RA, combined with obesity, can lead to serious cardiometabolic complications, such as increased risks of cardiovascular disease and hypertension. These comorbidities are particularly prevalent among African Americans, who already face disproportionate health disparities (Soliman et al., 2023). The physical and systemic inflammation caused by RA, compounded by obesity, exacerbates these risks, making it essential to study the combined effect of these conditions within this population.

Understanding the cardiometabolic outcomes of RA in African American adults with obesity is critical for developing targeted interventions that can improve both disease management and overall health outcomes. This research aims to fill a crucial data gap by examining the bidirectional relationship between rheumatoid arthritis (RA) and cardiometabolic complications among African American adults with obesity. Given that both RA and obesity independently contribute to poor cardiometabolic health, this study seeks to explore whether RA exacerbates existing cardiometabolic risks in individuals

already predisposed due to obesity, or if the cardiometabolic outcomes commonly associated with RA disproportionately affect this demographic. The goal is to inform targeted healthcare policies and interventions that mitigate compounded health risks in this vulnerable population (Butler et al., 2023).

### **Purpose of the Study**

The purpose of this quantitative study is multi-dimensional, aiming to bridge a critical gap in the understanding of Rheumatoid Arthritis (RA) among African American adults with obesity and to explore the cardiometabolic outcomes associated with RA in this key demographic. RA is a chronic inflammatory disorder with serious implications for physical health, particularly when combined with obesity, which increases the risk of cardiometabolic conditions such as cardiovascular disease, diabetes, and hypertension (Luciano et al., 2025). While extensive research on RA exists, there is a significant gap in studies that focus specifically on African Americans, particularly regarding the role of obesity in RA-related cardiometabolic complications (Radu et al., 2021).

This study will consider a range of factors, including biological, lifestyle, and healthcare access variables, with particular emphasis on sex cardiovascular disease, and hypertension as critical independent variables. Sex is a key biological factor that may influence susceptibility to RA and its cardiometabolic outcomes. At the same time, obesity serves as a critical lifestyle factor that significantly impacts disease progression and health outcomes. Additionally, cardiovascular disease and hypertension are key components of cardiometabolic outcomes, which refer to a group of interrelated conditions, including elevated blood pressure, insulin resistance, dyslipidemia, and

central obesity that increase the risk of cardiovascular events and metabolic disorders (Swarup et al., 2024) These conditions are prevalent comorbidities among African American adults with RA and obesity, making them highly relevant and essential variables to investigate in the context of this study.

Cardiometabolic outcomes are essential to examine in African American adults with obesity, who face a disproportionate burden of hypertension and cardiovascular disease conditions that can be further exacerbated by rheumatoid arthritis and excess adiposity. Cardiometabolic health encompasses a range of interrelated outcomes, including hypertension, atherosclerosis, insulin resistance, dyslipidemia, type 2 diabetes, and central obesity (Zhou et al., 2024). These conditions collectively increase the risk for cardiovascular events and metabolic disorders, making it essential to examine how RA further contributes to their development and progression within this high-risk population (Zhou et al., 2024). By examining the intersection of these health concerns, this study seeks to provide a comprehensive understanding of how RA, sex, cardiovascular disease, and hypertension together influence the cardiometabolic health of African American adults with obesity. These findings will contribute valuable insights into the development of targeted interventions that can improve health outcomes for this population, informing public health strategies aimed at reducing the burden of RA and its associated complications (Butler et al., 2023).

## **Independent Variables**

### ***Sex***

Sex is a significant independent variable due to observed differences in RA prevalence and severity between males and females. Females are disproportionately affected by RA, with some studies indicating that hormonal factors may play a role in this disparity (Maranini et al., 2022). Understanding sex differences in RA is essential for developing gender-sensitive approaches to prevention, treatment, and support for African Americans with obesity in managing this condition.

### ***Cardiovascular Disease***

Cardiovascular disease is a significant independent variable in this study due to the well-established link between RA and increased cardiovascular risk. Individuals with RA have a higher prevalence of cardiovascular disease, with chronic inflammation contributing to the development of atherosclerosis and other heart-related conditions (Wu et al. 2022?). This risk is further compounded by obesity, which is already a major risk factor for cardiovascular disease (Wu et al., 2022). Understanding how RA exacerbates cardiovascular disease, particularly among African Americans who are disproportionately affected by both conditions, is crucial for developing comprehensive interventions that address both RA management and cardiovascular health. This focus will help in creating strategies tailored to reduce cardiovascular morbidity and mortality in this vulnerable population.

### ***Hypertension***

A major risk factor for cardiovascular disease is a critical independent variable, as it frequently coexists with both RA and obesity, further increasing the risk of adverse cardiometabolic outcomes. The chronic inflammation associated with RA can elevate blood pressure, while obesity adds additional strain on the cardiovascular system, heightening the likelihood of hypertension (Tu et al 2025?). African Americans with obesity face a higher prevalence of hypertension compared to other racial groups, making it a key area of concern in this study (Tu et al., 2025). Exploring the relationship between RA, hypertension, and obesity will offer valuable insights into how these conditions interact and influence overall health outcomes. This understanding will guide the development of targeted interventions aimed at controlling blood pressure, improving cardiovascular health, and reducing the overall burden of disease for African American adults managing RA and obesity.

### **Controlling Variables**

#### ***Age***

Age is a crucial controlling variable in this study, as the risk of developing both RA and cardiometabolic conditions increases with age. As individuals age, they are more likely to experience chronic inflammation and metabolic changes that contribute to the progression of RA and obesity-related complications (Corrao et al., 2024). Understanding how age influences the severity of these conditions among African American adults with obesity will help tailor interventions aimed at older populations to improve overall health outcomes.

### ***Education Level***

Education plays a vital role in health behaviors, access to care, and the ability to manage chronic conditions like RA and obesity. Lower education levels are often linked to limited health literacy, affecting disease management, treatment adherence, and lifestyle choices (Tsieh et al., 2025). By controlling for education level, this study aims to assess how differences in educational attainment impact the cardiometabolic outcomes of African American adults with RA and obesity, guiding strategies for improved health education and support.

### ***Socioeconomic Status***

Socioeconomic status is a significant controlling variable, as it is closely tied to access to healthcare, quality of treatment, and the ability to adopt healthy lifestyle changes. African American adults with lower SES are disproportionately affected by barriers to care and financial strain, which can worsen the outcomes of RA and obesity (Lofton et al., 2023). Controlling for SES will provide insights into how economic disparities influence disease progression and cardiometabolic outcomes, informing policies that aim to reduce these health inequities and improve care for African American adults managing both RA and obesity.

In summary, this proposed study investigates the complex interplay of factors contributing to RA among African American adults with obesity, with a particular focus on cardiometabolic outcomes. The insights gained from this research will be instrumental in developing targeted, evidence-based strategies to mitigate RA risk, improve disease management, and address the associated cardiometabolic complications, such as

cardiovascular disease and hypertension. By exploring these interconnected health challenges, this study aims to enhance our understanding of RA within the African American population, contributing to improved health outcomes and overall quality of life for this underserved group.

### **Research Questions and Hypotheses**

This study is guided by the following research questions (RQ) and hypotheses (*H*):

RQ1: Is there an association between sex and rheumatoid arthritis among obese African American adults after controlling for age, education level, and socioeconomic status?

$H_01$ : There is no association between sex and rheumatoid Arthritis among obese African American adults after controlling for age, education level, and socioeconomic status.

$H_a1$ : There is an association between gender and rheumatoid Arthritis among obese African American adults after controlling for age, education level, and socioeconomic status.

RQ2: Is there an association between rheumatoid arthritis and cardiovascular disease among obese African American adults after controlling for age, gender, and socioeconomic status?

$H_02$ : There is no association between cardiovascular disease and rheumatoid arthritis among obese African American adults after controlling for age, gender, and socioeconomic status.

$H_{a2}$ : There is an association between cardiovascular disease and rheumatoid arthritis among obese African American adults after controlling for age, gender, and socioeconomic status

RQ3: Is there an association between rheumatoid arthritis and hypertension after controlling for age, gender, and socioeconomic status?

$H_{o3}$ : There is no association between hypertension and rheumatoid arthritis among obese African American adults after controlling for age, gender, and socioeconomic status

$H_{a3}$ : There is an association between hypertension and rheumatoid arthritis among obese African American adults after controlling for age, gender, and socioeconomic status.

### **Theoretical Framework**

The theoretical framework for this study is anchored in the socio-ecological model, initially developed by Urie Bronfenbrenner in the late 1970s (Kilanowski, 2017). This comprehensive framework posits that to understand human behaviors and outcomes fully, one must consider the complex interplay of multiple layers of influence, from the personal to the broader societal context (Butler et al., 2023). This approach is particularly pertinent for examining health conditions like RA, which are influenced by a wide array of factors, including but not limited to biological predispositions, individual behaviors, social networks, institutional policies, and broader societal norms.

While the socio-ecological model (SEM) traditionally encompasses five levels: individual, interpersonal, organizational, community, and policy, this study intentionally

focuses on just three: the individual, interpersonal, and community levels. This targeted application is justified by the specific aims of the study, which center on understanding how personal behaviors, social dynamics, and environmental contexts influence RA outcomes among African American adults with obesity. Recent scholarship affirms that the selective use of SEM levels is valid and methodologically sound when the omitted layers are less relevant to the research context and the selected levels capture the primary influences under investigation. For example, Sun et al. (2023) demonstrated the effective use of a modified SEM in a study of physical activity among pregnant women, focusing only on the most analytically pertinent levels. Similarly, this study omits the organizational and policy levels due to its emphasis on proximal determinants of health, allowing for greater conceptual clarity and analytical precision. This approach preserves the model's integrity while tailoring it to the specific needs and scope of the study.

### **Individual or Intrapersonal Level**

At the individual or intrapersonal level, the socio-ecological model considers personal characteristics such as age, sex, and educational level to directly influence health behaviors and outcomes (McGrath, 2019). Age is a critical factor, as the prevalence and manifestation of many diseases, including RA, are closely linked to aging due to cumulative exposures and a general decline in physiological resilience over time. Age affects the risk of chronic diseases, including RA, cardiovascular disease, and hypertension, as the likelihood of these conditions increases with age.

Gender is another significant variable, with numerous studies indicating disparities in RA prevalence and severity between men and women, with females more

frequently affected than males. Gender differences are likely due to a combination of hormonal and environmental factors. Gender influences individual risk for CVD, hypertension, and RA. For example, women may have a higher risk of RA, while men may experience more severe cardiovascular outcomes.

A person's knowledge about health conditions and self-management practices can shape their behaviors. Lower education levels may lead to poor health literacy, increasing the risk of chronic diseases. Educational level plays a significant role in shaping health outcomes, particularly among African American adults. Lower educational attainment can contribute to poor health literacy, which affects an individual's ability to understand, manage, and prevent chronic diseases like rheumatoid arthritis, cardiovascular disease, and hypertension. Among African American adults, educational disparities often compound existing challenges related to access to quality healthcare and culturally relevant health information (Muvuka et al., 2020). This can lead to delayed diagnoses, mismanagement of chronic conditions, and limited engagement with preventive health practices, all of which increase the risk and severity of these conditions (Muvuka et al., 2020).

The interpersonal and community levels within the socio-ecological model, this study expands its focus to examine how social relationships and environmental contexts influence health outcomes beyond personal risk factors. At the interpersonal level, the analysis considers how family dynamics, peer influence, and healthcare interactions shape disease perception, treatment adherence, and health-seeking behavior among African American adults with obesity. These relational factors often determine whether

individuals receive timely care, emotional support, and encouragement to adopt healthier behaviors. At the community level, the study investigates how neighborhood conditions, such as the availability of healthcare facilities, access to affordable, nutritious food, and exposure to chronic stressors, contribute to disparities in rheumatoid arthritis and cardiometabolic outcomes. Emphasizing these layers provides a more holistic understanding of the structural and social barriers that compound individual-level vulnerabilities, thus aligning with the study's broader objective to explore multilevel determinants of disease burden in this population.

The individual level encapsulates how personal attributes like age, gender, genetics, and behaviors (such as physical activity and diet) directly contribute to the risk of developing CVD, hypertension, and RA. These conditions are chronic and often interrelated, particularly in populations with obesity, making individual biological and behavioral factors central to understanding their prevalence and management.

### **Cardiovascular Disease**

As a chronic condition, CVD is influenced by individual factors such as genetics, lifestyle (diet, exercise), and biological processes (such as inflammation, which is also linked to RA). Obesity is a major individual-level risk factor for both CVD and RA, increasing strain on the cardiovascular system and contributing to inflammation.

### **Hypertension**

Hypertension is closely related to obesity and CVD and is influenced by individual lifestyle choices, such as diet, physical activity, and stress management. It is also linked to genetic predispositions that can lead to poor blood pressure control.

## **Rheumatoid Arthritis**

As the dependent variable, RA is influenced by individual-level factors such as genetic susceptibility, immune system function, and personal health behaviors. Obesity, a significant individual risk factor, can worsen RA symptoms and complicate its management. However, RA is also a social factor, shaped by broader social determinants that impact its prevalence, severity, and management across different communities. This dual nature underscores the importance of addressing RA not only at the individual level but also within a social and environmental context.

### **Nature of the Study**

The nature of this study is rooted in a quantitative research approach, employing a cross-sectional design to investigate the cardiometabolic outcomes of rheumatoid arthritis among African American adults with Obesity. Quantitative research offers a robust framework for investigating the Cardiometabolic outcomes of rheumatoid arthritis among African American adults with Obesity. This approach facilitates precise measurement and analysis of variables like gender, cardiovascular disease, and hypertension (with controlling variables, age, and socioeconomic status). It allows for the quantification of their relationship with rheumatoid arthritis risk. Moreover, the generalizability of findings extends the study's implications beyond the specific sample, enhancing credibility, validity, and reliability. The systematic nature of quantitative research makes it well-suited for exploring rheumatoid arthritis in this context.

This methodological choice is driven by the study's objective to identify and quantify the associations between various individual, interpersonal, and

environmental/community factors and the cardiometabolic outcomes of rheumatoid arthritis among African American adults with obesity. A cross-sectional design is particularly suited for this research as it allows us to use a secondary data set. Data for the study were obtained from the National Health and Nutrition Examination Survey (NHANES) 1999-2018. NHANES is conducted by the Centers for Disease Control and Prevention through the National Center for Health Statistics. The survey offers comprehensive and population-based data reflecting the overall health and nutritional conditions of individuals living in the United States. It combines interviews, physical exams, and lab tests, offering detailed information on chronic diseases, comorbidities, and demographic variables. Secondary data set from NHANES was selected for this study, not only for its alignment with a cross-sectional design but also for its large, diverse sample, which supports subgroup analysis such as African American adults with obesity. Furthermore, the NHANES data was collected using standardized procedures by trained professionals in participants' homes and mobile centers. The survey adheres to strict ethical protocols, including informed consent and approval by a federal ethics review board, ensuring data reliability and participant protection.

The choice of a quantitative approach and a cross-sectional design for my study is informed by the need to establish clear, empirical associations between the predictor variables and the dependent variable of RA among African American adults with obesity. This approach aligns with the principles of epidemiological research, seeking to understand the distribution and determinants of health-related states or events in specified populations (Radu et al., 2021). By quantifying the association between potential risk

factors and RA, this proposed study provides robust evidence that can inform public health interventions and policies designed to reduce the incidence and impact of RA among African American adults with obesity.

Data analysis will involve statistical techniques to test hypotheses and examine the associations between independent variables (such as Age, gender, cardiovascular disease, hypertension, and socio-economic status) and the dependent variable, RA diagnosis (Butler et al., 2023). Descriptive statistics, including disease prevalence, will summarize the sample characteristics and RA prevalence. Also, logistic regression analysis will be used to identify significant predictors of RA among the study participants to create a model explaining the variation in RA prevalence within the sample.

In summary, this study's quantitative, cross-sectional nature is designed to provide insights into the prevalence of RA in African American adults with obesity and to identify key factors contributing to the disease's prevalence. This methodological approach seeks to generate valuable insights that can guide the development of targeted strategies to mitigate the risk and burden of RA among African American adults with obesity.

### **Definitions**

*Cardiovascular disease:* CVD is a major cause of mortality and disability worldwide. Correctional ventilation disorder can include conditions such as coronary heart disease, stroke, and heart failure.

*Cardiometabolic outcomes:* Cardiometabolic outcomes are groups of conditions that are closely linked and can lead to an increased risk of CVD. Other conditions that

can be part of cardiometabolic risk include dyslipidemia, insulin resistance, and abdominal Obesity.

*Hypertension:* Hypertension refers to high blood pressure, which occurs when the pressure in blood vessels is too high. It is common and can be fatal if left untreated.

*Hypotension:* Hypotension refers to low blood pressure.

*Rheumatoid Arthritis (RA):* A chronic inflammatory disorder affecting many joints, including those in the hands and feet. It is an autoimmune condition where the immune system mistakenly attacks the body's tissues, causing joint inflammation and pain and potentially leading to joint damage (Yerima et al., 2022).

### **Assumptions**

Assumptions are crucial in research as they are the foundation for theories and paradigms, guiding the entire research process. They influence the selection of research methodologies, ensuring alignment with the theoretical framework. Assumptions facilitate argumentation, evidence generation, and conclusions by providing direction and focus to the study. Explicitly stating assumptions enhance clarity and rigor, aiding in the precise interpretation of results and identification of potential biases. Additionally, assumptions contribute to time efficiency by keeping researchers on track with the research objectives. Ultimately, assumptions are essential for achieving valid and reliable research outcomes, offering clarity, direction, and a basis for argumentation (Nkwake, A.M. (2020)

This study on the Cardiometabolic outcomes of RA among African American adults with Obesity operates under several critical assumptions foundational to the

research design and the interpretation of its findings. Firstly, it is assumed that the socio-ecological model is an appropriate and effective framework for analyzing the complex interplay of factors contributing to the incidence of RA among African American adults with obesity. This model presupposes that individual behaviors and health outcomes, including the development of RA, are influenced by a combination of intrapersonal, interpersonal, and environmental/community factors. The assumption here is that these diverse levels of influence interact in meaningful ways that can be identified and measured to understand their contribution to RA risk among African American adults with obesity (Radu et al., 2021).

Another assumption is that the data collected from the NHANES dataset (1999-2018) is reliable and will accurately reflect the experiences, perceptions, and behaviors of African American adults with Obesity regarding their health and lifestyle factors that may influence the risk of RA. Furthermore, the study assumes that the chosen variables for this research, such as age, gender, cardiovascular disease, and hypertension, are significant predictors of RA. It is also assumed that these factors have a measurable impact on the incidence and management of RA and that their effects can be isolated and analyzed within the socio-ecological framework to yield meaningful insights (Zhu et al., 2022).

There is also an underlying assumption regarding the generalizability of the study's findings. While the research focuses on African American adults with obesity, it is assumed that the results will offer insights that could be applicable or adapted to

similar contexts or other vulnerable populations, particularly those with comparable socioeconomic conditions (Yerima et al., 2022).

These assumptions are critical to the study's framework and help to define its scope and limitations. They provide a basis for research design and methodology, guiding the data collection, analysis, and interpretation of the findings. Acknowledging these assumptions also allows for a clearer understanding of the potential implications and applications of the research outcomes.

### **Scope and Delimitations**

#### **Scope**

This study is specifically designed to investigate the cardiometabolic outcomes of rheumatoid arthritis (RA) among African American adults with Obesity. The scope encompasses a detailed examination of several factors, including independent variables such as gender, hypertension, and cardiovascular disease, with controlling variables like age, education level, and socioeconomic status. By focusing on these variables, the study seeks to provide a comprehensive understanding of the factors contributing to the incidence and severity of RA within this vulnerable demographic. The research will employ a quantitative approach, utilizing secondary data from NHANES to assess the relationship between the identified variables and the occurrence of RA among African American adults with Obesity.

The rationale for focusing on the cardiometabolic outcomes of RA in African American adults with obesity is underscored by the global burden of the disease and its disproportionate impact on minority populations. Research indicates that RA affects

approximately 1% of the worldwide population, with a higher prevalence among females and individuals with Obesity (Scott et al., 2010). African Americans, particularly those with Obesity, are at heightened risk due to the intersection of Obesity with hypertension, cardiovascular disease, and systemic inflammation, which all contribute to RA severity (Sokka & Pincus, 2009). Additionally, socioeconomic status and access to quality healthcare significantly influence RA outcomes, highlighting the need for a comprehensive study of this population (Sandberg & Jacobsson, 2014). By employing a quantitative approach to explore these factors, this study aims to contribute to the limited literature on RA among African American adults with Obesity, offering insights that can inform targeted interventions and healthcare policy adjustments.

This approach will allow for the analysis of measurable and comparable data, facilitating statistical analysis to identify significant relationships between RA and the cardiometabolic variables within the study population. Operating under certain assumptions in a study is important because it sets a foundational framework for research, guiding both the design and interpretation of findings. Assumptions help outline the study's scope, methodological approach, and the expected generalizability of its results. They are crucial for acknowledging the study's limitations and providing a clear context within which the research findings can be understood and applied. Additionally, assumptions allow researchers to hypothesize relationships between variables based on existing literature, contributing to new knowledge and understanding within the field.

### **Delimitations**

The study is delimited to African American adults with Obesity, focusing on a vulnerable population within a specific demographic group. This delimitation is intentional to address the gap in existing literature regarding RA among minority groups and to provide insights that are directly applicable to the health challenges faced by African American adults with obesity. This focus is significant for understanding how cardiometabolic factors impact RA outcomes within this population.

The research incorporates secondary data from NHANES, which employs a suite of complex health and nutritional exams across segmented US populations. Data must be accumulated over several years for smaller population groups and less prevalent conditions, such as RA, to provide adequate estimates (NCHS, 2022). Additionally, NHANES intermittently changed over different surveying cycles, affecting both the scope of the examinations and the measures used in data analysis. These changes can affect data weighting, changes in respondent demographics, and changes in examination techniques and instruments from one cycle to the next, which must be recognized as limitations in the study methodology.

In 2020, the global prevalence of rheumatoid arthritis (RA) was estimated at approximately 17.6 million people, with an age-standardized rate of 208.8 cases per 100,000 population. This indicates a 14.1% increase in prevalence since 1990 (GBD 2021 Rheumatoid Arthritis Collaborators, 2023). Individuals affected by RA experience reduced quality of life, functional limitations, and increased mortality rates. The burden of RA among African American adults with obesity places a considerable strain on healthcare systems, with direct costs related to medications, hospitalizations, and

surgeries, as well as indirect costs from lost productivity (Zhu et al., 2024). This population faces unique challenges due to the intersection of obesity, RA, and cardiometabolic conditions like cardiovascular disease and hypertension. To address these issues, targeted public health interventions are crucial. These should include raising awareness among healthcare providers about the specific risks and needs of African American adults with obesity, ensuring access to affordable and culturally competent treatment options, implementing policies that support workplace accommodations, and investing in research focused on this vulnerable population. By adopting a multifaceted approach, policymakers and stakeholders can mitigate the impact of RA, improve cardiometabolic outcomes, and reduce the economic costs associated with managing the disease in this demographic.

The study will also be delimited by its cross-sectional design, which, while providing a snapshot of RA Cardiometabolic outcomes at a single point in time, may not fully capture the dynamic nature of these Cardiometabolic outcomes or their long-term impact on the development and progression of RA. This design choice is made in consideration of the logistical and resource constraints inherent in conducting research in a resource-limited setting like Sierra Leone (Zhu et al., 2022).

By clearly defining the scope and delimitations, this study seeks to provide targeted and relevant findings that can inform public health strategies and healthcare practices to better support African American adults with obesity, potentially reducing the incidence and impact of RA within this critical demographic.

## Limitations

The limitations of this study primarily stem from the inherent constraints associated with the cross-sectional study design and the use of secondary data from NHANES. Firstly, the cross-sectional nature of this research provides a snapshot of cardiometabolic outcomes and RA among African American adults with Obesity at a single point in time. While this design efficiently identifies associations between variables such as hypertension, cardiovascular disease, gender, and RA, it does not establish temporal sequence or causality (Butler et al., 2023). While correlations between these variables and RA can be observed, no definitive conclusions about cause-and-effect relationships can be drawn.

Secondly, the utilization of secondary data may present limitations concerning data quality, accuracy, and completeness. NHANES data, while comprehensive, was not initially collected for the specific purpose of investigating the cardiometabolic outcomes of RA in African American adults with Obesity. This may result in excluding certain variables that could have provided more detailed insights into the topic. Additionally, the data collection process for NHANES spans multiple years, and certain variables or measures may have changed across different cycles, potentially introducing inconsistencies in the analysis (NCHS, 2022). Changes in the sampling design, response rates, or data collection methods could also impact on the comparability of the data across different cycles.

Additionally, the study's reliance on secondary data means that some variables of interest, such as hypertension or cardiovascular disease, may have been self-reported in

NHANES, introducing the potential for measurement errors. While NHANES employs rigorous methodologies, there is always a possibility that self-reported data may not fully capture the true prevalence of these conditions, which could affect the accuracy of the findings.

Finally, while using NHANES data allows for a large and nationally representative sample, the focus on African American adults with obesity may result in a smaller subgroup, which could limit the study's statistical power. This could affect the ability to detect significant associations between the independent variables and RA outcomes. In summary, while this study provides valuable insights into the cardiometabolic outcomes of RA in African American adults with Obesity, its design and reliance on secondary data impose limitations on causality, data completeness, and potential unmeasured confounders (Butler et al., 2023). These limitations should be considered when interpreting the findings, and future research could benefit from longitudinal designs and the inclusion of more specific measures tailored to this population.

### **Significance of the Study**

The significance of this study lies in its potential to address a critical public health issue affecting African American adults with obesity. RA, a chronic autoimmune disease characterized by inflammation and joint pain (Zhang et al., 2011), has been shown to have strong links with cardiometabolic conditions such as hypertension and cardiovascular disease, both of which are more prevalent in African American

populations. This research aims to shed light on how these conditions, along with gender, contribute to RA outcomes within this vulnerable population.

This research aims to explore how obesity, cardiometabolic conditions, and gender collectively influence RA outcomes within the African American population. Gender plays a critical role in RA pathophysiology and progression. African American women experience a higher prevalence of both obesity and RA compared to men, and they are more likely to report more significant pain severity, physical limitations, and reduced quality of life. Biological differences, including hormonal fluctuations such as declining estrogen levels, may intensify inflammation and disease susceptibility in women. Meanwhile, African American men often delay seeking care, which may lead to later diagnosis and more advanced disease at presentation. Social and structural barriers, such as reduced access to gender-sensitive care and cultural stigma around illness, further widen these sex-based disparities. This study highlights the need to examine these differences closely to improve targeted interventions and promote equity in RA management.

African American adults with Obesity represent a demographic group that faces multiple health disparities, including higher rates of hypertension, cardiovascular disease, and limited access to healthcare. The study aims to address a gap in literature concerning the intersection of cardiometabolic factors and RA in a minority group facing disproportionate health challenges. By focusing on African American adults with obesity, the research aims to provide critical insights for developing targeted interventions that

enhance health outcomes and overall quality of life for individuals living with both obesity and RA.

By examining the effects of hypertension, cardiovascular disease, and gender on RA while controlling socioeconomic status, age, and educational level, this research will contribute valuable insights into the unique cardiometabolic risks this population faces. The findings could inform public health initiatives that aim to reduce health disparities, such as improving access to affordable healthcare, raising awareness about the importance of early diagnosis and intervention for RA, and promoting strategies to manage obesity and related health conditions effectively.

Moreover, the implications of this study extend beyond the individual level to public health policy and community health initiatives. By offering empirical evidence on the cardiometabolic outcomes linked to RA in African American adults with obesity, this study could inform the development of culturally tailored health interventions that specifically address the unique needs and challenges of this population. These efforts are crucial for reducing the overall burden of RA and improving long-term health outcomes within minority communities.

### **Summary**

The proposed study aims to investigate the cardiometabolic outcomes of rheumatoid arthritis among African American adults with obesity. RA, a chronic autoimmune condition characterized by inflammation and joint pain, significantly affects individuals within minority groups, such as African Americans, potentially hindering their overall health and quality of life. This impact is further compounded by the presence

of obesity and related cardiometabolic conditions, increasing the burden on this vulnerable population (Jahid et al., 2023). This research is particularly relevant for African American adults with obesity, a minority group disproportionately affected by limited healthcare resources, which can impact the understanding, diagnosis, and management of RA. This study intends to explore various levels of influence of the socio-ecological model on cardiometabolic outcomes of rheumatoid arthritis among African American adults with Obesity, ranging from individual factors like age and sex to broader determinants such as socio-economic status, educational level, hypertension, and cardiovascular disease. This comprehensive approach allows for understanding RA among African American adults with obesity, addressing a notable gap in the current literature and offering insights into a population crucial yet underrepresented in RA research (Zhu et al., 2022). This study aims to highlight factors contributing to delays in seeking treatment for RA among African American adults with obesity. Limited access to care, low awareness of early symptoms, and the burden of managing other chronic conditions often result in postponed diagnosis and worse health outcomes. By identifying specific interpersonal, intrapersonal, and environmental risk factors of RA, the research aims to inform policymakers and the broader community about the risks associated with the condition (Butler et al., 2023).

This knowledge is expected to guide the development of targeted interventions, such as modifications to work schedules, improved healthcare infrastructure, and targeted therapies that effectively treat RA. These efforts aim to reduce the incidence of RA among African American adults with obesity and enhance their overall well-being.

Furthermore, the study's findings could serve as a basis for public health initiatives that promote healthier lifestyles and early intervention strategies for RA, ultimately contributing to improving healthcare delivery among African American adults with obesity (Jahid et al., 2023). Paying close attention to and developing public health strategies to alleviate the unique challenges faced by African American adults with Obesity who are affected by RA and advocating for systemic changes in healthcare policy and practice, this research can significantly impact the well-being of this vulnerable population and contribute to reducing health disparities.

## Chapter 2: Literature Review

In 2020, an estimated 17.6 million individuals worldwide were diagnosed with RA, with an age-adjusted global prevalence rate of 208.8 cases per 100,000 population (Almutairi et al., 2021), marking a 14.1% increase since 1990. RA is a significant public health concern due to its chronic, debilitating nature and the substantial individual and societal burdens it imposes. RA impacts a considerable portion of the population globally, reducing quality of life and increasing medical costs (Yerima et al., 2022).

RA is a chronic autoimmune disease characterized by joint inflammation that results in pain, stiffness, and swelling, primarily targeting the synovial membrane (Díaz-González et al., 2023). Over time, RA can lead to joint damage, deformity, and systemic symptoms such as fatigue, fever, and weight loss (Cush et al., 2022). Although the exact cause of RA is unknown, genetic, environmental, and hormonal factors are believed to play a role. Diagnosis involves evaluating clinical symptoms, physical examinations, blood tests for inflammatory markers, and imaging studies. Treatment aims to reduce inflammation, manage pain, and prevent joint damage, typically involving medications, physical therapy, and lifestyle modifications (Cush et al., 2022). Although RA has no cure, early detection and aggressive treatment can effectively manage symptoms and improve long-term outcomes.

Approximately 1.3 million adults in the United States, representing 0.6% to 1% of the adult population, are affected by RA (Xu & Wu, 2021). This condition is associated with significant health and economic burdens, including a high prevalence of work disability (approximately 35%) and annual health care costs exceeding \$19.3 billion (Xu

& Wu, 2021). RA disproportionately impacts individuals with lower SES and racial/ethnic minorities (Xu & Wu, 2021). Through evaluation of clinical symptoms, physical examinations, blood tests for inflammatory markers, and imaging studies, treatment aims to reduce inflammation, manage pain, and prevent joint damage, typically involving medications, physical therapy, and lifestyle modifications (Cush et al., 2022). Although RA has no cure, early detection and aggressive treatment can effectively manage symptoms and improve long-term outcomes.

This chapter provides a review of the literature on RA, with a focus on its cardiometabolic implications among African American adults with obesity. RA, a chronic inflammatory condition, is frequently accompanied by cardiometabolic complications such as hypertension and cardiovascular disease conditions that disproportionately affect individuals in this demographic due to elevated obesity rates and systemic health care disparities (Yerima et al., 2022). The review explores the interplay between RA, obesity, and lifestyle-related factors that contribute to poor cardiometabolic health. The review also examines the influence of gender and hypertension on RA outcomes while considering cardiovascular disease as a key endpoint. Controlling for age, educational level, and socioeconomic status, the current study aimed to clarify the compound health risks that affect this high-risk population. This chapter further identifies gaps in recent research and advocates for a multidisciplinary approach to RA management that considers the unique challenges faced by African American adults with obesity. By synthesizing current evidence, the review provides a foundation for understanding the complex relationships between RA, obesity, and cardiometabolic health and supports the

creation of tailored programs intended to reduce disease burden and improve overall well-being in this underserved population.

### **Definition and Epidemiology of RA**

According to age-adjusted data from the 2005 to 2018 National Health and Nutrition Examination Survey (NHANES), the prevalence of self-reported rheumatoid arthritis (RA) in the United States remained relatively stable, with no significant linear trends observed overall among men and women. However, notable disparities were evident across racial and ethnic groups. Non-Hispanic Black adults, particularly women, reported higher prevalence rates compared to other populations, highlighting underlying inequities in disease burden and access to care (Xu et al., 2021). These Variations are influenced by environmental exposures, genetics, demographic factors, and, in some regions, underreporting. Over recent decades, the severity of RA has generally declined, likely due to advances in disease management, though prevalence still differs significantly across regions, including within industrialized nations (Finckh et al., 2022).

RA is a complex condition affected by both genetic and environmental factors, impacting individuals across different demographic groups. Globally, RA prevalence is estimated at approximately 460 cases per 100,000 people (Almutairi et al., 2021), with the disease typically African American adults with obesity, particularly as a minority group with limited access to quality healthcare, socioeconomic factors such as low income play a significant role in restricting their access to essential health resources presenting in adults between ages 30 and 50, although it can manifest at other ages as well. RA is more prevalent in women, with a female-to-male ratio global ratio of roughly

3:1 (Yu et al., 2020), emphasizing the importance of considering gender in understanding RA epidemiology.

This population often faces barriers to receiving timely and effective healthcare, contributing to delayed diagnoses and limited treatment options, which can exacerbate health conditions like rheumatoid arthritis and related cardiometabolic issues. RA diagnosis poses significant challenges, with various Environmental and lifestyle factors influencing its onset and progression. Factors such as smoking and obesity are known to elevate the risk of RA, particularly in underserved communities where limited socioeconomic resources can hinder access to timely diagnosis and effective management. These barriers emphasize the need to address disparities in care and promote preventive strategies to mitigate RA's impact (Faugno et al., 2025).

Obesity increases the risk of developing RA and intensifies cardiometabolic complications, such as hypertension and cardiovascular disease, which are common comorbidities among African American adults with obesity. The causes of obesity in this population are complex, often rooted in a combination of socioeconomic, environmental, and cultural factors. Limited availability of affordable, healthy food options, commonly known as "food deserts," is prevalent in many low-income communities, leading to diets high in processed and calorie-dense foods. Additionally, a lack of safe and suitable areas for physical activity in underserved neighborhoods can limit opportunities for regular exercise. Economic challenges also play a significant role, as financial strain often prioritizes immediate needs over long-term health investments (Ter et al., 2025).

Furthermore, chronic stress from social and economic inequities can influence weight gain through stress-related behaviors, such as emotional eating, and physiological factors, like increased cortisol levels (Odoms-Young et al., 2024) These combined factors contribute to higher obesity rates among African Americans, which, in turn, elevate their risk for RA and related cardiometabolic health issues (Gower et al., 2020).

In this context, the cardiometabolic outcomes of RA among African American adults are significant, as RA and obesity together increase risks of cardiovascular disease and hypertension, affecting quality of life and overall health outcomes (Thomas et al., 2023). The increased susceptibility to both RA and related cardiometabolic conditions, in this demographic underscore the need to consider factors like socioeconomic status, educational level, and healthcare accessibility in RA management. These considerations highlight the importance of a targeted, multidisciplinary approach to RA care among African American adults, particularly those with obesity, to address their heightened risk for adverse health outcomes and to inform tailored interventions for this population.

The epidemiology of RA highlights the complex interplay between age, gender, genetic predisposition, and environmental exposures in shaping RA prevalence and risk within different populations (Venetsanopoulou et al., 2023). Understanding these factors is essential for identifying high-risk individuals, developing targeted prevention strategies, and optimizing treatment approaches for RA patients. The incidence of RA is higher among women, with a female-to-male ratio ranging from 2:1 to 3:1, emphasizing the need to explore gender-specific factors in RA risk. Susceptibility to RA is also influenced by genetic factors (Xu et al., 2021). Among African American adults with

obesity, specific demographic, socioeconomic, and health factors play a critical role in RA's impact, particularly for associated cardiometabolic outcomes like hypertension and cardiovascular disease.

Geographically, RA prevalence and incidence show considerable variation, often higher in urban areas and developed nations. However, current trends suggest an increasing incidence of RA in minority and underserved populations, such as African American adults with obesity in the United States (Gower et al., 2020). Socioeconomic status, healthcare access, and lifestyle factors contribute to disparities in RA prevalence, and in communities with limited healthcare resources, these challenges are amplified. For African American adults, low socioeconomic status and limited healthcare access may delay diagnosis and exacerbate disease outcomes, including cardiometabolic complications. These patterns highlight the importance of understanding the geographic distribution of RA and the disparities in health care in the US to guide focused interventions (Xu et al., 2021). Over time, advancements in diagnostic techniques and treatment modalities, including disease-modifying DMARDs, and biologic agents, have significantly improved RA management, leading to better disease outcomes and quality of life for many patients (O'Brien et al., 2024). However, African American adults with obesity continue to face challenges related to healthcare access and treatment adherence, which can limit the benefits of these advancements (Lofton et al., 2023?). Additionally, the high prevalence of comorbidities, such as hypertension and cardiovascular disease, among this population highlights the need for comprehensive, multidisciplinary care approaches to address RA and its associated cardiometabolic outcomes (Lofton et al.,

2023). Disparities in healthcare access, socioeconomic barriers, and the emergence of these comorbidities emphasize the ongoing need for accessible and effective RA care within African American communities.

Examining the epidemiology of RA across person, place, and time provides valuable insights into the multifactorial nature of the disease and informs strategies for prevention, early detection, and management. While global data offer a general understanding of RA, studies focused on African American adults with obesity are essential for developing targeted prevention and management strategies tailored to their specific needs. Collaborative efforts among researchers, clinicians, and policymakers can enhance understanding of RA in this context, promoting better health outcomes within this population.

### **Literature Search Strategy**

In formulating the literature search strategy for the study on RA among African American adults with obesity, I adopted a targeted approach, focusing on research published within a specific timeframe (2020-2025) to capture the most recent advancements and discussions in the field. Including articles and studies from the last three to four years, for example, would ensure the data's relevance and currentness in reflecting the latest findings and trends in RA research.

A thorough literature review was conducted to gather and evaluate previous research and to identify gaps in the existing knowledge base related to the cardiometabolic outcomes of RA among African American adults with obesity. The databases used for this search included PMC PubMed Central, the National Center for

Biotechnology Information (NCBI), the Centers for Disease Control and Prevention (CDC), the World Health Organization (WHO), and ProQuest Central. Keywords were strategically employed, individually and in combination, to locate studies relevant to RA, obesity, cardiometabolic health, and racial disparities in healthcare. These keywords included: “cardiovascular disease,” “obesity,” “age,” “gender,” “socio-economic status,” “hypertension”, “level of education”, “Rheumatoid Arthritis”, “African American adults with obesity,” and “NHANES.” This approach ensured a thorough exploration of existing literature to support the study’s objectives.

Review articles were included to provide a comprehensive understanding of the subject by summarizing and synthesizing existing research, establishing a broad context for the study. Primary literature, consisting of original research articles, was also reviewed for detailed, specific, and novel insights into the cardiometabolic outcomes of rheumatoid arthritis among African American adults with obesity. These articles offer direct analysis of associations and causations relevant to the study’s aims, particularly in examining the relationships between RA, gender, cardiovascular disease, and hypertension while controlling for age, socioeconomic status, and education level.

The literature search focused on identifying factors contributing to RA among African American adults with obesity, with an emphasis on the relationships between RA, gender, hypertension, and cardiovascular disease. Studies were included if they were peer-reviewed, published between 2020 and 2025, written in English, and specifically addressed RA with cardiometabolic conditions or racial disparities, particularly within African American populations. Exclusion criteria included non-peer-reviewed articles,

studies not involving human subjects, publications outside the specified timeframe, and research that did not report outcomes relevant to RA or cardiometabolic health. This targeted approach helped identify research examining the cardiometabolic outcomes associated with RA and the role of demographic factors such as age, socioeconomic status, and education level. Using this systematic approach, the study aimed to establish a comprehensive and authoritative foundation for exploring RA's cardiometabolic impact within this population.

PubMed served as a primary source for current and historical medical research, offering a comprehensive collection of literature on RA's clinical and epidemiological facets. Scopus and Web of Science provided access to multidisciplinary research articles, enabling a broader perspective on RA and cardiometabolic health. APA PsycINFO was specifically chosen for its extensive coverage of psychological literature, adding insights into how demographic and psychosocial factors might influence RA outcomes among African American adults with obesity.

Sage Journals contributed valuable peer-reviewed articles on healthcare practices, policy implications, and the social determinants of health, which helped validate information from other sources. Google Scholar provided a supplemental resource for diverse scholarly content across disciplines, supporting the identification of complex studies on RA. However, it was used cautiously due to its inclusivity of sources.

SocINDEX was selected for its sociological focus, enhancing the understanding of social determinants and health disparities affecting RA outcomes. This database was

essential for exploring studies on social factors, socioeconomic disparities, and policy impacts on health outcomes for African American adults.

The search terms used across these databases included combinations of “Rheumatoid Arthritis,” “Age,” “Sex,” “cardiovascular disease,” “Hypertension,” “Socioeconomic Status,” and “African Americans with Obesity.” Various configurations of these terms were used to ensure a comprehensive collection of relevant literature. In cases where limited information was available, guidance from a university librarian was sought to refine search techniques, employing Boolean operators and nested searches for precision.

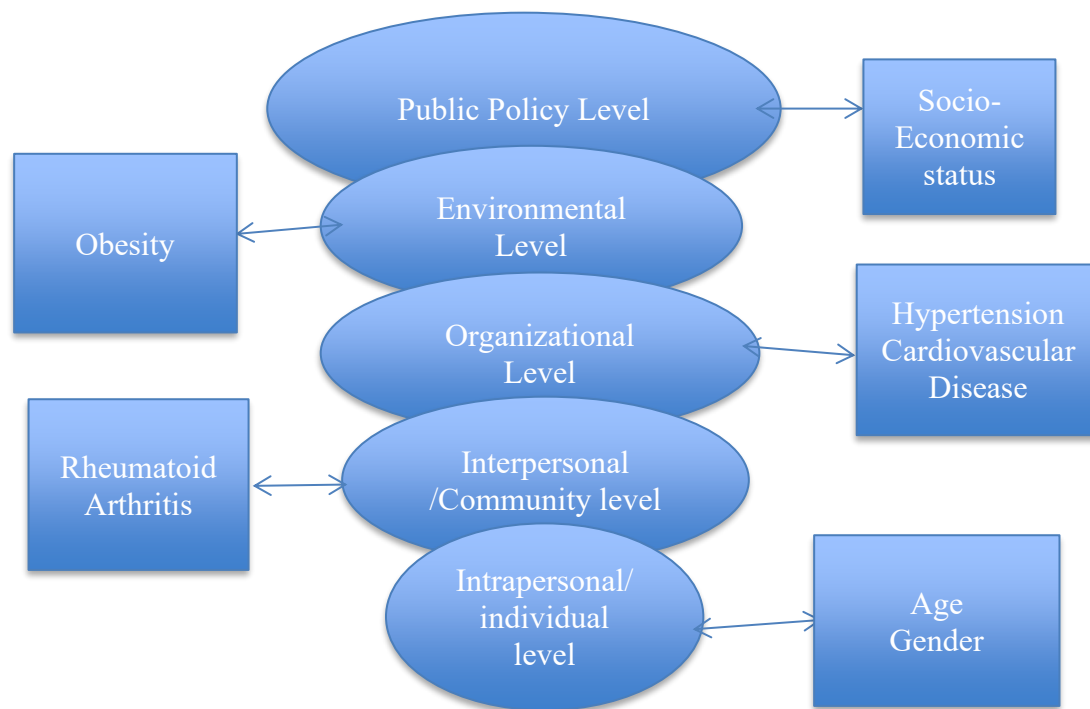
This strategic and systematic approach to the literature search ensured a wide capture of studies, from clinical research on RA’s cardiometabolic outcomes to sociological studies on the socioeconomic factors affecting African American adults with obesity. This methodology established a robust foundation for understanding the scope and depth of the research topic.

### **Theoretical Foundation**

The conceptual framework for this study is based on the Socio-Ecological Model (SEM), which guides the examination of how multiple, interconnected levels of individual, interpersonal, organizational, environmental, and policy influence the cardiometabolic outcomes of RA among African American adults with obesity. By aligning study variables such as age, gender, hypertension, cardiovascular disease, healthcare access, and community support with specific levels of the SEM, this

framework provides a structured lens for understanding how personal and systemic factors contribute to health disparities in this population.

Initially conceptualized by Urie Bronfenbrenner in the late 1970s (Kilanowski, 2017), the socio-ecological model has profoundly influenced the understanding of human development and behavior within the context of the interacting systems that shape individual and collective life (Crawford, 2020). It is an appropriate model for my study because this model posits that to fully comprehend the complexities of a health issue like RA, it is essential to consider the nested layers of influence that impact individuals, ranging from the most immediate personal factors to the broader societal forces (see Figure 1).

**Figure 1***SEM Diagram*

### **Socio-Ecological Model**

The socio-ecological model is a theoretical framework that emphasizes the interconnectedness of individual, interpersonal, organizational, community, and public policy factors in influencing health behaviors and outcomes (Bronfenbrenner, 1979). The various levels of the socio-ecological model (SEM) provide a framework for linking critical variables in the study on cardiometabolic outcomes of rheumatoid arthritis (RA) among African American adults with obesity. This framework offers insights into how individual, social, organizational, environmental, and policy influences shape the

prevalence and management of RA and associated cardiometabolic conditions in this population.

### **Intrapersonal/Individual Level**

At the intrapersonal/individual level, the SEM considers personal characteristics that influence behavior and health outcomes (Macleod, 2023). Characteristics within the individual that influence behavior, such as knowledge, attitudes, beliefs, and personality traits (Zhu et al., 2022). In this study, these characteristics include age and gender, which are known to impact RA risk. For example, women are more prone to developing RA, a trend attributed to hormonal and genetic differences between genders (Nilsson et al., 2021). Additionally, individual factors such as hypertension and cardiovascular disease conditions commonly comorbid with RA further compound the complexity of health management in individuals with obesity. These cardiometabolic conditions exacerbate RA symptoms and affect quality of life, making individual health management crucial. Age also plays a significant role in RA's progression, as the disease often presents in middle age, impacting disease management outcomes.

### **Interpersonal/Community Level**

Moving to the interpersonal/community level, the SEM examines the impact of social relationships and networks on health outcomes (Crawford, 2020). Social factors, including family, friends, and colleagues, influence an individual's behavior through social support, social norms, and relationships (Jahid et al., 2023). For African American adults managing RA, support from family, friends, and community networks can significantly influence their ability to manage RA and its cardiometabolic effects. Social

support can encourage individuals to adhere to treatment plans, engage in preventive care, and manage symptoms effectively. Strong interpersonal relationships act as a buffer against stress, which can worsen RA symptoms and contribute to poor cardiovascular outcomes. Family and community support can, therefore, play a vital role in improving both RA and cardiometabolic health outcomes.

### **Organizational Level**

At the organizational level, At the organizational level, the SEM focuses on institutions' policies, practices, and cultures that influence health outcomes. In this context, organizations such as healthcare facilities, community health centers, and support networks play a pivotal role in managing RA and its cardiometabolic comorbidities, particularly hypertension and cardiovascular disease, which are highly prevalent among African American adults with obesity. Healthcare organizations that provide affordable blood pressure and cardiovascular screenings, chronic disease education, and integrated care management programs can help detect and control these conditions early, preventing complications that may worsen RA outcomes. Community-based organizations that promote heart-healthy lifestyles, provide medication management support, and increase awareness about the links between RA and cardiometabolic health can significantly improve the quality of life, especially for individuals living in underserved or low-resource environments.

### **Environmental Level**

The environmental level considers the broader social and physical contexts that affect health. For African American adults with obesity, environmental factors such as

neighborhood access to healthcare facilities, healthy food options, and safe spaces for physical activity can significantly influence RA outcomes and cardiometabolic health. Many low-income neighborhoods face barriers to these resources, leading to increased rates of obesity and limited access to quality healthcare, which, in turn, exacerbate RA and associated conditions like hypertension and cardiovascular disease. Environmental stressors, such as pollution and lack of green spaces, can also increase inflammation, potentially worsening RA symptoms and cardiometabolic complications.

### **Public Policy Level**

At the public policy level, policies supporting healthcare access, affordability, and health equity are crucial for addressing disparities in managing RA and related cardiometabolic conditions. Policies that improve access to affordable medications, preventive care, and community health programs are incredibly impactful for underserved populations. For African American adults with limited socioeconomic resources, Medicaid expansion, affordable prescription drug coverage, and policies that support access to healthy food and physical activity options can help reduce the risk of obesity, manage RA symptoms, and prevent hypertension and cardiovascular disease.

By examining RA and its cardiometabolic outcomes within this socio-ecological framework, it becomes evident how multiple levels from individual behaviors to community support and policy interventions interact to shape health outcomes. This approach underscores the importance of targeted, multi-level strategies to address both the direct impacts of RA and the broader socio-environmental factors affecting disease management and health equity among African American adults with obesity.

Finally, the outermost layer of the socio-ecological model captures the dimension of time, including life transitions and socio-historical contexts, and how these factors shape interactions between individuals and their environments (Crawford, 2020). In the case of RA among African American adults with obesity, this level encompasses changes in healthcare policies, evolving public health priorities, and the influence of significant socio-historical events on healthcare access and chronic disease management. Public policies that enhance healthcare accessibility, support for managing chronic conditions, and strategies addressing health disparities are critical for mitigating RA and associated cardiometabolic risks such as hypertension and cardiovascular disease in this population.

Integrating the socio-ecological model into RA research provides a comprehensive approach to understanding the disease within the context of African American adults with obesity. This model enables the examination of individual health behaviors, such as lifestyle choices, within the broader context of social, organizational, environmental, and policy-level influences. Such a comprehensive view is essential for developing targeted interventions that address RA and related cardiometabolic conditions, improving this demographic's quality of life and health outcomes (Kilanowski, 2017). The application of this model underscores the importance of multi-level interventions, from personal health education and lifestyle modifications to broader systemic changes in policy and healthcare accessibility. By addressing the complex interplay of factors affecting RA risk and management, the socio-ecological model offers a robust theoretical foundation for this study, guiding the exploration of comprehensive

strategies to support individuals in managing RA and promoting broader public health efforts.

In summary, the socio-ecological model serves as a foundational framework for this study, providing a nuanced and multi-dimensional perspective on the factors contributing to RA and its cardiometabolic outcomes among African American adults with obesity. By considering interrelated influences at multiple levels, this model facilitates a deeper understanding of RA's complexities in this population, paving the way for more effective interventions and policies that support affected individuals in their health and quality of life.

### **Literature Review of Key Study Variables and Concepts**

#### **Overview of RA Within the Context of Existing Literature**

Rheumatoid arthritis presents a multifaceted public health concern, particularly among African American adults with obesity, where a convergence of biological, clinical, and social determinants exacerbates disease outcomes. Within this population, gender emerges as a significant factor, with women experiencing higher RA prevalence and symptom severity, possibly due to hormonal and immunological differences that also intersect with obesity-related inflammation (Zhu et al., 2024). Hypertension and CVD are key cardiometabolic complications that are not only common in individuals with RA. Still, they are further amplified by excess adiposity, which promotes systemic inflammation and accelerates joint and vascular damage (Zhu et al., 2024). These risks are compounded in African American communities, where socioeconomic disadvantage and limited access to timely, culturally competent healthcare increase the likelihood of

delayed diagnosis and inadequate treatment (Zhu et al., 2024). Age, educational attainment, and income are critical modifiers of disease burden and care outcomes in this context. Rather than treating these factors as background context, this study examines their collective impact on RA outcomes. It offers a focused lens on how cardiometabolic health is shaped by intersecting biological and structural forces in this high-risk group.

### **Impact of Cardiovascular Disease on RA Among African Americans With Obesity**

Fazeli et al., 2021 provide an overview of CVD risk factors in RA, focusing on the role of autoantibodies and antirheumatic therapies. The review highlights that inflammation serves as a common mechanism linking RA and atherosclerotic processes, contributing to a heightened CVD risk among RA patients. Autoantibodies, specifically rheumatoid factor (RF), anti-citrullinated peptide antibodies (anti-CCP), anti-phospholipid, and anti-lipoprotein autoantibodies, were identified as significant predictors of specific cardiovascular events. For example, RF-positive patients exhibited a higher risk of cardiovascular mortality, while anti-phospholipid antibody positivity was associated with increased thrombosis risk. Additionally, evidence suggests that RA patients may experience subclinical cardiovascular conditions before showing any symptoms, with CVD already present at the time of RA diagnosis in many cases. The review also explored the role of antirheumatic drugs, noting mixed findings on their cardiovascular impact: conventional therapies like methotrexate and glucocorticoids showed some protective effects. At the same time, biologics and DMARDs offered benefits, but they had unclear mechanisms.

Dessein et al., 2022 highlight the substantial CVD burden in patients with inflammatory joint diseases, particularly RA, and the associated challenges in assessing and managing CVD risk. The evidence suggests that RA patients face a significantly elevated risk of cardiovascular events, such as myocardial infarction and stroke, due to a combination of traditional risk factors, systemic inflammation, autoantibodies, and the impact of disease-modifying DMARDs. The findings emphasize how RA-related inflammation can drive atherogenesis, and they underline the importance of considering both traditional CVD risk factors and disease activity control in managing CVD risk among RA patients. Additionally, novel approaches like carotid plaque assessment and vascular age determination show promise in improving CVD risk assessment for RA patients.

The focus on inflammation, BMI, and systemic immune responses in the reviewed studies provides valuable context for exploring cardiometabolic outcomes of RA among African American adults with obesity. Obesity exacerbates RA and is an independent risk factor for CVD, particularly in African American adults who may face unique social and environmental barriers to effective RA and CVD management. While traditional CVD risk factors and systemic inflammation in RA are well-studied, research specific to African American adults with obesity, who are disproportionately affected by CVD, is limited. Understanding how obesity, combined with RA, influences CVD outcomes in this demographic could reveal critical insights into managing comorbidities more effectively.

RA, an autoimmune disease, is also influenced by factors such as age, sex, BMI, and smoking, with obesity significantly worsening its severity and progression (Mohammed et al., 2020). NHANES data indicate a higher prevalence of RA among African Americans, a group also disproportionately affected by obesity. RA's systemic inflammation increases cardiovascular risks, and smoking further complicates outcomes, particularly in men (Xu et al., 2021).

These findings highlight the critical need to study cardiometabolic outcomes in African Americans with RA and obesity, addressing the interplay of inflammation, obesity, and social determinants of health.

Obesity and depression significantly impact African American older adults, who face a 16% prevalence of co-occurrence, as shown in a study among older adults in Alabama (Melton et al., 2021). Chronic conditions like hypertension and diabetes exacerbate this dual burden, with systemic factors such as socioeconomic disparities and limited healthcare access amplifying risks. Protective factors, including older age and physical activity, highlight intervention opportunities (Melton et al., 2021). However, barriers like inadequate access to safe spaces and culturally tailored programs persist. Addressing these challenges requires targeted, culturally sensitive public health strategies to improve health equity and outcomes for African American older adults facing these intersecting conditions.

O'Brien et al. (2024) examined racial and ethnic differences in RA outcomes across White, Black, Hispanic, and Asian populations using data from the Corvita RA Registry, a large, U.S.-based registry that collects real-world clinical data from patients

with rheumatoid arthritis receiving routine care from rheumatologists. The registry provides longitudinal information on disease activity, treatment patterns, comorbidities, and patient-reported outcomes. It is a valuable resource for examining disparities in RA management and progression across diverse populations.

Key findings show that while all racial and ethnic groups experienced improvements in RA disease activity (as measured by the Clinical Disease Activity Index, or CDAI), Hispanic patients showed less progress than White patients. Additionally, White patients consistently demonstrated lower disability levels and higher functional status than other groups, as measured by the Health Assessment Questionnaire-Disability Index (HAQ-DI). Key findings from O'Brien et al. (2024) show that while all racial and ethnic groups experienced improvements in RA disease activity as measured by the Clinical Disease Activity Index (CDAI), Hispanic and Black patients showed less progress compared to White patients. Specifically, African American patients demonstrated slower clinical response rates and higher disease activity scores over time, while Asian patients showed comparable or slightly better improvements in some measures relative to Hispanic and Black groups, though still lagging White patients in functional outcomes. Furthermore, White patients consistently exhibited lower disability levels and higher functional status across the study period, as measured by the Health Assessment Questionnaire-Disability Index (HAQ-DI). These findings highlight persistent disparities in RA outcomes among minority populations, particularly among Black and Hispanic patients, despite overall advancements in treatment and disease management.

Backer et al., 2023 focused on RA disease activity using the multi-biochemical disease activity (MBDA) score, a biomarker-based measure predictive of disease progression. The study also analyzed traditional indices like the Clinical Disease Activity Index (CDAI) and DAS28-ESR. Among 267 participants, predominantly Latinx (51%) and Asian (34%), with Black participants constituting 9%, Latinx individuals had the highest MBDA scores, followed by Black participants, suggesting more excellent disease activity. These findings, consistent with DAS28-ESR but not CDAI, point to systemic inequities like limited healthcare access and structural racism rather than biological differences as key drivers.

The study highlights the compounded effects of systemic inflammation in RA on cardiometabolic risks, including cardiovascular disease and diabetes, conditions disproportionately affecting African Americans. Although not explicitly focused on obesity, the research underscores shared inflammatory pathways and the socioeconomic barriers to managing RA and obesity effectively. The findings advocate for more inclusive studies and tailored interventions that address healthcare disparities to improve outcomes for vulnerable populations, particularly African Americans with obesity.

Corrao et al. (2024) emphasized that RA contributes to an elevated risk of cardiovascular disease (CVD) and metabolic syndrome, both of which significantly increase morbidity and mortality among affected individuals. The heightened cardiovascular risk observed in RA patients cannot be entirely attributed to traditional factors like hypertension and obesity. Instead, underlying systemic inflammation and immune dysregulation are central to accelerating cardiovascular complications. Evidence

also links the long-term use of antirheumatic therapies to the progression of atherosclerosis, further increasing the risk of coronary artery disease, heart failure, and stroke. These associations are particularly concerning for African American adults with obesity, who often face systemic challenges that hinder consistent disease management and contribute to lower treatment adherence, increasing their vulnerability to adverse cardiovascular outcomes in the context of RA.

The research underscores the prevalence of cardiometabolic conditions, such as dyslipidemia and congestive heart failure, among RA patients, highlighting the need for a holistic, patient-centered management approach. Shifting from a reactive approach to a proactive one that emphasizes early diagnosis, prevention, and multidisciplinary treatment could help address these complex comorbidities. While current studies address cardiometabolic risks in RA generally, there is a noticeable gap in research focusing on African American adults with obesity, despite their greater vulnerability to both RA and CVD. More targeted studies are necessary to understand how race, obesity, and RA intersect, enabling the development of tailored, culturally relevant interventions that can better manage RA and associated cardiometabolic risks in this population

According to Bedeković et al. (2024), Chronic systemic inflammation is a central driver of cardiovascular complications in RA, accelerating atherosclerosis, vascular damage, and the early onset of cardiovascular diseases (CVD), with chronic heart failure being the most common diagnosis. An 8-year cohort study comparing RA and osteoarthritis (OA) patients revealed higher rates of cardiovascular events (43.9% vs. 37.5%) and mortality in RA patients, emphasizing the critical need for stringent

inflammation management to reduce cardiovascular risks (Bedeković et al. 2024).

Conventional CVD risk factors, including high blood pressure and abnormal lipid levels (dyslipidemia), diabetes, and smoking, interact with RA-specific factors, including elevated inflammatory markers, prolonged disease duration, and autoantibody presence, compounding the overall cardiovascular risk. RA-associated inflammation also disrupts lipid metabolism, rendering conventional risk prediction models less effective for this population and highlighting the need for RA-specific risk adjustments (Macias-Konstantopoulos et al., 2023). Racial disparities further complicate cardiovascular outcomes, with African American patients experiencing higher obesity prevalence, more significant systemic inflammation, and limited access to timely care, all of which exacerbate poor outcomes (Macias-Konstantopoulos et al., 2023).

Addressing these disparities requires tailored, multidisciplinary interventions that engage rheumatologists, cardiologists, and primary care providers. Despite the recognized interplay of inflammation, obesity, and traditional risk factors in RA, the unique cardiometabolic challenges faced by African American adults with RA and obesity remain underexplored, underscoring the urgent need for targeted research to inform equitable health strategies and improve outcomes in this vulnerable population (Macias-Konstantopoulos et al., 2023).

There is an important interplay between rheumatoid arthritis (RA), systemic inflammation, and cardiovascular disease (CVD), emphasizing the unique challenges faced by African American adults with obesity (Dessein et al., 2022). Researchers found that chronic inflammation in RA accelerates atherosclerosis, vascular damage, and

cardiometabolic conditions like hypertension, dyslipidemia, and congestive heart failure (Fazeli et al., 2021). Specific studies underline the role of autoantibodies, such as rheumatoid factor, anti-phospholipid antibodies, and systemic inflammation as critical drivers of heightened cardiovascular risk, which is compounded by traditional risk factors like obesity, smoking, and diabetes. Disparities in RA outcomes are evident, with African Americans facing higher disease activity, systemic inflammation, and socioeconomic barriers, such as limited healthcare access and structural inequities, exacerbating poor outcomes (O'Brien et al., 2024). Current research underscores the inadequacy of traditional CVD risk prediction models for RA patients due to the interaction between RA-specific factors and comorbidities. Despite growing evidence of the cardiometabolic burden in RA, gaps persist in exploring its impact on African American adults with obesity. Tailored research and interventions focusing on this intersection are needed to address disparities, improve outcomes, and guide equitable, multidisciplinary care strategies.

### **Impact of Hypertension on RA Among African Americans With Obesity**

Hypertension is highly prevalent among RA patients, as highlighted by Al-Ahmari et al. (2022), who identified social and clinical factors such as age, obesity, and comorbidities as significant contributors to this elevated cardiovascular risk in Saudi Arabia. A study by Al-Ahmari et al. (2022) on the prevalence of hypertension among RA patients in Saudi Arabia provides valuable insights into the elevated risk of hypertension among individuals with RA. This pattern reflects trends reported in U.S.-based research and is consistent with findings from other countries that have observed an increased

prevalence of cardiovascular comorbidities among individuals with RA (Ahmad et al., 2024). In Saudi Arabia, the study revealed that 32.35% of RA patients had hypertension, with significant risk factors including older age, female sex, low education, unemployment, obesity, and comorbidities such as diabetes and kidney disease. These findings underscore the impact of social and clinical variables on hypertension prevalence in RA patients, and they highlight the complex interrelationship between RA, hypertension, and other comorbid conditions (Al-Ahmari et al., 2022)

RA significantly increases the risk of CVD due to systemic inflammation that exacerbates traditional CVD risk factors such as hypertension, hyperlipidemia, and diabetes. While RA patients generally undergo more screenings for hypertension and diabetes compared to non-RA populations, they are less likely to receive appropriate screenings for diabetes and hyperlipidemia when RA is their sole risk factor, indicating gaps in preventive care (Montes et al., 2023). Factors like obesity, smoking, higher comorbidity scores, and shorter RA duration are associated with increased screening rates. At the same time, non-white patients, and those from lower socioeconomic backgrounds face disparities in access to preventive services inconsistent care (Montes et al., 2023).

Unlike Europe, where the European League Against Rheumatism (EULAR) provides specific guidance on cardiovascular risk assessment for patients with RA, the United States does not currently have a universally adopted protocol tailored to this population (Conrad et al., 2023) This absence of standardized national guidelines contributes to variability in cardiovascular risk screening and management among RA

patients (Conrad et al., 2023). Addressing these gaps with targeted interventions and equitable healthcare strategies is essential to improving outcomes for RA patients at elevated cardiovascular risk (Montes et al., 2023).

Chronic systemic inflammation is often associated with RA and can increase the risk of cardiovascular disease (CVD) including hypertension. Persistent systemic inflammation in RA can contribute to blood vessel damage, accelerating atherosclerosis and increasing cardiovascular risk (Al-Ahmari et al., 2022). The link between RA and CVD, particularly hypertension, is significant because it suggests that RA itself may be an independent cardiovascular risk factor, further amplified by other factors like obesity, smoking, and low socioeconomic status. However, while the study in Saudi Arabia focused on a specific Middle Eastern demographic, there is a notable gap in research examining cardiometabolic outcomes, specifically hypertension, among African American adults with RA and obesity.

African American adults with RA and obesity represent a demographic at heightened risk for both hypertension and cardiometabolic complications. This group may experience unique socio-environmental and genetic influences that exacerbate health disparities. Socioeconomic challenges such as limited healthcare access, lower levels of education, and systemic barriers contribute to poorer health outcomes among African Americans with RA. Additionally, obesity, which is more prevalent among African Americans, compounds the risk of hypertension and other cardiometabolic complications, underscoring the need for targeted research within this population (Ciofoaia et al., 2022). Obesity itself is an established risk factor for hypertension and, when combined with RA,

could lead to more severe cardiovascular outcomes due to the compounded effects of inflammation and metabolic dysfunction.

Global cause of mortality Despite advancements in healthcare, significant racial and ethnic disparities persist in CVD outcomes. In 2022, heart disease remained the foremost cause of death in the United States, responsible for 702,880 fatalities, which equates to approximately one in every five deaths (CDC, nd). Notably, non-Hispanic Black adults experience higher rates of CVD mortality compared to other racial and ethnic groups, underscoring the ongoing impact of structural inequities on health outcomes, highlighting the persistent impact of structural racism in the United States (Zakeri et al., 2024). People of color, including Black, Hispanic, American Indian, and Asian populations, face systemic inequities such as economic instability, unsafe living environments, limited educational opportunities, and unequal access to healthcare, all of which elevate their CVD risk and worsen outcomes (Javed et al., 2022). This inequity stems from historical and institutionalized racism, which continues to shape social determinants of health (SDOH). Addressing these disparities requires a comprehensive SDOH framework to explore the interplay between racism and health, guide equitable healthcare policies, and advance health equity.

Claus et al. (2025) highlights critical cardiometabolic risk factors in patients with RA based on a study of 200 individuals in a clinical setting. Their findings demonstrate that hypertension, diabetes mellitus, distress, and elevated Framingham scores are significantly associated with metabolic abnormalities among this patient. Their metabolomic analysis also identifies histidine metabolism as a potential surrogate marker

for cardiovascular burden in RA patients, offering insight into the inflammatory and metabolic pathways contributing to disease progression (Claus 2025?). However, while this study by Claus et al provides a crucial biological context for understanding cardiovascular risk in RA, it does not explore how these mechanisms manifest within the context of African American adults with obesity. This underscores a persistent gap in the literature regarding the intersection of RA, obesity, and racial disparities in shaping cardiometabolic outcomes. To address this gap, further studies are essential to investigate the cardiometabolic profiles and outcomes of RA among African American adults with obesity. Such research would provide vital insights for designing culturally tailored, patient-centered interventions and preventive measures to reduce hypertension and improve overall health outcomes in this vulnerable population.

Hadwen et al. (2024) investigated HTN as a prevalent comorbidity in patients with early rheumatoid arthritis (ERA) using data from the Canadian Early Arthritis Cohort (CATCH). Findings showed that 26% of ERA patients had HTN at baseline, with older age, diabetes, hyperlipidemia, and high BMI identified as key associated factors. However, the study did not provide detailed data on the racial or ethnic composition of the cohort, which limits the applicability of these findings to specific populations, such as African American adults with RA.

Over a median follow-up of 5 years, 24% of non-hypertensive patients developed HTN, with older age, overweight/obesity, hyperlipidemia, and excessive alcohol intake being significant predictors of incident HTN. Males had higher HTN prevalence and incidence than females, though obesity and alcohol consumption were more strongly

associated with HTN in females. Disease-specific factors like RA activity or treatments were not linked to HTN development. The study emphasizes the importance of routine cardiovascular risk screening and management for ERA patients and calls for further research into longitudinal risk factors and interventions tailored to evolving patient profiles.

The researchers elaborated on hypertension as a common comorbidity in RA patients, with studies indicating a prevalence of up to 80% in long-term cases. The presence of hypertension significantly increases the risk of cardiovascular events, which are a leading cause of mortality among RA patients. Traditional cardiovascular risk factors such as hypertension, hyperlipidemia, smoking, diabetes mellitus, and physical inactivity are highly prevalent among RA patients and contribute to the increased CVD risk (Hadwen et al., 2024). African American adults with RA are disproportionately affected by cardiovascular diseases. Hadwen et al., 2024 assessed cardiovascular disease risk and therapeutic patterns in a predominantly Black population. They found that traditional and RA-specific cardiovascular risk factors were higher than in previously reported White RA cohorts. This disparity underscores the need for targeted interventions to address the unique risk profile in this demographic.

Jia et al. (2024) established a link between rheumatoid arthritis (RA) and an increased risk of hypertension (HTN) by using Mendelian randomization to analyze genetic data and test for cause-and-effect relationships. Their findings demonstrated that RA significantly increases the risk of developing HTN, even after adjusting for confounding variables. The study also identified ten circulating inflammatory proteins,

particularly TNF-related activation-induced cytokines, as mediators in this association, with inflammation accounting for 11.17% of the causal pathway between RA and HTN. These results underscore the role of systemic inflammation as a key biological mechanism connecting RA to elevated blood pressure. The findings strongly support the inflammatory hypothesis of hypertension, linking chronic inflammation to blood pressure regulation via endothelial dysfunction, vascular remodeling, oxidative stress, and impaired kidney function. Additionally, traditional cardiovascular risk factors like high BMI, smoking, and diabetes exacerbate the risk. Sensitivity analyses confirmed the robustness of these associations, with no evidence of pleiotropy or significant heterogeneity. Jia et al., (2024) highlights the potential of targeting inflammatory pathways, including TNF-related activation-induced cytokines, as novel therapeutic approaches for managing hypertension in RA patients, emphasizing the importance of integrated cardiovascular risk management in this population.

Synthesis from the current studies underscores the critical intersection between RA, HTN, and associated cardiometabolic risks, particularly within vulnerable populations such as African American adults with obesity (Al-Ahmari et al., 2022; Hadwen et al., 2024; Jia et al., 2024).

Al-Ahmari et al. (2022) highlights the high prevalence of HTN among RA patients, identifying risk factors such as obesity, low socioeconomic status, and comorbidities like diabetes and kidney disease. These findings align with global trends demonstrating the role of systemic inflammation in accelerating cardiovascular risks through mechanisms like atherosclerosis and vascular damage. However, a notable

research gap exists in exploring these dynamics, specifically among African Americans with RA, a population disproportionately affected by obesity and cardiovascular disease due to socio-environmental and genetic factors.

Hadwen et al. (2024) reinforce the association between HTN and RA, emphasizing that traditional risk factors, older age, high BMI, and hyperlipidemia drive HTN prevalence in early RA patients. Their findings indicate that while RA disease activity itself may not directly cause HTN, the systemic inflammation inherent to RA exacerbates existing cardiovascular risks. Jia et al. (2024) further elucidate the inflammatory mechanisms linking RA to HTN, identifying inflammatory mediators like TNF-related activation-induced cytokine as critical contributors to endothelial dysfunction and vascular remodeling. Their work supports targeting inflammatory pathways as a therapeutic strategy for managing HTN in RA patients.

Collectively, these studies highlight the urgent need for targeted research into the compounded effects of RA, obesity, and racial disparities on HTN and cardiovascular outcomes. African American adults with RA and obesity face unique challenges, including higher disease activity, systemic inflammation, and socioeconomic barriers to healthcare access. Addressing these gaps requires culturally tailored, multidisciplinary interventions integrating cardiovascular risk management and RA care. Expanding research in this demographic will provide crucial insights for developing equitable strategies to mitigate cardiometabolic risks and improve outcomes in this vulnerable population.

### **Age and Sex Effects on Cardiometabolic Outcomes of RA**

Findings from Nilsson et al. (2021) underscore significant age- and sex-dependent differences in RA outcomes and treatment efficacy over eight years. Generally, both men and women experienced improvements in disease activity, function, and pain, though men showed more substantial progress across all age groups. Notably, men under 40 exhibited the lowest disease activity scores, although they were underrepresented in the study sample.

This study highlights the significant influence of age and gender on rheumatoid arthritis (RA) progression and outcomes. Men under 40 exhibited the lowest disease activity scores but were underrepresented in the sample, limiting broader insights into this group. Joint deterioration, measured by the Sharp van der Heijde Score (SHS), progressively worsened across all age and gender categories, with older women (aged 70 and above) showing the most severe joint space narrowing and minimal improvements in disability (Nilsson et al., 2021). These findings underscore the critical need to tailor therapeutic strategies based on age and gender, particularly for older adults who are more vulnerable to severe disease progression and limited functional recovery.

Joint deterioration, assessed via the Sharp van der Heijde Score (SHS), a radiographic scoring system that quantifies joint damage in rheumatoid arthritis by evaluating joint space narrowing and erosions in the hands and feet increased progressively across both genders and age categories (van der Heijde, 2000). Older women, particularly those aged 70 and above, experienced minimal improvements in disability and showed the most significant progression in SHS due to joint space

narrowing. These findings suggest that age and gender significantly influence RA progression and outcomes, underscoring the need to tailor therapeutic approaches, especially for older adults presenting with more advanced diseases.

Aging plays a significant role in the progression and impact of chronic diseases, including rheumatoid arthritis (RA). Alsaleh et al. (2022) examined the effects of aging on chronic diseases, including rheumatic conditions, revealing that age-related cellular changes contribute to increased vulnerability and adverse health outcomes. Their study identifies nine critical hallmarks of aging that could contribute to the pathogenesis of chronic diseases, including RA. They suggest that RA may exhibit features of accelerated aging influenced by cellular and molecular aging pathways. The study calls for further exploration of whether accelerated aging is a driver of RA or a consequence of chronic inflammation, proposing that targeting age-related pathways in treatment may offer new therapeutic possibilities.

These findings on age as a critical factor in RA progression are relevant for exploring cardiometabolic outcomes in African American adults with obesity. Age may influence the severity of RA and its cardiometabolic impacts, with older individuals potentially experiencing more significant challenges in managing both RA and comorbid conditions, such as cardiovascular disease (citation?). The accelerated aging model presented by Alsaleh et al. (2022) may also offer insights into the heightened cardiometabolic risks in obese RA patients, as age-related cellular dysfunction could exacerbate both RA progression and cardiovascular outcomes.

Maranini et al. (2022) emphasize the role of sex in the management and progression of RA, noting a predominance of the disease in women at a 3:1 female-to-male ratio. This sex differences suggests that women may experience more severe or prolonged RA symptoms, which has implications for treatment response and patient-reported outcomes. The study underscores the importance of incorporating sex-differences in RA research to better understand disease progression, treatment efficacy, and outcomes. Such analyses could be particularly useful for examining the intersection of sex with cardiometabolic factors in African American adults with obesity, as disparities in RA severity may align with differences in cardiovascular health and obesity outcomes.

These studies support the importance of examining age and gender as independent variables in exploring RA's cardiometabolic impacts, particularly in vulnerable populations like African American adults with obesity. Although there may be inconsistencies across research findings, including these variables remains critical. For this study, "Cardiometabolic outcomes of rheumatoid arthritis among African American adults with obesity," age and gender will be assessed alongside cardiovascular disease and hypertension, considering the influence of socioeconomic status and educational level to ensure a holistic approach. Together, these factors may elucidate how age and gender intersect with cardiometabolic risks in RA, guiding tailored interventions and improved health outcomes.

The synthesis of findings from Nilsson et al. (2021), Alsaleh et al. (2022), and Maranini et al. (2022) highlights the complex interplay between age, gender, and

rheumatoid arthritis (RA) outcomes, with critical implications for understanding cardiometabolic risks in vulnerable populations, such as African American adults with obesity. Nilsson et al. (2021) demonstrate significant age- and sex-dependent differences in RA progression, with older women exhibiting the most severe joint deterioration and minimal functional improvements over time. These disparities underscore the critical role of age and gender in shaping RA outcomes and treatment efficacy, particularly among older adults.

Alsaleh et al. (2022) add to this perspective by examining aging as a potential driver of RA progression, emphasizing that cellular and molecular aging processes may exacerbate chronic inflammation and disease severity. The concept of RA as a model of accelerated aging provides a novel framework for exploring the heightened vulnerability of obese RA patients to cardiometabolic complications, as age-related cellular dysfunction could amplify the impacts of both RA and cardiovascular disease.

Maranini et al. (2022) further contextualize the gender disparities in RA, noting the disease's predominance among women and the associated challenges in achieving optimal treatment outcomes. Their findings suggest that gender-specific biological and social factors may influence both RA severity and the risk of comorbid conditions, such as obesity and cardiovascular disease.

Together, these studies reinforce the necessity of incorporating age and gender as critical variables when examining RA's cardiometabolic impacts. In the context of African American adults with obesity, the intersection of age, gender, and systemic disparities such as socioeconomic status and access to care may exacerbate the severity of

RA and its associated cardiometabolic outcomes, including hypertension and cardiovascular disease. Addressing these complexities through a holistic approach that integrates demographic, biological, and social determinants is vital for developing tailored interventions and improving health outcomes in this high-risk population.

Socio-economic factors can also play a critical role in shaping the outcomes and management of RA. Patients with lower SES often experience higher disease activity, delayed diagnosis, and inconsistent access to effective treatments (Russell et al., 2023). Factors such as limited healthcare resources, financial barriers, and lower health literacy exacerbate disparities in care. Studies reveal that lower SES correlates with worsened patient-reported outcomes, such as pain, fatigue, and disability, even when radiographic disease progression remains unaffected. Furthermore, SES influences treatment disparities, with low-income and low-education groups less likely to access advanced therapies like biologics despite demonstrating higher adherence to healthcare protocols and increased disease severity (citation?). This inequity underscores systemic inefficiencies, including limited outpatient care engagement and physicians' reluctance to prescribe biologics due to comorbidities prevalent in low-SES populations (Russell et al., 2023). Addressing these disparities requires targeted interventions to reduce financial and logistical barriers, enhance health literacy, and ensure equitable access to advanced RA treatments. Comprehensive strategies are essential for improving outcomes in socioeconomically disadvantaged RA patients.

### **Impact of Socioeconomic Status on Cardiometabolic Outcomes**

A study by Astrike-Davis et al. 2023 on socioeconomic status (SES) among African Americans with early RA provides insights into how it can influence disease progression and patient-reported outcomes. The study highlights SES measures including education, occupation, and community poverty levels are linked to worsened patient-reported outcomes (PROs) such as pain, fatigue, and disability (Astrike-Davis et al. 2023). Still, they do not appear to correlate with radiographic progression. Specifically, lower education levels, non-professional occupation status, and living in high-poverty areas were associated with higher reports of pain, learned helplessness, and disability over 60 months (Astrike-Davis et al. 2023). The study underscores the role of SES in shaping health outcomes in RA patients. It suggests that socioeconomic factors may interact with disease mechanisms that affect patients' disease experiences.

Similarly, Kim et al., 2024, highlights the significant influence of socioeconomic status (SES), measured through the Area Deprivation Index (ADI), on RA disease activity and functional outcomes, with higher deprivation associated with worse outcomes in academic healthcare settings. While SES disparities were less pronounced in safety net hospitals, the findings emphasize the need for tailored interventions to address SES-driven health inequities in RA management. RA is often exacerbated by socioeconomic factors that hinder timely diagnosis, effective treatment, and consistent disease management (Kim et al., 2024). The study revealed that patients residing in neighborhoods with higher ADI scores (indicating more significant deprivation) exhibited significantly worse RA disease activity and functional impairment in the

academic cohort, alongside increased functional disability measured through the Multidimensional Health Assessment Questionnaire (MDHAQ) (Kim et al., 2024). The study findings align with prior research showing that lower SES correlates with higher RA disease activity, delayed treatment initiation, and more severe joint damage.

Additionally, Kim et al., 2024, reports underutilization of biologics among RA patients with lower SES despite their higher disease activity and better healthcare adherence, such as frequent hospitalizations and medication compliance. This paradox underscores systemic inefficiencies, including limited outpatient care engagement and physician hesitancy to prescribe biologics due to prevalent comorbidities in low SES groups. While low SES patients often rely more on inpatient care, this behavior does not mediate their reduced biologics access. The study emphasizes the need for targeted policy interventions to mitigate financial and logistical barriers, improve health literacy, and promote equitable access to health care for RA patients. Future research should explore SES impacts using longitudinal data to better inform inclusive healthcare strategies for RA patients.

### **Synthesis**

These studies underscore the significant impact of SES on RA disease progression, management, and patient-reported outcomes. Astrike-Davis et al. (2023) revealed that lower SES, measured by education, occupation, and community poverty levels, is strongly associated with worse PROs, such as pain, fatigue, and disability, but not radiographic progression. The findings suggest that socioeconomic factors may amplify disease experiences without directly altering radiographic markers. Similarly,

Kim et al. (2024) demonstrated that SES, as measured by the Area Deprivation Index, correlates with increased disease activity and functional impairment, particularly in academic healthcare settings. SES-driven disparities appeared less pronounced in safety net hospitals.

A critical aspect of Kim et al. (2024) is the paradox of lower biologics utilization among low-SES RA patients despite their higher disease activity and adherence to care protocols. Systemic inefficiencies, such as limited outpatient engagement and physicians' reluctance to prescribe biologics due to prevalent comorbidities, exacerbate this disparity. These studies collectively highlight the intersection of SES and RA outcomes, emphasizing how socioeconomic deprivation contributes to delayed diagnosis, inconsistent treatment, and suboptimal health outcomes.

The evidence supports the need for targeted interventions, including policies to reduce financial and logistical barriers, improve health literacy, and ensure equitable access to advanced RA treatments like biologics. Future research should focus on longitudinal studies to further unravel the dynamic effects of SES on RA management and to design inclusive healthcare strategies tailored to socioeconomically disadvantaged populations.

### **Literature Gaps**

RA is intricately linked to cardiovascular disease through shared pathways of inflammation and metabolic dysregulation. Despite substantial evidence highlighting these connections, the unique challenges faced by African American adults with obesity who have RA remain underexplored in the existing literature. Reviews such as those by

Fazeli et al. (2021) and Dessein et al. (2022) provide valuable insights into general RA and cardiovascular risk factors but neglect to examine the compounded effects of obesity, systemic inflammation, and socioeconomic determinants that disproportionately impact this demographic. Similarly, while studies like O'Brien et al. (2024) address racial disparities in RA outcomes, they do not specifically focus on the intersection of obesity and cardiometabolic risks in African Americans. This gap underscores an urgent need for research exploring these interrelated factors to inform tailored interventions. The proposed study on the cardiometabolic outcomes of RA among African American adults with obesity seeks to address this critical gap, offering a comprehensive understanding of how obesity and cardiometabolic health intersect with RA in this underserved population.

The interplay between RA and cardiovascular risk remains underexplored in the context of African American adults with obesity, particularly regarding the impact of social determinants of health on the prevalence and management of CVD in this population. While this review from Fazeli et al., 2021, provides valuable insights into the interplay between RA and cardiovascular risk, it does not address the unique cardiovascular and metabolic challenges faced by African American adults with obesity who have RA. Specifically, the literature lacks a focused examination of how social determinants of health, such as socioeconomic status, access to healthcare, and environmental stressors, influence the prevalence and management of CVD in this demographic group. Moreover, while inflammation and autoantibodies are acknowledged as risk factors for CVD in RA patients, the review does not consider how obesity is a significant and modifiable risk factor interacts with these RA-specific factors to

compound CVD risk. This gap in the literature indicates a need for studies that examine how obesity and associated cardiometabolic risks uniquely impact African American populations with RA, who are already at an increased risk of both RA and CVD due to genetic, socioeconomic, and environmental factors.

The literature gap from Dessein et al., 2022, underscores the importance of the proposed study, “Cardiometabolic Outcomes of Rheumatoid Arthritis among African American Adults with Obesity.” By focusing specifically on African American adults with obesity, this study aims to address the unmet need for research into the unique cardiometabolic profile of this population, considering both traditional and RA-specific cardiovascular risk factors. Understanding these interactions could improve targeted interventions and inform healthcare strategies that address both RA and CVD in this population, potentially leading to more equitable health outcomes.

The literature lacks a targeted exploration of CVD risk in RA patients within minority populations, specifically African American adults with obesity. Most studies have focused on general or white populations and do not account for the unique risk profiles and socioeconomic factors impacting African American adults. Furthermore, existing research seldom investigates the compounded effects of obesity on both RA progression and CVD risk in African Americans, who may experience more significant systemic inflammation due to higher obesity rates and greater exposure to socioeconomic stressors. Addressing this gap could improve targeted interventions and preventive strategies for this vulnerable population, aligning with the proposed study’s aim of examining cardiometabolic outcomes of RA in African American adults with obesity.

The study O'Brien et al., 2024, primarily focuses on RA disease activity and functional status by race and ethnicity without explicitly addressing the role of obesity or cardiometabolic conditions, which are critical factors for African American adults who face a high burden of both RA and cardiovascular risks. Furthermore, while the analysis examines general disparities in clinical outcomes, it lacks a specific focus on African American adults, particularly those with obesity, who may experience unique challenges due to socioeconomic factors, access to healthcare, and comorbid conditions. Addressing this gap in the proposed study could provide a more comprehensive understanding of how the combined influence of race, obesity, and cardiometabolic health factors in African American populations impacts RA outcomes. This approach aligns with the need for more nuanced, intersectional research that considers the compounded effects of comorbidities and socioeconomic determinants on RA outcomes within minority populations.

While the study (Astrike-Davis et al. 2023) advances our understanding of SES and RA among African Americans, it also exposes critical research gaps. Although SES influences outcomes, this study did not account for the cardiometabolic comorbidities that are especially prevalent among African American adults with obesity. This group faces unique health challenges at the intersection of race, chronic disease, and economic hardship. Obesity, which is highly prevalent among African American adults, is a known risk factor for both hypertension and cardiovascular disease, two significant contributors to cardiometabolic morbidity in RA. This gap points to an unmet need for research that

examines explicitly how SES as a controlling variable might impact the cardiometabolic outcomes of RA among African American adults with obesity.

Further research could explore how SES factors, such as income, education, and neighborhood poverty levels, may exacerbate cardiometabolic risks in RA. By understanding how SES interacts with both obesity and RA in this demographic, future studies could support the development of targeted interventions that address the compounded effects of low SES, obesity, and RA, ultimately improving disease outcomes in this high-risk population.

### **Summary and Conclusions**

The literature review in Chapter 2 thoroughly examined the multifaceted relationships between gender, cardiovascular disease, hypertension, and controlling variables: age, socioeconomic status, and educational level, and their combined impact on the management and outcomes of RA among African American adults with obesity. It highlights that socioeconomic disparities play a significant role in exacerbating RA symptoms and related cardiometabolic complications, while supportive healthcare interventions and targeted management strategies can potentially mitigate these effects. The review also underscores the critical influence of cardiovascular and metabolic conditions on RA progression, with hypertension and cardiovascular disease amplifying health risks and complicating disease management.

Findings from the reviewed literature stress the importance of a comprehensive approach to managing RA that includes tailored interventions based on age, gender, and socioeconomic background. These insights call for further research addressing gaps in

knowledge, particularly about the African American population, who may face unique socioeconomic challenges that affect their access to optimal care. The chapter emphasizes the need for collaborative efforts among policymakers, healthcare providers, and community leaders to create targeted interventions primarily focused on reducing cardiovascular risks, hypertension, and improving RA management outcomes. Addressing these needs is essential for enhancing the quality of life and reducing health disparities among African American adults with obesity and RA.

This chapter identified a significant gap in research investigating cardiometabolic risk factors associated with RA in African American adults with obesity. While there is a broad understanding of RA's risk factors in the general population, limited attention has been given to the specific interplay of cardiometabolic conditions, genetic predisposition, and socioeconomic factors within this demographic. Emerging evidence suggests that African American individuals may carry genetic and biological susceptibilities that increase the risk of developing both RA and cardiometabolic conditions such as hypertension and cardiovascular disease independent of lifestyle or behavioral factors. When combined with systemic barriers to care, these underlying predispositions may further elevate the disease burden and complicate disease management. This study aims to address this gap by developing a statistical model that analyzes not only socioeconomic and clinical factors but also acknowledges the potential influence of genetic vulnerability on RA and its cardiometabolic outcomes. By doing so, the research seeks to offer a holistic perspective of the unique risk landscape faced by African

American adults with obesity and to support the development of targeted, culturally appropriate interventions that improve long-term health outcomes.

### Chapter 3: Research Method

This chapter contains the methodology for this study, including research design, target population, data analysis, and statistical models. This study investigated the complex interplay between the independent variables (gender, hypertension, and cardiovascular disease), the controlling variables (age, SES, and education level), and RA outcomes among African American adults with obesity. This chapter not only justifies the chosen methodologies but also clarifies the study's scope, objectives, and anticipated contributions to existing knowledge. Through a detailed exploration of the quantitative techniques, this chapter provides a description of the multidimensional aim of the study to bridge a critical gap in the understanding of RA among African Americans with obesity. This research was conducted with the necessary Institutional Review Board (IRB) approval, granted under the study title "Cardiometabolic Outcomes of Rheumatoid Arthritis Among African American Adults with Obesity" (IRB Approval Number: 07-03-24-1023680).

#### **Research Questions and Hypotheses**

The following RQs and hypotheses guided this study:

RQ1: Is there an association between gender and RA among obese African American adults after controlling for age, education level, and SES?

$H_0$ 1: There is no association between gender and RA among obese African American adults after controlling for age, education level, and SES.

$H_{a1}$ : There is an association between gender and RA among obese African American adults after controlling for age, education level, and SES.

RQ2: Is there an association between RA and cardiovascular disease among obese African American adults after controlling for age, gender, and SES?

$H_{o2}$ : There is no association between RA and cardiovascular disease among obese African American adults after controlling for age, gender, and SES.

$H_{a2}$ : There is an association between RA and cardiovascular disease among obese African American adults after controlling for age, gender, and SES.

RQ3: Is there an association between RA and hypertension among obese African American adults after controlling for age, gender, and SES?

$H_{o3}$ : There is no association between RA and hypertension among obese African American adults after controlling for age, gender, and SES.

$H_{a3}$ : There is an association between RA and hypertension among obese African American adults after controlling for age, gender, and SES.

### **Research Design and Rationale**

This study employs a quantitative research design to provide a comprehensive examination of how gender, hypertension, cardiovascular disease, and controlling variables, age, socio-economic status, and level of education influence RA outcomes among African American adults with obesity. The complexity of RA underpins this choice as a disease and the complicated nature of its management among African American adults with obesity (Radu & Bungau, 2021).

The current study utilizes secondary data from NHANES to analyze gender, hypertension, and cardiovascular disease as independent variables, with socioeconomic status, educational level, and age as controlling variables. The study provides a comprehensive examination of cardiometabolic outcomes associated with rheumatoid arthritis among African American adults with obesity by analyzing variables through a structured quantitative design. It also enables the statistical analysis of correlations between these variables and RA outcomes, including symptom severity, medication adherence, and quality of life (Bruce, Pope, & Stanistreet, 2018).

Employing a quantitative research design for the study on the cardiometabolic outcomes of RA among African American adults with obesity offers numerous advantages that align with the research question and objectives. Firstly, quantitative methods enable precise measurement of variables related to RA and associated cardiometabolic conditions, ensuring accuracy and reliability in data analysis. Secondly, statistical analyses, such as regression and correlation, can identify significant statistically significant relationships between variables like hypertension, cardiovascular disease, and RA, providing insights into potential risk or protective factors. Using secondary data from NHANES further enhances the study by leveraging a large, nationally representative dataset for robust analysis (Dawadi, Shrestha, & Giri, 2021). Overall, the rigorous and systematic approach of quantitative research enhances the validity and robustness of the study findings, making it a valuable tool for identifying and addressing research gaps.

This research design is guided by ethical considerations, ensuring confidentiality, responsible data handling, and the respectful use of secondary data (Pandey & Pandey, 2021). It aligns with the study's objectives to quantify the influence of gender, hypertension, and cardiovascular disease on RA outcomes while controlling variables such as age, socio-economic status, and educational level. This study aims to contribute valuable insights into the complex relationships between cardiometabolic factors, obesity, and RA among African American adults with obesity. By detailing the quantitative approach and its rationale, this chapter lays the foundation for the investigation, offering evidence-based recommendations to improve RA management and support health interventions tailored to this vulnerable population.

### **Methodology**

This segment establishes the framework for gathering and analyzing data, ensuring a robust foundation for our investigation. It outlines the methodology employed to explore the interplay between gender, hypertension, and cardiovascular disease while controlling for age, socio-economic status, and educational level, and their effects on RA outcomes in African American adults with obesity.

The cross-sectional design is appropriate for this study on cardiometabolic outcomes of rheumatoid arthritis among African American adults with obesity because it enables the assessment of disease prevalence and health outcomes from survey and clinical records in the NHANES 1999-2000 dataset. Given the unique focus on RA within this population, the cross-sectional approach allows for an exploration of cardiometabolic risk factors that may not be routinely examined in relation to RA and

obesity. While causality cannot be established due to the single time-point nature of the design, this study will provide valuable insights into the prevalence of cardiometabolic outcomes in African American adults with RA, aligning with findings on the influence of inflammatory markers (Wang et al., 2020).

Alternative study designs, such as case-control or experimental studies, are less practical due to the time and complexity associated with prospectively tracking cardiometabolic outcomes or establishing experimental controls. These approaches are generally more suitable once specific associations have been identified (Pérez-Guerrero et al., 2024). Consequently, a cross-sectional approach is most appropriate as it fills a crucial gap in understanding the role of inflammatory and cardiometabolic risk factors among African Americans with RA and obesity, while also allowing for potential replication or future longitudinal studies for deeper insights.

### **Study Sample and Population Setting**

This study utilized NHANES dataset from 1999-2018, which includes data on 23,644 African American adults aged 20 years and above. Previous NHANES analyses have indicated that approximately 9% of African American adults have cardiovascular disease (Banerjee, 2015), which is approximately the percentage of cases expected within this dataset. NHANES was selected for this study because it provides a nationally representative, population-based dataset that includes detailed health, demographic, and laboratory information relevant to the study variables. Specifically, it offers robust data on rheumatoid arthritis, obesity, cardiovascular disease, hypertension, and socioeconomic indicators among African American adults. The large sample size and oversampling of

minority populations make NHANES particularly valuable for examining health disparities. Additionally, the survey's standardized data collection methods and publicly available datasets spanning multiple years (1999–2018) enable longitudinal trend analysis and support the statistical power necessary for complex analyses, such as logistic regression, focused on cardiometabolic outcomes in this high-risk population.

By utilizing this robust dataset, the study assessed the prevalence and cardiometabolic outcomes associated with rheumatoid arthritis among African American adults with obesity, providing insights that are valuable to understanding health disparities within this population. For the primary analysis of cardiometabolic outcomes related to rheumatoid arthritis among African American adults with obesity, power calculations based on logistic regression were conducted.

### **Power Analysis**

Power calculations for the primary logistic regression analysis assumed an event rate of 0.09 under the null hypothesis, a minimum detectable odds ratio of 1.8, a balanced design ( $\pi = 0.5$ ), and a two-sided test with an alpha level of 0.05. These parameters indicated that a minimum sample size of 896 was required to achieve 80% statistical power. With over 11,000 participants and more than 1,000 expected CVD cases, the sample size was sufficient to support the planned analyses.

### **Instrumentation and Materials**

This study conducted a secondary, retrospective analysis using archival data from the NHANES database, publicly accessible online (CDC, 2011). NHANES utilizes a complex, stratified, multistage sampling method to ensure representativeness. The

NHANES data collection process begins with carefully structured sampling stages, starting with selecting Primary Sampling Units (PSUs), which are groups of contiguous or single large counties. Within these PSUs, clusters of households are chosen, followed by individual households within each cluster. Finally, eligible participants from these households are selected for inclusion.

Participants meeting the study's criteria were notified in advance with a letter explaining that an NHANES interviewer would visit their home. During the visit, the interviewers explained the purpose of the survey, ensured the confidentiality of responses, obtained informed consent, and conducted interviews using a computer-assisted personal interview (CAPI) system. Additionally, participants were invited to complete health examination components if they signed a further consent form, allowing for the collection of more detailed health information. This systematic approach to sampling and data collection supports the validity and reliability of data used to analyze cardiometabolic outcomes of rheumatoid arthritis among African American adults with obesity.

### **Validity and Reliability of the Instrument**

NHANES has implemented stringent procedures during both data collection and analysis. With data collection. To ensure the validity of measures used in this secondary analysis examining cardiometabolic outcomes related to RA among African American adults with obesity, this study utilized data from the National Health and Nutrition Examination Survey (NHANES). NHANES has been collecting nationally representative health data since the 1960s and has undergone extensive validity testing on its

instruments across over 130,000 participants (Zigbuo-Wenzler et al., 2020), addressing empirical, content, and construct validity.

### ***Empirical Validity***

Researchers at the National Center for Health Statistics (NCHS) have taken steps to ensure empirical validity in the NHANES survey by designing questions and laboratory protocols that accurately measure outcomes of interest, such as biomarkers associated with cardiometabolic health. For example, when measuring high-sensitivity C-reactive protein, a marker of inflammation relevant to RA and obesity, the laboratories followed strict, standardized protocols to ensure reliable measurements. Predictive validity was also maintained, allowing an accurate assessment of relationships between inflammatory biomarkers, obesity, and cardiometabolic outcomes in rheumatoid arthritis.

For data analysis, statistical software packages like SAS and SPSS were employed to maintain consistency with past NHANES studies and ensure empirical validity for this secondary analysis (Zigbuo-Wenzler et al., 2020). This comprehensive approach to sampling, data collection, and validation ensures the NHANES data are robust and suitable for examining the complex interactions between obesity, RA, and cardiometabolic health among African American adults. The NHANES dataset used in this study ensures validity and reliability through well-established methodologies, which are essential for investigating the cardiometabolic outcomes associated with rheumatoid arthritis (RA) in African American adults with obesity.

### ***Content Validity***

The NHANES survey maintains high content validity by employing a complex, stratified, multistage sampling design, reducing bias and enhancing representativeness across the US population. This structure ensures that the survey captures diverse demographic and health-related variables, which is vital for exploring the prevalence of RA and cardiometabolic conditions. In addition to self-reported questionnaire responses, NHANES collects objective health data from physical exams and laboratory tests, strengthening the survey's content validity beyond face value and subjective assessments (Zigbuo-Wenzler et al., 2020). As outlined below, NHANES implements several controls throughout the study design to mitigate selection and information bias.

### ***Selection Bias***

Selection bias occurs when participants are chosen based on characteristics that may influence study outcomes. To minimize this risk, this study utilized secondary data from the National Health and Nutrition Examination Survey (NHANES), which applies a complex, multistage probability sampling design to ensure a nationally representative sample. NHANES selects primary sampling units (PSUs), divides them into smaller clusters, randomly selects households, and then selects individuals based on demographic characteristics such as age, sex, and ethnicity to enhance diversity and reduce bias (Zigbuo-Wenzler et al., 2020).

For this specific study, participants were selected from the 1999–2018 NHANES dataset based on the following inclusion criteria: individuals who self-identified as non-Hispanic Black, were aged 20 years or older, had a body mass index (BMI)  $\geq 30$

(classified as obese) and had complete data on rheumatoid arthritis diagnosis and key cardiometabolic variables (e.g., hypertension, diabetes, cardiovascular disease).

Exclusion criteria included missing data on RA status, cardiometabolic outcomes, or demographic covariates critical to the analysis.

While NHANES's design minimizes sampling bias, this study's analytic sample may still be subject to selection bias due to missing data or self-reported diagnoses, which can introduce reporting bias. However, the large sample size, rigorous NHANES methodology, and clearly defined selection criteria support the internal and external validity of the findings, particularly for the target population of African American adults with obesity.

### ***Information Bias***

Information bias, particularly recall bias, arises when participants inaccurately report past health information. NHANES mitigates this bias by emphasizing direct, objective measurements whenever possible. In addition to anthropometric data such as height and weight, NHANES collects a range of molecular biomarkers through laboratory analyses, including C-reactive protein (CRP), total cholesterol, HDL and LDL cholesterol, triglycerides, fasting glucose, serum insulin, and glycated hemoglobin (HbA1c) all of which are essential indicators of cardiometabolic health. NHANES also records clinical measurements, such as blood pressure, using standardized protocols to enhance accuracy. These objective data sources reduce the errors commonly found in self-reported information, particularly in areas like weight or disease history, and are essential for reliably assessing health outcomes related to obesity and RA. Including

molecular and physiological markers ensures that NHANES data maintains high validity and reliability in evaluating cardiometabolic conditions in diverse populations.

### ***Construct Validity***

NHANES ensures construct validity by applying consistent measurement techniques and protocols over time, allowing for comparable results across different study cycles. The survey's standardized procedures mean that measurements for indicators like blood pressure and CRP levels align with those used in previous studies, validating the results in the context of RA, cardiometabolic health, and inflammatory markers in African Americans with obesity (Frankfort-Nachmias & Nachmias, 2008). This continuity also helps confirm that the instruments measured the intended constructs accurately.

### ***Reliability***

Reliability in NHANES data is reinforced by strict procedures to control for potential measurement errors. Data transcription and coding are carefully checked against the original CDC data, ensuring accuracy in nominal, ordinal, and ratio data analyses. Regular quality control meetings and cross-checking among team members further reinforce the reliability of the dataset. By following these rigorous procedures, NHANES produces reliable data suitable for examining the intersections of RA, obesity, and cardiometabolic health outcomes in African American adults. The survey's longstanding reputation as a reliable data source further enhances the credibility of findings related to these health outcomes (Zigbuo-Wenzler et al., 2020). This approach to validity and reliability in NHANES supports its use in a study of cardiometabolic outcomes among

African American adults with RA and obesity, providing robust and trustworthy data for meaningful insights.

### **Study Variables**

The variables used in the analysis were selected based on the three research questions of interest and the availability of variables in the NHANES 1999-2018.

#### ***CVD***

CVD will be defined using self-reported data from the NHANES questionnaire. The questionnaire data will be examined for any respondent reporting having experienced any one of the following: coronary heart disease, congestive heart failure, angina, cerebrovascular accident, and heart attack. Any positive report will be coded 1, and all other respondents will be coded 0 for CVD.

#### ***Hypertension***

Hypertension was defined using variables for average systolic and diastolic blood pressure in the NHANES dataset. High blood pressure will be defined according to the seventh report of the internationally recognized Joint National Committee: a systolic BP  $\geq 140$  mmHg and/or diastolic BP  $\geq 90$  mmHg, or currently taking medication for hypertension was classified as high blood pressure; systolic BP  $< 120$  mmHg and diastolic BP  $< 80$  mmHg was classified as normal blood pressure; measurements in between the two categories will be classified as elevated blood pressure. For this analysis, systolic BP  $\geq 140$  mmHg and/or diastolic BP  $\geq 90$  mmHg will be coded 1, and the remaining two categories will be coded 0. In addition to the blood pressure measurement, any

respondents who report ever being told that they had high blood pressure in the questionnaire will be coded 1.

### ***Rheumatoid Arthritis***

The medical conditions section of the NHANES questionnaire will be used to define rheumatoid arthritis. Respondents who report that a doctor diagnosed them with arthritis will be coded as 1, while those who respond “no” will be coded as 0.

Rheumatoid arthritis will serve as the dependent variable in this research.

### **Covariates**

#### ***Age***

NHANES collects data on the age of the sample person at screening for individuals aged less than 85 years; those aged 85 and above are coded into one category. The age variable will be coded into categories for the adult age groups, which are associated with different CVD epidemiology and outcomes, i.e., 20-34 years, 35-49 years, 50-64 years, and 65 years and above.

#### ***Gender***

The gender of the sample person in NHANES is categorized as male or female with appropriate coding for missing data. The data will be dummy codes as Male (1) or female (2) in this analysis.

#### ***Education Level***

The highest grade or level of school completed, or the highest degree attained by adults in NHANES and reported in the demographic section of the survey will be used.

The levels will be coded into five categories to be used in the analysis (1 = some high school, 2 = high School graduate, 3= some college degree.

### ***Obesity***

BMI will be calculated using body measurements for weight and height as weight (in kg)/ height (m<sup>2</sup>). For inclusion in this analysis, participants will have obesity (defined as BMI  $\geq$  30). Further categorization will be done among the obese persons to obtain a variable for classifying the severity of obesity, which will be categorized into three groups: obesity was coded as a binary variable based on the Body Mass Index (BMI) classification standard set by the Centers for Disease Control and Prevention (CDC). Participants with a BMI of 30 or greater were categorized as “obese” and coded as 1, while those with a BMI less than 30 were classified as “not obese” and coded as 0. This classification allowed for a clear distinction between obese and non-obese individuals in the analysis of rheumatoid arthritis outcomes among African American adults (see Table 1).

**Table 1***Data Categorization and Analysis*

Section (data set title)	Variable	Variable type
Demographic	Gender	Categorical
	Age	Continuous
	Education level	Categorical
	Poverty income ratio (socioeconomic status)	Categorical
Medical conditions	Cardiovascular disease	Categorical
	Rheumatoid arthritis	Categorical
Medical conditions and blood pressure	Hypertension	Categorical
Body measures	BMI (kg/m <sup>2</sup> )	Continuous

**Statistical Analyses**

The study employed various statistical analyses using SPSS (version 28) to examine the cardiometabolic outcomes of RA among African American adults with obesity. Descriptive statistics were conducted to summarize demographic characteristics, including gender, hypertension (HTN), socioeconomic status (PIR2), educational level, age distribution, obesity (BMI categories), cardiovascular disease (CVD), and RA prevalence. The analysis included frequency distributions, means, and percentages to provide a clear overview of the sample composition.

Collinearity diagnostics assessed potential multicollinearity among independent variables, including Variance Inflation Factor (VIF), tolerance values, condition index, eigenvalues, and variance proportions. These diagnostics helped determine whether the

predictor variables were highly correlated, which could impact the reliability of the regression models. The results confirmed that multicollinearity was not a concern, ensuring the stability of the logistic regression models.

The study used complex sample logistic regression to identify key predictors of RA while controlling age, gender, socioeconomic status, and educational level. The binary logistic regression model included RA as the dependent variable and gender (male vs. female), CVD (yes vs. no), hypertension (yes vs. no), socioeconomic status (impoverished vs. not impoverished), and education level (some high school, high school graduate, some college) as independent variables. The analysis generated odds ratios (ORs) with 95% confidence intervals (CIs) to determine the strength and direction of associations. Wald F-statistics were used to assess the significance of individual predictors, while pseudo-R-squared values, including Cox and Snell  $R^2$ , Nagelkerke  $R^2$ , and McFadden  $R^2$ , evaluated the model's explanatory power.

Model fitness and significance tests were performed to determine the logistic regression models' effectiveness. The study calculated the Wald F-statistics to measure each predictor's contribution and analyzed p-values to confirm statistical significance. Pseudo-R-squared values offered insight into how much variability in RA outcomes the independent variables explained, providing an assessment of model strength.

A subpopulation analysis focused explicitly on RA prevalence among African American adults with obesity while controlling for gender, hypertension, cardiovascular disease, socioeconomic status, and age. This analysis tailored the study results to this demographic group. Additionally, the study examined categorical variables by cross-

tabulating RA prevalence with gender, hypertension, socioeconomic status, and cardiovascular disease. The study used weighted counts and percentages to represent the distribution of RA cases across different categories, ensuring alignment with the complex survey design of NHANES data.

Overall, the statistical analysis comprehensively examined the factors influencing RA in this population. The findings from descriptive statistics, multicollinearity diagnostics, complex sample logistic regression, model fit assessments, and subpopulation analyses helped identify key predictors of RA. These methods ensured that the study results were robust, reliable, and relevant for understanding the cardiometabolic risks associated with RA in African American adults with obesity.

### **Data Collection and Analysis**

The purpose of this study was to examine the association between rheumatoid arthritis and cardiovascular outcomes in obese African American adults. The following specific questions guided the analysis:

RQ1: Is there an association between gender and rheumatoid Arthritis among obese African American adults after controlling for age, education level, and socioeconomic status?

$H_01$ : There is no association between gender and rheumatoid Arthritis among obese African American adults after controlling for age, education level, and socioeconomic status.

$H_{a1}$ : There is an association between gender and rheumatoid Arthritis among obese African American adults after controlling for age, education level, and socioeconomic status.

A multivariable logistic regression model was used to assess the association between rheumatoid arthritis (RA) and gender ( $X_1$ ) while controlling for the effects of education level ( $X_2$ ), socioeconomic status ( $X_3$ ), and obesity status ( $X_4$ ). All variables were entered simultaneously into the model. Statistical significance was evaluated using an alpha level of 0.05, and odds ratios with 95% confidence intervals that excluded the null value of 1.0 were considered significant. Multicollinearity among predictors was assessed using the Variance Inflation Factor (VIF) to ensure model stability. The equation for the logistic regression model was specified as:

$$\text{Logit(RA)} = \beta_0 + \beta_1 * \text{gender} + \beta_2 * \text{education level} + \beta_3 * \text{socioeconomic} + \beta_4 * \text{BMI severity}$$

RQ2: Is there an association between rheumatoid arthritis and cardiovascular disease among obese African American adults after controlling for age, gender, and socioeconomic status?

$H_{o2}$ : There is no association between rheumatoid arthritis and cardiovascular disease among obese African American adults after controlling for age, gender, and socioeconomic status

$H_{a2}$ : There is an association between rheumatoid arthritis and cardiovascular disease among obese individuals after controlling for age, gender, and socioeconomic status.

The stepwise logistic regression approach outlined for research question 1 will be applied but the model will evaluate between CVA as a dependent variable ( $Y_i$ ) and rheumatoid arthritis as a primary independent variable ( $X_1$ ). The model will control for the effect of gender ( $X_2$ ) education level ( $X_3$ ), socioeconomic status ( $X_4$ ) and BMI severity ( $X_5$ ).

The equation for the logistic regression model will be as follows:

$$\text{Logit(CVD)} = \beta_0 + \beta_1 * RA + \beta_2 * gender + \beta_3 * education\ level + \beta_4 * socioeconomic + \beta_5 * BMIseverity$$

The cuts off for the stepwise regression for both inclusion and exclusion of variables will be like those used in research question 1. The cut-off for statistical significance will be  $p < 0.05$ .

RQ3: Is there an association between rheumatoid arthritis and hypertension after controlling for age, gender, and socioeconomic status?

$H_03$ : There is no association between rheumatoid arthritis and hypertension among obese African American adults after controlling for age, gender, and socioeconomic status

$H_a3$ : There is an association between rheumatoid arthritis and hypertension among obese individuals after controlling for age, gender, and socioeconomic status.

The stepwise logistic regression approach outlined for research question 1 will be applied, but the model will evaluate hypertension as a dependent variable ( $Y_i$ ) and rheumatoid arthritis as a primary independent variable ( $X_1$ ). The model will control for

the effect of gender ( $X_2$ ), education level ( $X_3$ ), socioeconomic status ( $X_4$ ), and BMI severity ( $X_5$ ).

The equation for the logistic regression model will be as follows:

$$\text{Logit(HBP)} = \beta_0 + \beta_1 * RA + \beta_2 * gender + \beta_3 * education\ level + \beta_4 * socioeconomic + \beta_5 * BMIseverity$$

The cuts off for the stepwise regression for both inclusion and exclusion of variables will be like those used in research question 1. The cut-off for statistical significance will be  $p < 0.05$ .

### **Potential Threats to Validity**

Selection bias might arise if the NHANES sample does not fully capture the target population, specifically African American adults with obesity, which could limit the study's broader applicability. Although NHANES uses stratified sampling to enhance representativeness, nonresponse bias could still skew results, particularly in marginalized communities.

Information bias, as self-reported data on conditions such as cardiovascular disease and hypertension can be prone to recall errors if participants misremember or underreport their health history. NHANES includes objective measurements, like height, weight, and inflammatory markers, to reduce this risk and provide more accurate data than relying solely on self-reports.

Confounding variables are also a concern, as socioeconomic factors and education levels can influence both RA and cardiometabolic health outcomes, potentially distorting associations. The study attempts to control these confounders by incorporating them into

logistic regression models, though residual confounding may still occur if not all relevant factors are included. Finally, Smoking is a well-established risk factor for both rheumatoid arthritis and cardiometabolic conditions. However, this study excludes it as a confounding variable to maintain focus on gender, hypertension, cardiovascular disease, socioeconomic status, and education level as primary predictors of RA among African American adults with obesity. Inconsistencies in smoking data across NHANES survey cycles and concerns about self-reporting accuracy further supported its exclusion from the analysis. Although the model does not include smoking, the study recognizes its importance and discusses this limitation when interpreting results and outlining directions for future research.

Measurement reliability is supported by NHANES through consistent data collection protocols, which help maintain uniformity in survey tools across study cycles. However, minor data collection or coding discrepancies could still impact on the study's overall reliability and validity despite these rigorous efforts.

### **Sample Weights and Other Considerations**

NHANES's intricate and complex probability cluster design requires specialized techniques to minimize correlations within clusters and provide accurate data analysis (CDC, 2011). This design involves differential weighting, stratification, and clustering, wherein fewer individuals are chosen per cluster, but multiple clusters are sampled to ensure representativeness. Over each two-year cycle, NHANES samples from 30 population sampling units (PSUs), with each PSU representing about 5,000 individuals in the US. Sample weights are applied to correct for over- or under-represented groups,

balancing any oversampling or under-sampling that might otherwise bias results (Park & Lee, 2004). Simple random sampling would not adjust for these factors, which could lead to inflated significance levels and underestimated variances (CDC, 2011).

Calculating these weights involves a three-step process (CDC, 2013). In the first step, NHANES determines each participant's final probability by combining the selection probabilities at various levels, including individual, household, PSU segment, and PSU overall. This probability is then adjusted to account for nonresponse, and a final post-stratification adjustment is aligned with control totals from the 2000 US Census to ensure representativeness. The Design Effect (DEFF) measures how this complex design impacts variance compared to simple random sampling and helps evaluate the effectiveness of the weights. In NHANES, DEFF values typically exceed 1, reflecting a more significant variance estimate for the clustered design than a simple random sample would produce. DEFF varies across variables, and NHANES requires a minimum sample size to yield a relative standard error of 30% or less to ensure precision (CDC, 2011).

The Taylor Series Linearization method estimates variances, and Masked Variance Units (MVUs) replace actual PSUs to safeguard participant confidentiality. Within the NHANES dataset, PSU and stratum variables are labeled as "sdmvpsu" and "sdmvstra," respectively (CDC, 2009).

### **National Representativeness and Sampling Method**

NHANES is designed to be nationally representative, with each participant representing 50,000 US residents to capture national health trends accurately (CDC, 2013b). The sampling process starts by dividing the US into counties, subdivided into

local areas, housing communities, and individual households. Each year, 15 counties are selected randomly, followed by the random sampling of households within these counties, ensuring findings are generalizable and based on an equal selection probability.

### **Recruitment and Participant Engagement**

The National Center for Health Statistics (NCHS) employs various measures to encourage participation and maintain data quality (CDC, 2013b). Local media outlets inform communities about the study, and community leaders are contacted in advance. Each potential participant receives an introductory letter outlining the survey's purpose, procedures, and benefits. NCHS representatives then visit selected households to verify eligibility, explain the survey's goals, and assure confidentiality and voluntary participation. Participants are free to opt-out at any time.

Participants engage in two primary components: a household interview and a medical examination conducted at mobile examination centers. Written consent forms are provided for each element, allowing participants to participate in one or both. This comprehensive approach ensures that participants are fully informed, supported, and engaged, enhancing data quality for the study.

For this research on the cardiometabolic outcomes of rheumatoid arthritis (RA) among African American adults with obesity, these methodological practices ensure that the data reflect a national perspective on health disparities. By carefully structuring sampling and participant engagement, NHANES supplies a robust, reliable dataset to explore how RA and obesity intersect to impact cardiometabolic health in this population.

In addition to its rigorous methodology, NHANES upholds strong ethical standards in data collection and participant protection. All survey protocols receive approval from the National Center for Health Statistics (NCHS) Research Ethics Review Board, and participants provide informed consent before data collection. The program ensures confidentiality by de-identifying participant data and employing secure data management practices. These ethical safeguards reinforce the credibility of NHANES data and ensure that all analyses conducted using this dataset respect participants' rights, privacy, and welfare.

### **Summary**

This chapter outlines the methodological approach employed to examine the predictors and cardiometabolic outcomes of RA among African American adults with obesity, using secondary data from the National Health and Nutrition Examination Survey (NHANES) spanning 1999–2018. As a quantitative, cross-sectional study, it utilizes existing population-based survey data to investigate associations between RA and key variables, including gender, hypertension, and cardiovascular disease.

The chapter details the study population, sampling design, and inclusion criteria, emphasizing the representativeness of the NHANES dataset for African American adults aged 20 and older. Ethical considerations are addressed through de-identified, publicly available data, ensuring participant confidentiality and research integrity.

To ensure the validity and reliability of findings, the methodology incorporates standardized NHANES variables, clearly defined constructs, and statistical controls for confounding factors such as age, educational level, and socioeconomic status. Strategies

to minimize bias and improve analytical rigor, such as logistic regression modeling and appropriate weighting, are also discussed. This chapter establishes a robust foundation for analyzing and interpreting the findings presented in Chapter 4, aiming to generate evidence-based insights into the cardiometabolic risks associated with RA in a historically underserved population.

## Chapter 4: Results

This chapter presents the study results, including descriptive statistics, linear multicollinearity diagnostics results, complex sample logistic regression models, and the interpretation of key findings. The chapter begins with a discussion of data collection and sample characteristics, includes a presentation of inferential statistical analyses, and concludes with a summary of findings. This study aimed to analyze the cardiometabolic outcomes of RA among African American adults with obesity by examining key predictors and their associations with RA. Using NHANES data, this research evaluated the impact of gender, hypertension, and cardiovascular disease while controlling for age, SES, and education level on RA outcomes in this population. Given that African Americans experience disproportionate health disparities, understanding the interplay between these cardiometabolic risk factors and RA is essential. The systemic inflammation associated with RA, exacerbated by obesity, increases susceptibility to cardiovascular disease and hypertension, further compounding health risks. By analyzing these complex relationships, this study provided critical insights into RA-related cardiometabolic complications, and may contribute to more targeted prevention and intervention strategies for African American adults.

This chapter presents the study's findings, beginning with descriptive statistics for independent and dependent variables. I then provide the results of the complex sample logistic regression analysis, including key assumptions and statistical outputs relevant to the study objectives. I also interpret the effect sizes and significance levels, providing insight into the strength and direction of the observed associations. Finally, the chapter

presents a summary of the main results and discusses their relevance and implications within existing literature.

This study used data from NHANES, which were collected using a complex sample logistic regression to account for the complex, multistage probability sampling design. NHANES uses a stratified, clustered sampling approach and applies survey weights to ensure that the data are representative of the noninstitutionalized U.S. population. Because of this design, conventional logistic regression, which assumes simple random sampling, would likely yield biased standard errors, potentially leading to incorrect statistical inferences (CDC, 2022). Complex sample logistic regression incorporates survey weights, strata, and PSUs, which are correct for design effects and provide more accurate parameter estimates and standard errors. This method is appropriate for public health studies using nationally representative data and is consistent with best practices for analyzing NHANES data (Johnson et al., 2013).

In the context of the current study, which focused on African American adults with obesity, complex sample logistic regression allowed for the accurate estimation of associations between independent variables (gender, hypertension, cardiovascular disease, SES, and education) and the dependent variable (RA). The rationale for this analytic approach, including the application of NHANES sample weights, was outlined in Chapter 3. Incorporating this technique ensured methodological rigor and enhanced the generalizability of the findings to the broader African American adult population in the United States.

## **Data Collection**

I used a cross-sectional study design to examine the cardiometabolic outcomes of RA among African American adults with obesity. The analysis focuses on key predictors, including gender, cardiovascular disease, and hypertension, while controlling variables like age, educational level, and socioeconomic status to assess their associations with RA. This research was conducted with the necessary Institutional Review Board (IRB) approval, granted under the study title “Cardiometabolic Outcomes of Rheumatoid Arthritis Among African American Adults with Obesity” (IRB Approval Number: 07-03-24-1023680).

This study employs secondary data from the NHANES 1999-2018, encompassing 23,644 African American adults, M=41.73 years of age. Prior analyses of NHANES data indicate that approximately 9% of African American adults have cardiovascular disease (CVD) (Banerjee, 2015), yielding an estimated 1,037 CVD cases within this dataset. To examine the cardiometabolic outcomes associated with RA among African American adults with obesity, power calculations utilizing logistic regression were performed to ensure the statistical robustness of the primary analysis.

## **Results**

### **Descriptive Statistics**

SPSS version 28 was employed to perform a descriptive frequency analysis to summarize and present key characteristics of the study sample in a structured manner. Table 2 depicts an overview of the study’s predictor variables. The dataset provides demographic distribution data among the study participants, including gender, RA status,

educational level, socio-economic status (poverty-income ratio), ethnicity, cardiovascular disease (CVD), obesity, and hypertension (see Table 2).

**Table 2**

*Descriptive Statistics for Study Variables*

Variable	Category	Frequency	Percentage
Gender	Male	11,680	49.4%
	Female	11,964	50.6%
	Total	23,644	100%
Hypertension	Negative	8,718	62.7%
	Positive	5,177	37.3%
	Total	13,985	100%
Socioeconomic status	Not impoverished	8,378	39.1%
	Impoverished	13,026	60.9%
	Total	21,404	100%
Education level	Some high school	5,950	28.6%
	High school graduate	5,352	25.7%
	Some college	9,527	45.7%
	Total	20,829	100%
Obesity	< 30	14,988	71.9%
	>= 30	5,871	28.1%
	Total	20,859	100%
Cardiovascular disease	No	10,174	83.3%
	Yes	1,342	11.3%
	Total	11,516	100%

*Note.* The full sample size consisted of  $N = 23644$ . The totals for each variable in the table represent collected data minus the missing values. Percentages are calculated specifically for each variable total and not the full sample size.

Table 3 presents the prevalence of RA among study participants:

**Table 3***Prevalence of RA Among African American Adults With Obesity*

RA	Frequency	Percentage
No	8,781	95.2%
Yes	438	4.8%
Total	9,219	100%

**Descriptive Statistics of Study Variables**

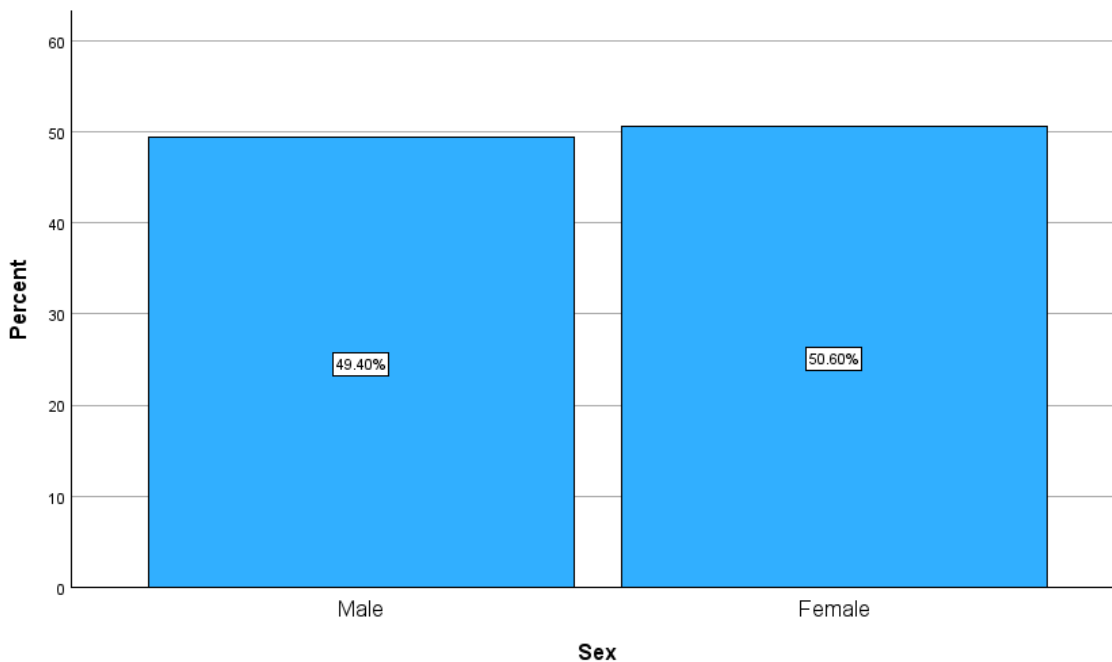
The descriptive statistics for key variables include gender, socioeconomic status, education level, age group, rheumatoid arthritis, hypertension, and cardiovascular disease. These statistics provide an overview of the sample composition and the completeness of the dataset.

***Distribution of Males and Females***

The sample consists of 23,644 participants, with a nearly equal distribution of males and females: Males: 49.4% (N = 11,680) and Females: 50.6% (N = 11,964). The sample distribution among women and men was balanced, ensuring that disproportionate sample sizes would not skew analyses involving gender differences in RA and hypertension outcomes (see Figure 2).

**Figure 2**

*Distribution of Males and Females Among the Study Participants*



### ***Hypertension***

Hypertension (HTN) Prevalence: Based on valid responses, 37.3% of participants (N = 5,177) were identified as having hypertension, while 62.7% (N = 8,718) did not report hypertension, totaling 13,895 valid cases. The notable proportion of individuals with hypertension underscores the importance of this variable in analyzing its potential association with RA.

### ***Socioeconomic Status***

Socioeconomic status, measured by the poverty-to-income ratio (PIR2), categorized participants as impoverished. Of the valid cases, 60.9% (N = 13,026) were classified as impoverished, while 39.1% (N = 8,378) were not impoverished. It indicates

that most participants face economic hardship, which may have important implications for healthcare access and disease outcomes, particularly in the context of rheumatoid arthritis and hypertension.

### ***Education Level***

Among valid cases, 28.6% of participants (N = 5,950) reported having some high school education, 25.7% (N = 5,352) were high school graduates, and 45.7% (N = 9,527) had attended some college. The most considerable proportion of participants had some college education, while 54.3% had a high school education or less. This distribution provides valuable context for analyzing the role of educational attainment in Rheumatoid Arthritis and hypertension outcomes.

### ***Cardiovascular Disease Prevalence***

Among participants with valid responses, 11.3% (N = 1,342) reported having cardiovascular disease, while 88.7% (N = 10,174) reported no history of CVD. These results are based on 11,516 valid cases and reflect the self-reported prevalence of CVD within the study population.

### ***Age Group Distribution***

Among participants with valid responses, 71.9% (N = 14,988) were younger than 30 years, while 28.1% (N = 5,871) were 30 years or older. The dataset predominantly consists of younger individuals, reflecting a higher proportion of participants under 30 years of age.

### ***Rheumatoid Arthritis Prevalence***

Based on valid responses, 4.8% of participants (N = 438) reported a diagnosis of RA, while 95.2% (N = 8,781) did not. These figures are derived from 9,219 valid cases and provide a more accurate estimate of RA prevalence among respondents with complete data. (Figure 1)

### **Test for Multicollinearity**

Preliminary analyses assessed multicollinearity in the logistic regression model predicting RA. This analysis helps identify potential multicollinearity, which occurs when independent variables are highly correlated, potentially compromising the stability and interpretability of the regression. The Collinearity Diagnostics table provides key indicators for assessing multicollinearity among the independent variables in the logistic regression model predicting RA. The Appendix presents the results of a multiple regression analysis predicting RA based on the independent variables. The analysis focuses on statistical significance, effect sizes, and collinearity diagnostics to ensure the stability of the model.

### ***Interpretation of Regression Coefficients***

The standardized coefficients (Beta) represent the relative contribution of each predictor in the model. The findings emphasize the key predictors of RA and their broader implications. Ethnicity was a statistically significant predictor of RA ( $B = -0.006$ ,  $p < .001$ ,  $VIF = 1.055$ ). The negative coefficient suggests that certain ethnic groups may be less likely to develop RA. Collinearity diagnostics indicate that tolerance (0.948) and  $VIF$  (1.055) are within acceptable ranges, suggesting no major collinearity concerns.

Economic level (PIR2) was also a significant predictor ( $B = 0.006$ ,  $p = .004$ ,  $VIF = 1.166$ ), indicating that individuals with lower socioeconomic status had a higher likelihood of RA. The collinearity statistics (tolerance = 0.857,  $VIF = 1.166$ ) confirm that multicollinearity is not a concern for this variable.

Education (EDUC) was found to be highly significant ( $B = -0.014$ ,  $p < .001$ ,  $VIF = 1.181$ ). The negative coefficient suggests that higher education levels reduce the likelihood of RA. The collinearity diagnostics (tolerance = 0.847,  $VIF = 1.181$ ) indicate that multicollinearity does not pose an issue for this predictor.

Obesity emerged as another significant predictor ( $B = 0.010$ ,  $p < .001$ ,  $VIF = 1.030$ ), with the positive coefficient indicating that individuals with obesity are more likely to develop RA. This study defines obesity using the standard NHANES classification: a body mass index (BMI) of 30 kg/m<sup>2</sup> or higher, per CDC guidelines. The collinearity statistics (tolerance = 0.971,  $VIF = 1.030$ ) show no concern regarding multicollinearity for this variable.

Hypertension (HTN) was found to be highly significant ( $B = 0.031$ ,  $p < .001$ ,  $VIF = 1.107$ ), with a positive coefficient indicating that individuals with hypertension have an increased likelihood of RA. The collinearity diagnostics (tolerance = 0.904,  $VIF = 1.107$ ) confirm that no significant collinearity exists for this predictor.

Cardiovascular disease (cvd2) was enormously significant ( $B = 0.066$ ,  $p < .001$ ,  $VIF = 1.084$ ), with a positive coefficient suggesting that individuals with cardiovascular disease are more likely to develop RA. The collinearity statistics (tolerance = 0.923,  $VIF = 1.084$ ) indicate no concern regarding collinearity.

### ***Multicollinearity Analysis***

The collinearity diagnostics indicate that multicollinearity is not a concern in this model. Tolerance values are all above 0.1, and *VIF* values are below 5, confirming that the independent variables are not excessively correlated. Although the highest *VIF* value (1.181 for Education) is slightly elevated, it remains well within the acceptable range, further validating the stability of the regression model. These interpretations are based on established statistical guidelines for diagnosing multicollinearity in regression analysis. According to commonly accepted thresholds, tolerance values below 0.1 and *VIF* values exceeding 5 (or more conservatively, 10) may indicate problematic multicollinearity (Kutner et al., 2005). In this study, all tolerance and *VIF* values fall within acceptable limits, supporting the reliability and independence of the predictor variables in the logistic regression model.

### ***Model Implications***

The results suggest that Education and socioeconomic status play a protective role against RA, with higher levels of Education and economic stability reducing the likelihood of developing the disease. Conversely, obesity, hypertension, and cardiovascular disease increase the likelihood of RA, highlighting the impact of metabolic and cardiovascular health on RA risk. However, ethnicity also emerged as a significant predictor with a small effect size. Given acceptable collinearity diagnostics, multicollinearity does not pose a substantial issue in this model, ensuring reliable estimates.

In summary, several variables were statistically significant predictors of RA. Ethnicity, economic status (PIR2), education, obesity, hypertension, and cardiovascular disease were all significantly associated with RA risk. Multicollinearity was not a concern, as indicated by tolerance and *VIF* values, which confirm a stable regression model. The findings highlight the importance of health and socioeconomic factors in RA development, with obesity, hypertension, and cardiovascular disease increasing RA risk. At the same time, education and economic stability serve as protective factors (see Table 4).

**Table 4**

*Collinearity Diagnostics<sup>a</sup>*

Model	Dimension	Eigenvalue	Condition Index	Variance proportions						
				(Constant)	Ethnicity	PIR2	EDUC	Obese	HTN	cvd2
1	1	4.136	1.000	.00	.01	.01	.00	.02	.02	.01
	2	.976	2.058	.00	.01	.01	.00	.00	.11	.63
	3	.658	2.507	.00	.01	.13	.00	.46	.19	.13
	4	.527	2.802	.00	.00	.04	.01	.51	.48	.15
	5	.485	2.921	.00	.01	.53	.04	.00	.18	.07
	6	.182	4.766	.01	.72	.11	.16	.00	.00	.00
	7	.036	10.747	.98	.24	.16	.79	.01	.02	.01

a. Dependent Variable: RA

Table 4 presents collinearity diagnostics for the regression model predicting RA. This analysis evaluates the relationships among independent variables to determine whether multicollinearity may compromise the stability and interpretability of the model.

Key indicators used in this assessment include eigenvalues, condition index, and variance proportions, which help identify whether predictors are excessively correlated.

The diagnostics revealed moderate multicollinearity, particularly among socioeconomic variables such as education, ethnicity, and economic status. For instance, the intercept accounted for 98% of the variance, suggesting a degree of instability. Education contributed 79% of the variance, followed by ethnicity at 24% and economic status at 16%, indicating some shared variance among these predictors. Ethnicity also accounted for 72% of the variance in another dimension, alongside 11% for economic status, suggesting a moderate correlation between these variables.

However, variant inflation factors (*VIFs*) were well below the accepted threshold of 5, and tolerance values remained above 0.1, indicating that severe multicollinearity is not present. Although some overlap exists among variables, particularly within socioeconomic indicators, the results do not indicate problematic multicollinearity that would undermine the regression model. Overall, the model remains stable and suitable for interpretation, with multicollinearity levels within acceptable limits for social science research.

Obesity and hypertension emerged as key contributors to variance, with obesity explaining 51% and hypertension accounting for 48%, suggesting a potential link between metabolic health factors and RA risk. Furthermore, obesity alone contributed 46% of the variance, reinforcing concerns about its collinearity with other health-related predictors in the model. These findings suggest that while some level of correlation exists

between independent variables, the overall multicollinearity does not reach a level that would compromise the stability of the logistic regression model.

The regression model exhibits moderate multicollinearity, particularly among socioeconomic factors (education, ethnicity, and economic status) and health-related variables (obesity and hypertension).

### **Complex Sample Logistics Regression Analysis**

The cardiometabolic outcomes of RA and its association between variables like hypertension, cardiovascular disease, and gender, while controlling age, socioeconomic status, and educational level, were explored using complex logistic regression analysis in SPSS v. 28. Gender was divided into two categories, male and female, while one denoted male and two denoted female. Cardiovascular disease was divided into 2 categories. In this study, I defined cardiovascular disease (CVD) based on participants' self-reported physician diagnoses recorded in the NHANES dataset. Specifically, participants who answered "yes" to being told by a healthcare professional that they had congestive heart failure, coronary heart disease, angina, heart attack, or stroke were classified as having CVD and coded as 1. Those who did not report any of these conditions were coded as 0. Those with confirmed cases of CVD (Yes) are coded as 1, and those with no CVD (No), are coded as 0. Ethnicity was divided into four categories: 1 denotes non-Hispanic whites, 2 denotes non-Hispanic blacks, 3 denotes Hispanics, and 4 denotes others. The poverty to income ratio, which represents socio-economic status, was divided into two categories: 1 denotes impoverished, and zero denotes not impoverished. Educational level was divided into three categories: 1 denoted some high school, 2 denoted high school

graduates, and 3 denoted some college degree or above. Hypertension was divided into two categories: 1 denotes positive, and 0 denotes negative.

Weight adjustments for the complex NHANES design were used in all analyses to represent the U.S. population as recommended by NHANES. This chapter provides the results of these analyses. Complex sample logistics regression was conducted to answer Research Question 1.

RQ1: Is there an association between gender and rheumatoid Arthritis among obese African American adults after controlling for age, education level, and socioeconomic status?

$H_0$ 1: There is no association between gender and rheumatoid Arthritis among obese African American adults after controlling for age, education level, and socioeconomic status.

$H_a$ 1: There is an association between gender and rheumatoid Arthritis among obese African American adults after controlling for age, education level, and socioeconomic status.

Table 5 displays the combined odds ratios for the variables analyzed in Research question 1, summarizing their associations with rheumatoid arthritis (RA) among African American adults with obesity. The table provides a comprehensive overview of the predictive strength and statistical significance of each independent variable with RA outcomes.

**Table 5**

*Logistic Regression Analysis: Odds Ratios, 95% Confidence Intervals, and P-values for Sex, Socioeconomic Status, and Education Level*

Variable	Odds ratio	95% confidence interval	<i>p</i> value
Sex	0.45	0.34–0.59	0.001
Socioeconomic status (PIR2)	0.90	0.67–1.22	0.504
Education level:			
Some high school (1)	Reference category		
High school graduate (2)	2.89	1.9–4.29	0.001
Some college (3)	2.57	1.82–3.63	0.001

RQ1 presents the statistical analysis results for assessing the association between sex and RA among African American adults with obesity while controlling for additional variables, age, educational level, and socio-economic status.

### **Sex as a Predictor of RA**

The complex sample logistic regression analysis results indicate that gender is a significant predictor of RA among obese African American adults. The odds ratio for Sex is (0.446, with a 95% confidence interval (*CI*) of 0.339–0.588 or 0.45(0.34-0.59). Sex is coded as 1 = Male and 2 = Female, thus, this result indicates that females have 55.4% lower odds of having RA compared to males (calculated as  $1 - 0.446 = 55.4\%$  reduction in odds)

### **Statistical Analysis**

The confidence interval (0.339–0.588) does not include 1, confirming that the association between gender and RA is statistically significant ( $p < .001$ ). The odds ratio 0.45 (0.34 - 0.59) indicates that females have 55% lower odds of having RA than males. Since the odds ratio is less than 1, females have a lower likelihood of developing RA, while males face a significantly higher risk. This reinforces the conclusion that gender has a meaningful impact on RA risk among obese African American adults. The logistic regression model controlled key socioeconomic and demographic factors: Socio-economic status (PIR2), EDUC = 3 (higher education level), and Age = 41.73 years (mean age of the sample population). By holding these variables constant, the results indicate that gender remains a strong independent predictor of RA, meaning that the observed gender disparity is not explained by differences in socioeconomic status, education, or age.

### **Differences in RA Risk Among African American Males and Females With Obesity**

The results demonstrate that men have significantly higher odds of developing RA compared to women in this population, a finding that contrasts with the broader epidemiological trend, where RA is typically more prevalent among females than males (Maranini et al., 2022). This unexpected result suggests that obesity and race may interact differently with RA risk factors in men compared to women.

Estrogen and other female sex hormones influence immune system function, potentially offering protective effects against autoimmune diseases like rheumatoid arthritis (RA) (Waghmare et al., 2025). Estrogen has been shown to modulate immune

responses by promoting anti-inflammatory pathways, which may contribute to the lower incidence of RA observed in women than men (Cutolo et al., 2023). In contrast, obese African American men may face higher exposure to occupational and environmental risk factors, such as chronic physical stress, and exposure to inhalants like silica dust, which are associated with increased RA susceptibility (Sigaux et al., 2023). These factors, combined with lifestyle elements, may elevate the risk of developing RA in this demographic.

Additionally, differences in healthcare utilization between genders have been observed. Some studies suggest that men are less likely to seek medical care promptly for joint symptoms, leading to delayed diagnoses and increased disease severity upon presentation (Tarannum et al., 2023). Delayed treatment for RA can lead to more severe disease progression by the time of diagnosis.

### **Odds Ratio Analysis for Socioeconomic Status**

The odds ratio for socioeconomic status is 0.904, indicating a slight reduction in the odds of RA among individuals classified as impoverished compared to those who are not. However, the association is not statistically significant, as the 95% confidence interval (0.670–1.219) includes 1.0. OR: 0.90 [95% CI; 0.67-1.22]

### **Odds Ratio for Education Level**

The statistical findings of educational level, which is a controlling variable for this study, are a significant predictor of RA among African American Adults with obesity. The analysis indicates that individuals with moderate 2.89 (1.95-4.29) and higher education levels. OR: 2.57 [95% CI: 1.816–3.632] or 2.57 (1.82 – 3.63) have increased

odds of developing RA compared to those with lower education, with statistically significant associations.

**Table 6**

*Test on Model Effects*

Source	<i>df</i> 1	<i>df</i> 2	Wald <i>F</i>	Sig.
(Corrected model)	5.000	134.000	92.904	<.001
(Intercept)	1.000	138.000	916.103	<.001
RIAGENDR	1.000	138.000	33.392	<.001
PIR2	1.000	138.000	.449	.504
EDUC	2.000	137.000	18.947	<.001
RIDAGEYR	1.000	138.000	275.798	<.001

Subpopulation: number = 2

Dependent Variable: RA (reference category = 1)

Model: (Intercept), RIAGENDR, PIR2, EDUC, RIDAGEYR

Table 6 depicts the test of model effects for RQ1. The overall model is statistically significant (Wald  $F = 92.904$ ,  $p < .001$ ), indicating that at least one predictor significantly influences RA. Gender (RIAGENDR) is a significant predictor (Wald  $F = 33.392$ ,  $p < .001$ ), suggesting that RA risk differs between males and females. Education (EDUC) also shows a significant association with RA (Wald  $F = 18.947$ ,  $p < .001$ ), indicating that individuals with different education levels experience varying risks of RA. Age (RIDAGEYR) is highly significant (Wald  $F = 275.798$ ,  $p < .001$ ), demonstrating a strong association between aging and RA prevalence. Poverty-income ratio (PIR2) is not a significant predictor (Wald  $F = .449$ ,  $p = .504$ ), indicating that socioeconomic status does not independently predict RA in this model. From the analysis, gender, education,

and age are strong predictors of RA among African American adults with obesity, while socio-economic status does not show a significant relationship with RA.

**Table 7**

*Pseudo R Squares*

Cox and Snell	.052
Nagelkerke	.178
McFadden	.155

Subpopulation: number = 2  
 Dependent Variable: RA  
 (reference category = 1)

Table 7 depicts the Pseudo R-squared values for a logistic regression model predicting RA status and provides an indication of the variance explained by the predictors. From table 7, Cox and Snell  $R^2 = 0.052$ , Nagelkerke  $R^2 = 0.178$ , and McFadden  $R^2 = 0.155$ . These values suggest that the independent variables, gender, socio-economic status, education level, and age, explain approximately 17.8% of the variability in RA status based on Nagelkerke's  $R^2$ , which is the most reported measure in logistic regression. While this indicates a moderate fit, additional unmeasured factors likely contribute to RA risk in this population.

Although the model does not account for a large proportion of variance in RA outcomes, the inclusion of gender, socioeconomic status, education level, and age provides valuable insight into demographic and socioeconomic influences on RA among

obese African American adults. The relatively low pseudo-R-square values suggest that other biological, genetic, or environmental factors may play a role in RA development.

**Table 8**

*Covariate Information*

Category	Mean
Age at Screening	41.73
Adjudicated - Recode	

Subpopulation: number = 2

Table 8 depicts age at screening as a covariate. The mean age of research participants in the study's subpopulation is 41.73 years. Age is employed as a controlled variable for this analysis to ensure that the association between gender and RA is not confounded by age-related risk. Age as a control variable in the logistic regression model to examine whether there is an association or no association between gender and RA among African American Adults with obesity, after controlling for education level and socio-economic status.

The mean age of participants in the study's subpopulation is 41.73 years, which is relevant to the research question assessing the association between gender and RA among African American adults with obesity. This age reflects a midlife demographic in which RA risk rises, making age a critical confounder to control for in the analysis. The logistic regression model includes age as a control variable to ensure that age-related differences in disease prevalence do not drive any observed association between gender and RA. For example, in the model assessing whether gender is significantly associated with RA

status after adjusting for socioeconomic status and education level, controlling for age helps isolate the independent effect of gender on RA outcomes

### **Summary of Research Question 1**

This study explores the cardiometabolic outcomes of RA and its association with gender, CVD, HTN, controlling for age, socioeconomic status, and educational level, with RA outcomes among African American adults with obesity. The research questions are structured with null ( $H_0$ ) and alternative ( $H_1$ ) hypotheses to test the statistical significance of these independent variables.

### **Research Hypotheses and Findings for RQ1: Association Between Gender and RA**

RQ1: Is there an association between rheumatoid arthritis and gender among obese African American adults after controlling for age, gender, and socioeconomic status?

$H_0$ 1: There is no association between gender and rheumatoid arthritis among obese African American adults after controlling for age, education level, and socioeconomic status.

$H_a$ 1: There is an association between gender and rheumatoid arthritis among obese African American adults after controlling for age, education level, and socioeconomic status.

Conclusion: Gender is a significant predictor of RA, suggesting that male African American adults with obesity are at a higher risk of RA compared to their female counterparts. The findings support the rejection of the null hypothesis, affirming that

gender is significantly associated with RA among obese African American adults, even after adjusting for age, education level, and socioeconomic status.

### **Sex Differences of RA Among African American Adults With Obesity**

The odds ratio for males vs. females ( $OR = 0.45$ , 95%  $CI: 0.34 - 0.59$ ) indicates that females have 55% lower odds of developing RA than males. Since gender is coded as 1 = Male and 2 = Female, and the OR is less than 1, it suggests that being female is associated with a lower likelihood of having RA than males. The confidence interval ( $0.34 - 0.59$ ) does not include 1, confirming that this result is statistically significant ( $p < .001$ ). The finding implies that males are at a higher risk of RA compared to females in the studied population. Complex sample logistics regression was conducted to answer question two:

### **Research Question 2**

RQ2: Is there an association between rheumatoid arthritis and cardiovascular disease among obese African American adults after controlling for age, gender, and socioeconomic status?

$H_0$ 2: There is no association between rheumatoid arthritis and cardiovascular disease among obese African American adults after controlling for age, gender, and socioeconomic status

$H_a$ 2: There is an association between rheumatoid arthritis and cardiovascular disease among obese individuals after controlling for age, gender, and socioeconomic status.

### Cardiovascular Disease and RA risk (Odds Ratio Analysis)

Table 9 displays the combined odds ratios for the variables analyzed in research question 2, summarizing their associations with RA among African American adults with obesity. The table provides a comprehensive overview of the predictive strength and statistical significance of each independent variable with RA outcomes.

**Table 9**

*Logistic Regression Results: Odds Ratios, 95% Confidence Intervals, and P Values for Cardiovascular Disease, Gender, and Socioeconomic Status*

Variable	Odds ratio	95% confidence interval	<i>p</i> value
Cardiovascular disease	2.66	(2.03–3.48)	0.001
Gender	0.45	(0.34–0.59)	0.001
Socioeconomic status	1.31	(1.00–1.70)	0.047

#### Odds Ratio for Cardiovascular Disease

The odds of having RA are 2.66 times higher among individuals with CVD compared to those without CVD ( $OR = 2.66$ , 95%  $CI$ : 2.03–3.48,  $p = 0.001$ ). Since the confidence interval (2.03-3.48) does not include 1.0 and the  $p$ -value is less than 0.05, the association between CVD and RA is statistically significant. This finding suggests that CVD is a strong and essential predictor of RA among African American adults with obesity in the USA

#### Odds Ratio for Gender

The odds ratio for gender from the complex logistic regression analysis was used to examine the association between RA and CVD. The odds ratio for gender (female vs.

male) is *OR*: 0.45 [95% *CI*: 0.34–0.59]. Since the reference category is male, females have 55.5% lower odds of having RA than males ( $1 - 0.445 = 55.5\%$  reduction in odds). *OR*:0.455 Suggesting that men are at significantly higher risk of developing RA compared to women. The confidence interval (0.337–0.586) does not include 1.0, indicating that the association between gender and RA is statistically significant. This suggests that gender plays a vital role in predicting RA among obese African American adults.

### **Odds Ratio for Socioeconomic Status**

The odds ratio for socioeconomic status is *OR*: 1.31 [95% *CI*: 1.00–1.70]. The odds ratio indicates that individuals classified as not impoverished ( $PIR2 = 0$ ) have 1.306 times higher odds of having RA than those classified as impoverished ( $PIR2 = 1$ ). The confidence interval excludes 1.0, indicating that the association between  $PIR2$  and RA is statistically significant at  $p < .05$ . This finding suggests that socioeconomic status may influence the risk of developing RA among obese African American adults.

**Table 10***Pseudo R Squares*

Cox and Snell	.045
Nagelkerke	.161
McFadden	.141

Subpopulation: Ethnicity = Non-Hispanic Black

Dependent Variable: RA (reference category = Yes)

**Pseudo R-Squared Analysis**

Table 10 presents the model fit statistics for the logistic regression analysis. The Pseudo R-squared analysis provides insight into the explanatory power of the logistic regression model, examining the relationship between RA and CVD while controlling for age, gender, and socioeconomic status among non-Hispanic Black individuals. The model fit statistics indicate that Cox and Snell  $R^2$  is 0.045, Nagelkerke  $R^2$  is 0.161, and McFadden  $R^2$  is 0.141. Among these, Nagelkerke  $R^2$  0.161 is the most used measure in logistic regression, suggesting that about 16.1% of the variance in RA results from the independent variables included in the model. The Nagelkerke  $R^2$  value of 0.161 indicates that predictors such as CVD, gender, socioeconomic status, and age contribute to RA risk. The findings demonstrate a moderate level of explanatory power, with CVD, gender, socioeconomic status, and age collectively accounting for some of the variation in RA occurrence.

### Cardiovascular Disease as a Predictor of RA (Test of Model Effects)

**Table 11**

*Tests of Model Effects*

Source	<i>df1</i>	<i>df2</i>	Wald <i>F</i>	Sig.
(Corrected model)	4.000	150.000	142.281	<.001
(Intercept)	1.000	153.000	548.533	<.001
cvd2	1.000	153.000	51.254	<.001
RIAGENDR	1.000	153.000	33.547	<.001
PIR2	1.000	153.000	3.993	.047
RIDAGEYR	1.000	153.000	229.726	<.001

Subpopulation: Ethnicity = Non-Hispanic Black

Dependent Variable: RA (reference category = Yes)

Model: (Intercept), cvd2, RIAGENDR, PIR2, RIDAGEYR

Table 11 presents the p-value analysis from the model output. It provides insight into the statistical significance of each predictor variable with rheumatoid arthritis (RA) among African American adults with obesity.

#### ***Corrected Model***

The overall model is statistically significant ( $p < 0.001$ ), indicating that at least one predictor variable significantly contributes to explaining rheumatoid arthritis (RA) outcomes.

#### ***Intercept ( $p < 0.001$ )***

The intercept is statistically significant, meaning the model predicts a non-zero baseline probability of RA even when all independent variables are held constant. In logistic regression, this reflects the log odds of RA occurring when all predictors are set to their reference values or zero.

***Cardiovascular Disease (cvd2) (p < .001)***

Results also show that there is a statistically significant association between CVD and RA. This suggests that individuals with cardiovascular disease are significantly more likely to have RA compared to those without CVD.

***Gender (RIAGENDR) (p < .001)***

Gender is a significant predictor of RA, showing that RA prevalence differs between males and females. The significance of this variable suggests that gender plays a crucial role in determining RA risk.

***Socioeconomic Status (PIR2)***

The model results indicate that socioeconomic status is significantly associated with the prevalence of RA ( $p = 0.047$ ), which suggests that financial and social factors are meaningful in RA outcomes.

The findings suggest that cardiovascular disease, gender, and age are strong predictors of RA among obese African American adults, whereas socioeconomic status has a weaker yet still significant association. The results indicate that individuals with CVD are at a greater risk of having RA, and gender differences contribute to variations in RA prevalence. Age is the most influential factor, reinforcing that RA is more common in older populations.

## Analysis of Covariate Information

### *Age Distribution*

**Table 12**

#### *Covariate Information*

Category	Mean
Age at Screening Adjudicated - Recode	41.60

Subpopulation: Ethnicity = Non-Hispanic Black

The mean age of the study participants at the time of screening was 41.60 years. Suggesting that the sample population primarily consists of middle-aged adults, an important demographic factor to consider in the study of RA and its associated risk factors. Since age is a well-documented risk factor for RA, this finding highlights the need to examine how aging influences the condition within this specific group. The subpopulation analyzed in this dataset consists exclusively of non-Hispanic Black individuals. This distinction is crucial as it ensures the findings address RA risk factors within this racial and ethnic group. Previous research has indicated potential racial and ethnic disparities in RA prevalence, severity, and healthcare access, making this subpopulation an essential focus for targeted public health interventions.

### **Summary of Research Question 2**

Research question 2 investigates the relationship between CVD and RA among obese African American adults, controlling for age, gender, and socioeconomic status (PIR2). The research question tests the following hypotheses:

$H_02$ : There is no association between rheumatoid arthritis and cardiovascular disease among obese African American adults after controlling for age, gender, and socioeconomic status.

$H_a2$ : There is an association between rheumatoid arthritis and cardiovascular disease among obese African American adults after controlling for age, gender, and socioeconomic status.

### ***Findings and Interpretation***

This analysis confirms a strong and statistically significant association between CVD and RA among obese African American adults with obesity.

### ***Effect of CVD on RA Among African American Adults With Obesity***

The odds ratio ( $OR = 2.656$ , 95%  $CI: 2.028 - 3.478$ ,  $p < .001$ ) indicates that individuals with CVD have 2.66 times higher odds of having RA than those without CVD. The confidence interval also suggests that the association is statistically significant, reinforcing that CVD strongly predicts RA. The logistic regression model further supports this relationship, with the overall model reaching statistical significance ( $Wald F = 142.281$ ,  $p < .001$ ), confirming that at least one predictor variable (CVD, gender, socioeconomic status, and age) significantly contributes to RA risk. CVD ( $Wald F = 51.254$ ,  $p < .001$ ) emerged as a significant predictor, suggesting a potential link between inflammatory pathways common to CVD and RA.

In addition to CVD, gender and socioeconomic status also influence RA risk. The odds ratio for gender ( $OR = 0.445$ , 95%  $CI: 0.337-0.586$ ) suggests that males are at a significantly higher risk of RA than females, reinforcing existing gender disparities in RA

prevalence. Socioeconomic status ( $OR = 1.306$ , 95%  $CI$ : 1.003–1.702,  $p = .047$ ) also shows a statistically significant, albeit weaker, association with RA, suggesting that economic disparities may impact RA risk. However, age remains the most influential predictor, as evidenced by its Wald statistic (229.726,  $p < .001$ ), indicating that RA risk significantly increases.

The findings support the rejection of the null hypothesis, affirming that CVD is significantly associated with RA among obese African American adults, even after adjusting for age, gender, and socioeconomic status. These findings provide robust evidence that CVD is a major predictor of RA among obese African American adults, with gender and socioeconomic status also contributing to RA risk but age being the most dominant factor.

### **Results Research Question 3**

RQ3: Is there an association between rheumatoid arthritis and hypertension after controlling for age, gender, and socioeconomic status?

$H_03$ : There is no association between rheumatoid arthritis and hypertension among obese African American adults after controlling for age, gender, and socioeconomic status.

$H_a3$ : There is an association between rheumatoid arthritis and hypertension among obese individuals after controlling age, gender, and socioeconomic status.

**Table 13***Weighted Distribution of Selected Categorical Variables Among Non-Hispanic Black**Adults in the United States*

Categorical variable	Category	Weighted count	Weighted percentage
Rheumatoid arthritis (RA)	No (0)	17,780,450.987	96.2%
	Yes (1)	708,005.597	3.8%
Hypertension (HTN)	Negative (0)	12,510,699.944	67.7%
	Positive (1)	5,977,756.641	32.3%
Gender	Male (1)	8,597,289.481	46.5%
	Female (2)	9,891,167.104	53.5%
Socioeconomic status (PIR2)	Not impoverished (0)	9,039,093.582	48.9%
	Impoverished (1)	9,449,363.002	51.1%
Subpopulation size		18,488,456.584	100.0%

Subpopulation: Ethnicity = Non-Hispanic Black

a. Dependent Variable

b. Reference Category

***Prevalence of RA***

Most participants in the sample (96.2%) do not have RA, while only 3.8% have been diagnosed with this condition. This low prevalence aligns with general population estimates, although RA remains a significant health concern due to its long-term effects on mobility, quality of life, and associated comorbidities.

***Prevalence of Hypertension***

Hypertension (HTN) is present in 32.3% of the sample, while 67.7% of participants are classified as not having high blood pressure. Given that hypertension is a known cardiovascular risk factor, its presence in nearly one-third of the study population highlights the importance of investigating comorbid conditions and their potential impact on RA risk and progression.

***Gender Distribution***

The sample consists of 46.5% male and 53.5% female participants. The slight overrepresentation of females is consistent with broader health research trends, as women are more likely to seek healthcare and participate in studies. This gender distribution is particularly relevant since RA affects women at higher rates than men, necessitating gender-specific analyses in subsequent statistical modeling

***Socioeconomic Status***

The poverty-income ratio (PIR2) categorizes participants as either impoverished (51.1%) or not impoverished (48.9%). This nearly even distribution allows for meaningful comparisons in evaluating the role of socioeconomic status in RA risk and health outcomes. Socioeconomic factors are known to influence healthcare access, treatment adherence, and disease management, making this variable a crucial control factor in further analysis.

***Subpopulation Characteristics (Non-Hispanic Blacks)***

The sample is composed entirely of non-Hispanic Black individuals, which is the population of interest in this study, ensuring that the results are specific to this demographic group.

**Table 14***Covariate Information*

Category	Mean
Age at Screening Adjudicated - Recode	41.60

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Subpopulation: Ethnicity = Non-Hispanic Black (N= ?)

Table 14 depicts the demographic characteristics of the study population, indicating that age and ethnicity are key contextual factors in the analysis of RA prevalence. The mean age of 41.60 years suggests that research participants are within an age range where RA risk increases, reinforcing the importance of considering age as a covariate in subsequent statistical analyses. Additionally, focusing on a racially homogenous group allows for a more precise examination of ethnic disparities in RA risk, disease progression, and healthcare access.

**Table 15***Pseudo R Squares*

Cox and Snell	.043
Nagelkerke	.155
McFadden	.135

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Subpopulation: Ethnicity = Non-Hispanic Black

Dependent Variable: RA (reference category = Yes)

Model: (Intercept), HTN, RIAGENDR, PIR2, RIDAGEYR

Table 15 presents the pseudo-R-squared values provide insight into how well the independent variables explain the variance in the dependent variable, RA, in Research

Question 3. The Cox and Snell  $R^2$  0.043 suggests that the model accounts for 4.3% of the variance in RA occurrence. The Nagelkerke  $R^2$  0.155, a more adjusted measure, indicates that the predictors included in the model explain 15.5% of the variance in RA status. The McFadden  $R^2$  0.135 suggests that the model has a modest explanatory power.

Although these values appear relatively low, they indicate that hypertension, gender, socioeconomic status, and age contribute to RA risk. However, the Nagelkerke  $R^2$  value of 0.155 also implies that additional unmeasured factors may significantly predict RA among non-Hispanic Black individuals. Suggesting that while hypertension is a significant predictor, other biological, environmental, or lifestyle-related influences may also affect RA development in this population.

**Table 16**

*Tests of Model Effects*

Source	<i>df1</i>	<i>df2</i>	Wald <i>F</i>	Sig.
(Corrected model)	4.000	150.000	131.772	<.001
(Intercept)	1.000	153.000	564.709	<.001
HTN	1.000	153.000	16.294	<.001
RIAGENDR	1.000	153.000	28.681	<.001
PIR2	1.000	153.000	5.564	.020
RIDAGEYR	1.000	153.000	154.218	<.001

Subpopulation: Ethnicity = Non-Hispanic Black

Dependent Variable: RA (reference category = Yes)

Model: (Intercept), HTN, RIAGENDR, PIR2, RIDAGEYR

**Model Fit and Overall Significance**

The Tests of Model Effects in Table 16 summarize the logistic regression analysis results for RQ3, displaying the Wald F-statistic and significance levels for each predictor

variable in the model. The Model is statistically significant ( $Wald F = 131.772, p < .001$ ), indicating that the combination of the independent variable, hypertension, and the controlling variables, gender, socioeconomic status, and age, meaningfully contributes to explaining RA status. The Intercept is also significant ( $Wald F = 564.709, p < .001$ ), confirming that baseline variation exists in RA occurrence even without accounting for predictor variables.

### **Individual Predictor Variables**

The p-value for HTN is less than 0.001, indicating a statistically significant association between hypertension and RA, suggesting that individuals with hypertension are more likely to have RA compared to those without hypertension.

The p-value for gender is statistically significant ( $p < 0.001$ ), indicating that gender is associated with RA risk in this sample. Interestingly, the odds ratio suggests that males in this dataset are more likely to diagnose RA than females. While this contrasts with the broader epidemiological trend that RA predominantly affects women (Scott et al., 2010), such a finding may reflect sample-specific factors, including comorbidities, reporting biases, or differential diagnosis patterns. It is also possible that gender-specific risk factors in this subgroup (e.g., among African American adults with obesity) may influence RA prevalence differently. Further investigation is needed to understand these patterns in the context of this specific population.

The p-value for socioeconomic status (PIR2) is 0.047, indicating a statistically significant association between socioeconomic status and RA suggests that financial hardship or limited access to resources may contribute to RA prevalence.

Age (RIDAGEYR) has a p-value less than 0.001, indicating a statistically significant association between age and RA.

The model confirms that hypertension, gender, and age are substantial and statistically significant predictors of RA. These results emphasize the need for targeted interventions addressing hypertension, aging, and gender-specific RA risks while also considering the potential influence of socioeconomic factors.

### **Odds Ratio Analysis for Research Question 3**

Table 17 displays the combined odds ratios for the variables analyzed in Research question 3, summarizing their associations with rheumatoid arthritis (RA) among African American adults with obesity. The table provides a comprehensive overview of the predictive strength and statistical significance of each independent variable with RA outcomes.

**Table 17**

*Logistic Regression Analysis: Association Between Hypertension and Predictor*

*Variables*

Variable	Odds ratio	95% confidence interval	p value
Hypertension	1.89	1.38 - 2.58	0.001
Gender	0.48	0.36 - 0.63	0.001
Socioeconomic status (PIR2)	1.38	1.05 – 1.79	0.020

### **Logistics Regression Odds Ratio for RA (RQ3)**

This section examines how hypertension is associated with rheumatoid arthritis while controlling for gender, socioeconomic status, and Age in African American adults

with obesity. The analysis focuses on understanding whether individuals with hypertension face a higher risk of developing RA compared to those without hypertension, considering these key demographic and socioeconomic factors.

### ***Odds Ratio Analysis for Hypertension***

The odds ratio (*OR*) for HTN with RA is 1.891, with a 95% confidence interval (*CI*) of 1.384 – 2.583 or 1.89 (1.38 – 2.58). The odds ratio suggests that individuals with hypertension are 1.89 times more likely to have RA compared to those without hypertension, and the association between HTN and RA is statistically significant because the confidence interval does not include one.

The reference category for RA is (No). The model estimates the likelihood of having RA (Yes) given the independent variables. An odds ratio above 1.0 suggests a higher likelihood of developing RA among individuals with hypertension. This finding supports the hypothesis that hypertension significantly contributes to RA occurrence, suggesting a potential link between cardiovascular health and inflammatory disease processes. The control variables, gender, socioeconomic status, and Age, were fixed at Female, impoverished (PIR2), and Age = 41.60 years, meaning that the odds ratio reflects the association between hypertension and RA while holding these factors constant.

In summary, the odds of RA are significantly higher in individuals with hypertension ( $OR = 1.891$ ,  $CI = 1.384 - 2.583$ ,  $p < .001$ ). The association remains significant even after controlling for gender, socioeconomic status, and Age. These results highlight hypertension as a key modifiable risk factor for RA in this population.

### ***Odds Ratio Analysis for Gender***

The odds ratio for gender (female vs. male) in Table...is 0.477, with a 95% confidence interval of 0.363 – 0.627, or 0.48 (0.36 – 0.63). This result suggests that women are less likely to have RA compared to men, with the odds of RA in women being 52.3% lower than in men ( $1 - 0.477 = 0.523$ ). Since the confidence interval does not cross 1.0, the association is statistically significant and unlikely to be due to chance.

Men had a significantly higher likelihood of RA compared to women (OR = 0.477, CI = 0.363 – 0.627,  $p < .001$ ). While this finding differs from traditional research, it may reflect unique risk factors within this specific population. Given these results, implementing gender-specific screening, education, and prevention strategies could help reduce RA risk and improve early diagnosis and treatment outcomes among men.

### ***Odds Ratio Analysis for Socioeconomic Status***

The odds ratio for socioeconomic status (PIR2: Impoverished vs. Not Impoverished) is 1.375, with a 95% confidence interval (CI) of 1.053 – 1.794, or 1.38 (1.05 – 1.79). The result suggests that poor or impoverished people are 1.38 times more likely to develop RA compared to those who are not impoverished. Since the OR is greater than 1, this indicates an increased likelihood of RA among the impoverished group. Additionally, the confidence interval does not cross 1.0, confirming that this association is statistically significant and unlikely to be due to chance. The fact that the lower bound (1.053) is more significant than 1.0 supports the conclusion that impoverished individuals are significantly more likely to develop RA compared to those who are not impoverished. Individuals who are impoverished have significantly higher

odds of RA ( $OR = 1.375$ ,  $CI = 1.053 - 1.794$ ,  $p < .05$ ) compared to those who are not impoverished.

Table 19 depicts percentages of each of the covariates within the African American adults with obesity sample for RA.

**Table 18**

*Percentages of Each of the Covariates Within the African American Adults With Obesity*

*Sample for RA*

Variables	Percentage
<b>RQ1</b>	
Rheumatoid Arthritis	
Yes (1)	95.8%
No (0)	4.2%
Gender	
Male (1)	46.5%
Female (2)	53.5%
Socio-economic Status (PIR2)	
Impoverished (1)	48.6%
Not Impoverished (0)	51.4%
Educational Level	
Some High School (1)	24.6%
High School Graduate (2)	23.6%
Some College (3)	51.8%
Age (Mean)	41.73
<b>RQ2</b>	
Rheumatoid Arthritis	
Yes (1)	3.8%
No (0)	96.2%
Cardiovascular Disease	
No	93.5%
Yes	6.5%
Gender	
Male (1)	46.5%
Female (2)	53.5%
Socio-economic Status (PIR2)	
Not Impoverished	48.9%
Impoverished	51.1%
Age (Mean)	41.60
<b>RQ3</b>	
Rheumatoid Arthritis	
Yes (1)	96.2%
No (0)	3.8%
<b>Hypertension</b>	
Positive (1)	32.3%
Negative (0)	67.7%
Gender	
Male (1)	46.5%
Female (2)	53.5%
Socio-economic Status (PIR2)	
Impoverished	51.1%
Not Impoverished	48.9%
Age (Mean)	41.60

### Summary of Research Question 3

Research Question 3 examines the relationship between HTN and RA among obese African American adults, controlling for age, gender, and socioeconomic status (PIR2). The research tests the following hypotheses:

$H_03$ : There is no association between rheumatoid arthritis and hypertension among obese African American adults after controlling for age, gender, and socioeconomic status.

$H_a3$ : There is an association between rheumatoid arthritis and hypertension among obese African American adults after controlling for age, gender, and socioeconomic status.

The analysis provides strong statistical evidence supporting a significant association between rheumatoid arthritis and hypertension. The odds ratio for hypertension ( $OR = 1.89$ , 95%  $CI: 1.384 - 2.583$ ,  $p < .001$ ) indicates that individuals with hypertension are 1.89 times more likely to have RA compared to those without hypertension. Since the confidence interval does not include 1.0, this confirms that the association is statistically significant, reinforcing hypertension as a strong predictor of RA.

Further validation comes from the logistic regression model, which is statistically significant ( $Wald F = 131.772$ ,  $p < .001$ ), confirming that the combined effects of hypertension, gender, socioeconomic status, and age contribute significantly to RA risk. The Wald statistics for HTN (16.294,  $p < .001$ ) further reinforce that hypertension independently predicts RA.

Overall, the results confirm a strong and statistically significant relationship between hypertension and RA, even after controlling for gender, socioeconomic status, and age. Both the odds ratio ( $OR = 1.891$ ) and the Wald F-statistic (16.294,  $p < .001$ ) indicate that hypertension significantly increases RA risk. Therefore, the findings support rejecting the null hypothesis, affirming a significant association between hypertension and RA among obese African American adults.

### **Summary and Conclusion**

In the study examining the cardiometabolic outcomes of RA among African American adults with obesity, the current study investigated whether gender, cardiovascular disease (CVD), and hypertension (HTN) serve as significant predictors of RA. Given that African Americans experience disproportionate health disparities, particularly in chronic inflammatory conditions and cardiometabolic diseases, understanding the relationship between RA and its associated risk factors is crucial for improving prevention and intervention strategies. Using data from NHANES 1999–2018, this study explored the interplay between demographic and cardiovascular factors in the development of RA. Specifically, I assessed whether males and females experience different risks for RA, whether cardiovascular disease increases susceptibility to RA, and whether hypertension contributes to RA onset or severity. Additionally, I controlled age, socioeconomic status (PIR2), and educational level to ensure that these variables did not confound the observed associations.

The first research question sought to determine whether gender was associated with RA among obese African American adults after controlling for age, education level,

and socioeconomic status. The results show a statistically significant finding, designating that the odds of having RA were 1.446 times higher for males than females. Gender was a significant predictor of RA, with males exhibiting a higher risk than females, indicating that females had 55% lower odds of developing RA than males. The study accepted the alternate hypothesis that gender is a predictor of RA after controlling for age, educational level, and socioeconomic status.

The second research question examined whether CVD was associated with RA after controlling for age, gender, and socioeconomic status. The results demonstrated a strong and statistically significant association between CVD and RA, indicating that individuals with CVD had 2.66 times higher odds of having RA than those without CVD. The findings from RQ2 reject the null hypothesis and support the alternate hypothesis that there is an association between rheumatoid arthritis and cardiovascular disease among obese African American adults after controlling for age, gender, and socioeconomic status.

The third research question evaluated the association between hypertension and RA while controlling for age, gender, and socioeconomic status. The logistic regression results confirmed a strong and statistically significant relationship between hypertension and RA. Indicated that individuals with hypertension were 1.89 times more likely to have RA than those without hypertension.

The findings from RQ3 indicate a statistically significant association between rheumatoid arthritis and hypertension among obese African American adults, even after

adjusting for age, gender, and socioeconomic status, thereby supporting the alternative hypothesis.

The results from my research indicated that gender, cardiovascular disease, and hypertension are predictors of RA among African American adults with obesity, after controlling for age, socio-economic status, and education level. Males are more likely to be associated with developing RA compared to females. Chapter 5 discusses and interprets the study findings, addresses study limitations, explores the implications for social change, provides recommendations for future research, and presents the overall study conclusion.

## Chapter 5: Discussion, Conclusions, and Recommendations

This chapter includes a discussion of the study's findings, implications, and relevance to public health and epidemiology. The results are contextualized within existing literature and linked to the study's research questions and problem statement, which addressed the cardiometabolic impact of RA among African American adults with obesity, a population disproportionately affected by RA and cardiovascular comorbidities. By addressing this understudied intersection, the findings helped to bridge a critical gap in the literature related to racial disparities, chronic inflammation, and cardiometabolic risk. Furthermore, the findings support the socio-ecological model, the study's underlying conceptual framework, by demonstrating how individual (e.g., age, gender), interpersonal (e.g., access to care), and community-level (e.g., SES) factors collectively influence RA outcomes. The evidence reinforced the model's assertion that health outcomes result from multilevel interactions, validating the model's application in chronic disease research (Butler et al., 2023).

The chapter also addresses the broader implications for social change. The findings underscore the need for culturally tailored, patient-centered interventions and policies to reduce health disparities in RA care. These changes are needed at both the health care system and community levels to improve access, early screening, and integrated management of cardiometabolic comorbidities in African American populations. This study may contribute to evidence-based strategies that promote equity and reduce the long-term burden of chronic disease in vulnerable groups.

RA can contribute to cardiovascular disease, metabolic disorders, and other comorbidities (Jahid et al., 2023). African American adults face unique challenges in RA diagnosis, treatment, and management due to disparities in health care access, socioeconomic factors, and genetic predisposition. According to the GBD 2021 RA Collaborators (2023), although RA remains a significant global health concern affecting an estimated 17.6 million people worldwide, its burden is complex among African American adults due to persistent health disparities. Although national estimates suggested that African Americans have similar or slightly lower RA prevalence compared to non-Hispanic Whites, the current study indicated that African American adults with obesity face distinct cardiometabolic challenges that may exacerbate RA outcomes (see GBD 2021 RA Collaborators, 2023). Current findings reinforce prior concerns that social and structural inequities contribute to poorer disease management and greater functional limitations within this population (see Zhu et al., 2024). By examining predictors such as cardiovascular disease, gender, and socioeconomic status, the current study added to the understanding of how RA impacts African American adults with obesity beyond prevalence alone, offering insight into the underlying risk dynamics that could inform public health interventions.

Although several studies investigated the prevalence of RA in the USA, no studies, to my knowledge, had examined the cardiometabolic outcomes of RA among African American adults with obesity. To understand the association between RA and its cardiometabolic outcomes among African American adults with obesity, I examined how factors such as gender, cardiovascular disease, and hypertension that might be associated

with RA. The purpose of my study was to investigate the cardiometabolic outcome of RA among African American adults with obesity. I used the secondary data from the NHANES 1999-2018. Gender, cardiovascular disease, and hypertension were the independent variables examined, and the controlled variables for the study were age, SES, and education level, with one dependent variable, RA. The variables were examined using bivariate analysis and complex sample logistic regression in SPSS. Gender emerged as a significant predictor of RA, with men displaying a higher risk compared to women. Cardiovascular disease and hypertension also showed substantial and statistically significant associations, further strengthening the observed patterns. Parallel outcomes were observed in hypertension to be a significant predictor of RA. Hypertension had one of the highest statistical effects on RA compared to the other variables in the study.

### **Interpretation of the Findings**

The study utilizes secondary data from the NHANES spanning 1999-2018, with a total sample size of 23,644 African American adults. Among these, approximately 1,037 individuals were identified with CVD. The dataset allows for robust statistical analysis of RA and its cardiometabolic outcomes among obese African American adults while controlling for factors such as gender, hypertension, cardiovascular disease, age, socioeconomic status, and educational level.

The variables for this study are gender, cardiovascular disease, and hypertension. Controlling variables for the study are age, socio-economic status, and educational level. Findings from the logistics regression indicated that the independent variable predicts the

dependent variable after controlling confounding variables (age, socio-economic status, and educational level).

The primary objective of RQ1 in the study was to assess whether there is an association between gender and RA among obese African American adults, controlling for age, education level, and socioeconomic status. The findings for RQ1 indicate that gender significantly predicts RA in this population. The analysis confirmed that males had a significantly higher odds of RA than females.

Consistent with the study's original hypothesis, the results confirmed that gender is a significant predictor of RA among African American adults with obesity. Males had higher odds of developing RA compared to females, even after adjusting for age, educational level, and socioeconomic status. This finding, supported by both the odds ratio and Wald F-statistics, underscores the importance of gender as a contributing factor in RA risk within this population.

Demonstrating that gender is a predictor of RA is consistent with previous findings. Yu et al. (2020), in their study "Gender Differences in RA," identified Interleukin-4 as a critical gene contributing to gender differences in RA, influencing immune pathways like cytokine-receptor interaction and T cell differentiation. While the current study found that male African American adults with obesity are at a higher risk of RA, the molecular study reveals potential biological underpinnings that could explain these gender disparities. This aligns with the hypothesis that inflammatory pathways may operate differently between genders, leading to the observed disparities in RA prevalence. The interleukin-4 pathway could be particularly relevant in obese

populations, where chronic inflammation is already heightened, possibly exacerbating gender-specific RA risks.

Nillson et al. (2021), in their study “Age and Sex Influence on RA Outcomes,” identified that men showed more significant improvements in disease outcomes than women across all age groups. Women  $\geq 70$  years had the worst outcomes, while men  $< 40$  fared best. Contrasting with the Nillson et al. (2021) study, findings from the current study identified men as having higher odds of developing RA among obese African American adults. The difference may be due to population-specific factors such as obesity prevalence, ethnic background, and socioeconomic factors, which disproportionately affect African American males. However, both studies suggest that age and gender influence RA outcomes, underlining the importance of including these variables in epidemiological research.

Maranini et al. (2022) consistently show that women are more frequently affected by RA, with a 3:1 female-to-male ratio. This could be because women tend to report worse pain perception and poorer patient-reported outcomes, whereas men often experience better treatment responses and higher remission rates. Despite these differences, sex-specific treatment strategies remain limited. Results from the current study reveal a contrasting trend among African American adults with obesity. This significant finding suggests that gender plays a critical role in RA prevalence within this population. While the study focused on RA prevalence rather than treatment outcomes, it indicates that African American obese men may require specialized screening and management due to their heightened RA risk. While Maranini et al. (2022) focus on

gender disparities in the general population, this analysis draws further attention to the unique vulnerabilities of African American obese men, offering a population-specific perspective that challenges broader assumptions. By integrating these insights, future research and clinical practices can better address the complex social and biological factors that influence RA, promoting more equitable healthcare strategies.

The Ferreira et al. (2022) study revealed that women exhibited elevated biomarkers linked to adipokine signaling and vascular function. Men showed higher levels of proteins associated with inflammation and extracellular matrix remodeling. These sex-specific proteomic patterns suggest that the pathophysiology of RA may differ between men and women, reinforcing the importance of investigating gender as a key variable in RA risk and progression. These outcomes correspond with the results of the current study, which found a statistically significant association between gender and RA among obese African American adults. Ferreira et al.'s insights into sex-based biological pathways provide mechanistic support for the gender disparities observed in RA prevalence and risk, thus extending the current study's findings by offering a molecular perspective that may inform future gender-tailored RA management strategies.

The findings of Carmona et al. (2023) highlight the well-documented female predominance in RA, reporting a female-to-male ratio of approximately 3:1. Interestingly, this contrasts with the findings from the current study, which identified gender as a statistically significant predictor of RA, with males showing higher odds of RA among obese African American adults. This divergence may reflect population-specific variations, including biological, genetic, or socioeconomic factors unique to the

study cohort. It may also suggest the need for further exploration into gender-related disparities in RA risk within underserved or racially diverse populations.

Moreover, they highlight that women with RA tend to experience more severe disease activity, reduced treatment responsiveness, and more significant functional impairment compared to men. These gender-based disparities align with the current study's conclusion that gender plays a critical role in RA susceptibility and clinical progression. Although Carmona et al., 2023 did not focus exclusively on African American populations, their detailed analysis of sex-specific immunological, hormonal, and psychosocial factors provides a broader context that reinforces the importance of integrating gender considerations into RA research and management. Their call for personalized treatment approaches that account for sex and gender differences echoes this study's advocacy for tailored interventions, particularly for underserved, high-risk populations such as obese African American women.

The current study also investigates the association between RA and CVD among obese African American adults after controlling for age, gender, and socioeconomic status. The complex sample logistic regression analysis findings provided convincing evidence of a significant relationship between CVD and RA in the study population. My findings indicated that obese African American adults with CVD are more than twice as likely to develop RA compared to those without CVD. Thus, rejecting the null hypothesis and supporting the alternate hypothesis.

The regression analysis reinforced the relevance of key covariates in predicting RA among African American adults with obesity. Gender and age both emerged as

statistically significant factors, with males demonstrating higher odds of RA than females and older individuals showing increased susceptibility to the condition. Socioeconomic status also played an important role, as individuals classified as impoverished were more likely to have RA compared to their non-impoverished counterparts. These findings support the study's broader assertion that demographic and social determinants contribute meaningfully to RA risk in this population and underscore the need for targeted prevention and management strategies.

In conclusion, this study identifies cardiovascular disease as the strongest predictor of RA among obese African American adults, suggesting a critical overlap in the pathophysiology of these conditions. The findings underscore the importance of adopting a multidisciplinary approach to patient care, incorporating cardiovascular and rheumatologic considerations, especially within vulnerable populations. Further research should explore the biological mechanisms underlying this association and investigate targeted interventions that could mitigate cardiometabolic risks in individuals with RA.

Demonstrating CVD as a predictor of RA is consistent with previous findings. Venetsanopoulou et al. (2023) and the current study highlight RA as a chronic autoimmune disease left untreated, which can lead to joint damage and disability, stressing its systemic inflammatory nature that extends beyond joint involvement. The findings of this study provide strong empirical support for the original hypothesis that cardiometabolic conditions, specifically cardiovascular disease and hypertension, are significantly associated with rheumatoid arthritis among African American adults with obesity. The elevated odds of RA observed among individuals with CVD and

hypertension align with the hypothesized link between systemic inflammation and the development of comorbid conditions. These results not only affirm the role of shared inflammatory mechanisms but also highlight the importance of integrated disease management strategies for populations disproportionately affected by both RA and cardiometabolic disorders.

Age is recognized in both studies as a crucial factor in RA risk, with peak onset between 40 and 60 years and a higher susceptibility to comorbidities in older adults. Both studies advocate for integrated healthcare approaches that consider comorbidities, particularly in high-risk populations, and stress the importance of targeting systemic inflammation in treatment strategies. While the current study adds population-specific insights, especially regarding gender differences among obese African American adults, it aligns with broader literature by emphasizing the complex interplay between RA, cardiometabolic risks, SES, and the need for comprehensive management strategies.

A robust association was evident between RA and CVD among obese African American adults, showing that individuals with CVD are 4.59 times more likely to have RA. This relationship corroborates previous findings from Fazeli et al. (2021), who highlighted chronic inflammation as a key factor connecting RA with many RA patients already showing subclinical CVD at diagnosis. Both studies underscore the need for integrated healthcare strategies that address both RA and cardiometabolic risks, particularly in high-risk populations. The findings also call for further research on how autoantibodies and antirheumatic therapies influence CVD risk in RA patients, especially within underserved communities.

The findings from RQ2 align closely with Corrao et al. (2024), which emphasize that CVD risk factors alone do not fully account for the increased morbidity and mortality observed in RA patients. Corrao et al. 2024 highlighted the complex interplay between RA and CVD, suggesting that underlying mechanisms, such as systemic inflammation and immune dysregulation, contribute significantly to this elevated risk. Similarly, the current study demonstrates a strong and statistically significant association between CVD and RA among obese African American adults, with individuals diagnosed with CVD being 2.66 times more likely to have RA compared to those without CVD 2.66 (95% CI: 2.03–3.48,  $p < .001$ ). This reinforces Corrao et al.'s assertion that conventional CVD risk assessments may underestimate RA-related cardiovascular risk, particularly in high-risk populations.

The findings from the current study reveal a significant association between CVD and RA among African American adults with obesity. Aligning with previous studies that highlight racial disparities and the role of chronic inflammation in RA-related cardiovascular risks. Studies by O'Brien et al. (2024) and Macias-Konstantopoulos et al. (2023) emphasize the increased CVD risk among racial minorities with RA, particularly African Americans, while Backer et al. (2023) show that these populations often experience more severe RA and higher cardiovascular risks. Bedeković et al. (2024) highlight how chronic systemic inflammation in RA accelerates atherosclerosis, contributing to early CVD and supporting the strong CVD-RA link identified in the current study. Collectively, such results point to the need for integrated, population-

specific healthcare strategies to manage RA and its cardiometabolic comorbidities in high-risk groups.

Findings from this study are aligned with recent evidence demonstrating a strong association between rheumatoid arthritis (RA) and cardiovascular disease (CVD). A retrospective case-control study by Tekeoglu (2024) found that RA was an independent risk factor for CVD, with RA patients exhibiting a significantly higher prevalence of hypertension, hyperlipidemia, and chronic kidney disease compared to non-RA controls. Notably, RA patients with CVD were predominantly older males, further highlighting age and gender as influential covariate factors, also confirmed in the current study. Such evidence underscores the importance that chronic systemic inflammation and shared metabolic risk factors play a significant role in linking RA and CVD. The consistency between these findings and those of the present study, which found that obese African American adults with CVD were more likely to have RA, provides robust support for the need to address cardiometabolic comorbidities in RA management through integrated care strategies.

Solomon et al. (2024) offer critical insight into the cardiovascular burden associated with rheumatoid arthritis (RA), directly complementing the findings of this study on the link between RA and cardiovascular disease (CVD) among obese African American adults. The study reinforces the understanding that RA is a systemic condition with far-reaching effects beyond joint involvement by identifying key inflammatory biomarkers such as C-reactive protein and soluble tumor necrosis factor receptors associated with increased arterial inflammation. These biomarkers serve as indicators of

heightened cardiovascular risk, affirming the interconnected pathophysiology of RA and CVD.

In my study, individuals with CVD were significantly more likely to have RA, pointing to the role of chronic inflammation as a shared mechanism contributing to both conditions. While Solomon et al., 2024 did not center on African American populations, the researchers focused on arterial inflammation, providing strong empirical support for the observed association between RA and CVD in my analysis. Both studies highlight the importance of incorporating cardiovascular risk assessment into RA management strategies, especially in high-risk and underserved populations where both conditions are disproportionately prevalent.

The current study also focused on predicting whether there is an association between RA and hypertension after controlling for age, gender, and socioeconomic status. Findings revealed a significant association between HTN and RA among African American adults with obesity after controlling for age, gender, and socioeconomic status. The logistic regression analysis demonstrated that individuals with hypertension are 1.89 times more likely to have RA compared to those without hypertension. The association between hypertension and RA was statistically significant, making hypertension a strong predictor of RA risk in this population. The statistical significance of other factors such as gender, socioeconomic status, ethnicity, and obesity further highlights the multifactorial nature of RA. These findings underscore the importance of integrated healthcare strategies that address hypertension as a critical risk factor for RA, particularly in high-risk populations like obese African American adults.

Findings from the current study align with previous research by Al-Ahmari A. K. (2022), which identified HTN as a significant comorbidity that increases RA risk. The study by Al-Ahmari A. K. (2022) revealed that 32.35% of RA patients had hypertension, with advanced age, female sex, low education, unemployment, smoking, and comorbidities like obesity and diabetes identified as risk factors. Similarly, the current study found that obese African American adults with hypertension were nearly 1.8 times more likely to have RA even after controlling for age, gender, and socioeconomic status. Both studies stress the importance of integrated, population-specific care strategies to address the heightened RA risk linked to hypertension, emphasizing the need for tailored interventions that consider demographic, socioeconomic, and health disparities.

The findings by Montes et al. (2023) identified higher hypertension screening rates in RA patients, which support the current study's findings examining the association between HTN and RA among obese African American adults. While Montes et al. focused on screening practices, the current study reveals a stronger association, showing that hypertensive individuals are nearly 1.8 times more likely to develop RA. Unlike Montes et al., this research highlights the role of systemic health disparities, emphasizing how factors like socioeconomic status and ethnicity elevate RA risk in African American populations. It also shifts focus from screening adequacy to hypertension as a potential contributor to RA pathogenesis, advocating for targeted prevention strategies in high-risk groups.

While Montes et al. (2023) highlighted the importance of blood pressure monitoring, they did not address how hypertension may directly contribute to RA risk,

especially within high-risk populations. This result addresses a critical gap in understanding the association between hypertension and RA among obese African American adults, uncovering significant health disparities and emphasizing the need for targeted prevention strategies that go beyond routine screening to address underlying risk factors and systemic inequalities.

The current study found a statistically significant association between hypertension and rheumatoid arthritis among African American adults with obesity, reinforcing hypertension as a critical cardiometabolic outcome in this population. These findings align with those of Rezaianzadeh et al. (2024), who conducted a prospective cohort study to investigate gender-specific predictors of hypertension. Their analysis identified modifiable and non-modifiable risk factors such as age, waist-to-height ratio, pre-hypertension, and contraceptive use among women and smoking and opium use among men. Notably, hypertension was more prevalent among females, suggesting the need for gender-sensitive strategies in hypertension prevention and management. Findings from Rezaianzadeh et al. (2024) support the current study's rationale for controlling gender as a covariate and emphasize the complex interaction between lifestyle, gender, and hypertension risk. Although Rezaianzadeh et al.'s population differs demographically, their findings on gendered hypertension predictors provide external validation of hypertension's importance in evaluating cardiometabolic comorbidities. When contextualized within African American communities with known disparities in both RA and hypertension outcomes, these insights highlight the urgency of targeted interventions to address overlapping disease burdens.

Dijkshoorn et al. (2022) examined RA patients with cardiometabolic multimorbidity, including hypertension, and their findings further validate the association between hypertension and RA. The study reported that individuals with two or more cardiometabolic conditions, such as hypertension, dyslipidemia, or type 2 diabetes, exhibited more severe RA disease characteristics. Findings from Dijkshoorn et al. align closely with results from my research, which identified a statistically significant association between hypertension and RA among obese African American adults. In my study, individuals diagnosed with hypertension were 1.89 times more likely to have RA than those without hypertension. Hypertension stood out as a strong independent predictor of RA in this high-risk population.

Both studies highlight a critical subset of RA patients with overlapping cardiometabolic risks who may face more complex disease trajectories and treatment resistance. These shared findings reinforce the necessity of integrated care strategies that address hypertension not merely as a coexisting condition but as a key risk factor influencing RA onset and progression. This is especially important for vulnerable and underserved populations, such as obese African American adults, where systemic disparities can further compound health outcomes.

Evidence presented in this analysis highlights a strong and statistically significant association between hypertension and rheumatoid arthritis. The outcome is supported by a recent cross-sectional study conducted by Almalki et al., 2022. The researchers examined the prevalence of uncontrolled blood pressure and the risk factors in RA patients. The study found that 31.65% of RA patients had uncontrolled hypertension and

identified key risk factors such as male gender, age over 60, obesity, hyperlipidemia, diabetes, and smoking. These factors substantially overlap with the demographic and cardiometabolic variables considered in my analysis. Although the study took place in a different geographic and ethnic population, it reveals consistent patterns of risk that underscore the broader relevance of hypertension as a comorbid and potentially compounding factor in RA pathophysiology.

Both studies emphasize the need for routine cardiovascular screening and targeted intervention strategies within RA populations, particularly those burdened by obesity and other metabolic risk factors. For African American adults who already face disparities in hypertension control and RA care, these findings reinforce the necessity of integrated care models that address the interconnected nature of autoimmune and cardiometabolic conditions. The current study found a significant association between HTN and RA among African American adults with obesity, extending existing research like Jia et al. (2025), which confirmed a causal link between rheumatoid arthritis and increased hypertension risk.

The results of this study reinforce the hypothesized link between hypertension and rheumatoid arthritis, demonstrating that individuals with hypertension have significantly higher odds of developing RA. This association supports emerging evidence of a bidirectional relationship between the two conditions, likely mediated by systemic inflammation. By focusing on African American adults with obesity, a population already burdened by disproportionate hypertension rates, the study highlights how underlying cardiometabolic risk factors, shaped by social and structural determinants, contribute to

RA vulnerability. These findings extend previous research by establishing hypertension as an independent predictor of RA within a high-risk demographic, affirming the importance of integrated risk assessment in both clinical and public health contexts.

### **Strengths and Limitations of the Study**

#### **Study Limitations**

As discussed in Chapter 1, this study's cross-sectional design captures data simultaneously, limiting the ability to establish causality between variables. Potential biases such as selection bias, recall bias, and the influence of confounding variables may affect the internal validity of the findings. While the large, nationally representative sample of NHANES enhances generalizability, the reliance on self-reported measures for certain variables, including medical history and behavioral factors, may introduce recall and social desirability biases. Additionally, researchers have no control over the original data collection methods, which restricts the ability to tailor variables or instruments to fit specific research questions.

Utilizing NHANES data presents unique analytical challenges. While intended to improve national representativeness, its complex multi-stage probability sampling design can potentially overstate significance and introduce bias, especially when analyzing subpopulations such as African Americans and Hispanics. NHANES nonresponse bias is another concern; if those who decline participation differ meaningfully from those who respond, results may not fully capture the health realities of the target population. Moreover, changes in NHANES data collection protocols and variable definitions across survey cycles make it difficult to conduct valid trend analyses without careful

harmonization. The extensive time and expertise required for proper data cleaning, variable merging, weighting, and analysis adjustments further highlight the need for rigorous methodological handling to ensure accurate and reliable interpretations of the findings.

### **Study Strengths**

One of the key strengths of this study lies in its focus on an underrepresented and high-risk population of African American adults with obesity who face compounded health disparities in both rheumatoid arthritis and cardiometabolic outcomes. The study ensures analytical rigor by utilizing nationally representative NHANES data and applying complex sample logistic regression techniques while accounting for the stratified sampling design. Including critical sociodemographic covariates such as age, gender, education level, and socioeconomic status strengthens the internal validity of the findings by controlling for potential confounding variables. Additionally, the study is grounded in the socio-ecological model, which provides a robust theoretical framework for examining multilevel determinants of RA. This conceptual foundation, combined with a methodologically sound approach, enhances the relevance and applicability of the findings to public health research, policy development, and clinical practice aimed at reducing disease burden in marginalized populations.

## **Recommendations**

### **Targeted Screening and Early Intervention**

Given the significant associations between rheumatoid arthritis (RA) and cardiometabolic conditions such as cardiovascular disease (CVD) and hypertension,

implementing targeted screening programs for African American adults with obesity is crucial. Early identification of RA in patients with existing hypertension or CVD can facilitate prompt diagnosis and intervention, potentially mitigating disease progression and improving outcomes. Studies emphasized the importance of early detection and management of RA to reduce long-term joint damage and disability.

### **Integrated Health Care Strategies**

The strong link between RA and cardiometabolic comorbidities underscores the need for multidisciplinary care approaches. Healthcare systems should integrate rheumatology, cardiology, and primary care services to ensure comprehensive management of RA alongside coexisting conditions like hypertension and CVD, especially in high-risk populations. Integrated care models have improved clinical outcomes and patient satisfaction in managing chronic disease (Evén et al., 2024).

### **Population-Specific Interventions**

Recognizing the disparities in RA prevalence and outcomes among African American adults with obesity, culturally sensitive and population-specific interventions are necessary. Programs should address unique socioeconomic and healthcare access challenges this population faces, including tailored education on lifestyle modifications, disease management, and cardiovascular risk reduction. Culturally adapted interventions have effectively improved health behaviors and outcomes in African American communities (Lalika et al., 2024).

**Policy-Level Actions**

Policymakers should focus on reducing healthcare disparities affecting African American communities by improving access to affordable healthcare services, promoting community-based health programs, and funding research that focuses on racial and ethnic disparities in chronic disease outcomes. Expanding coverage for preventive services and chronic disease management under public health programs could also bridge existing gaps in care. Addressing structural racism and implementing policies that promote equity in healthcare access are essential steps toward reducing disparities (Jack et al., 2021).

**Promote the Utilization of Family Health History Tools**

Encouraging culturally tailored family health history (FHH) tools can empower African Americans to understand their genetic predispositions and make informed health decisions. A study by Key et al. (2024) emphasizes the development of culturally appropriate FHH toolkits to increase utilization and ultimately decrease health disparities in the African American community (Key et al., 2024).

**Further Research**

While this cross-sectional study has established significant associations, longitudinal studies are needed to examine causal relationships between RA and cardiometabolic outcomes. Future research should explore genetic, environmental, and behavioral factors contributing to these associations in African American populations. Additionally, investigating the effectiveness of integrated care models in improving RA outcomes in high-risk populations could yield valuable insights.

## **Implications**

RA is a chronic inflammatory autoimmune joint disease that affects about 1% of the world's population. In the United States alone, around 1.3 million adults live with RA, accounting for 0.6% to 1% of the adult population (Xu et al. 2021). RA can lead to severe long-term consequences, including physical limitations, work disability, reduced quality of life, and increased mortality. Work disability is one of the most significant impacts of RA, with about 35% of RA patients in the U.S. experiencing work-related limitations. The economic burden of RA is substantial, with indirect costs from lost productivity nearly tripling the direct costs of treatment. In total, the annual healthcare costs for RA patients in the U.S. are estimated to be around \$19.3 billion, highlighting the significant personal and societal impact of the disease.

### **Public Health**

The findings emphasize the critical need for public health initiatives focusing on the cardiometabolic burden of RA among African American adults with obesity. Increased awareness and education regarding the interconnections between RA, hypertension, and CVD can guide the development of public health strategies aimed at reducing the incidence and severity of these comorbid conditions and, thus, drive positive social change.

### **Clinical Practice**

Clinicians should recognize hypertension and CVD as strong predictors of RA in African American patients with obesity and incorporate regular RA assessments into cardiometabolic disease management. The identification of gender as a significant

predictor of RA risk also suggests the importance of gender-specific clinical approaches in high-risk populations. The study's findings have significant implications for healthcare providers, especially at the interpersonal and organizational levels. Clinicians should incorporate routine RA screenings into the management of patients with cardiometabolic conditions, particularly African American adults with obesity. Recognizing hypertension and CVD as strong predictors of RA can help clinicians develop comprehensive care plans that address both autoimmune and cardiometabolic health.

Moreover, the identification of gender as a significant predictor of RA suggests the need for gender-specific interventions. For example, African American men with obesity, found to have a higher risk of developing RA, may benefit from targeted outreach and specialized treatment strategies that consider unique biological and social determinants of health. Healthcare systems should also implement multidisciplinary care models that bring together rheumatologists, cardiologists, endocrinologists, and primary care providers to manage the complex needs of patients with comorbid RA and cardiometabolic conditions. Such integrative care approaches can improve outcomes and reduce healthcare costs

### **Research and Epidemiology**

This study contributes valuable data to the epidemiological understanding of RA among African American adults, an underrepresented population in RA research. The study also highlights the importance of using large-scale, nationally representative datasets like NHANES, despite their limitations, to uncover critical health disparities. At the individual and policy levels, the study fills a critical gap in RA research by focusing

on an underrepresented population, African American adults with obesity, thereby contributing to a more inclusive understanding of RA's epidemiology. Despite its limitations, the use of NHANES data demonstrates the value of large-scale, nationally representative datasets in identifying health disparities and informing evidence-based policies.

Future research should explore longitudinal studies to establish causal relationships between RA and cardiometabolic conditions and to assess the long-term impact of interventions. Investigating social determinants of health such as income, education, and neighborhood environments will also be crucial in understanding how systemic inequities contribute to the observed disparities in RA outcomes.

Additionally, this study highlights the importance of using a multi-level approach in epidemiological research consistent with the SEM framework. By considering how individual behaviors, social networks, community structures, and societal policies influence health outcomes, researchers can develop more effective disease prevention and management strategies.

### **Conclusions**

This study emphasized the complex relationships between RA and cardiometabolic conditions, specifically cardiovascular disease and hypertension among African American adults with obesity. The results reveal that hypertension and CVD are strong predictors of RA among African American adults with obesity. The result emphasizes the pressing need for targeted interventions and integrated healthcare strategies that address the unique risk factors faced by African American adults with

obesity. The study's outcome supports numerous empirical research studies conducted worldwide, which show a relationship between RA and predictor variables (gender, cardiovascular disease, and hypertension). Future studies should focus on developing strategies on how to mitigate the risk of RA among minority groups to enhance positive social change.

The study highlights the need for public health policies to prioritize equitable healthcare access and preventive care tailored to this high-risk group to mitigate the dual burden of RA and cardiometabolic diseases, and crucial associations that warrant further exploration through longitudinal research. By focusing on population-specific risk factors and addressing systemic healthcare disparities, future efforts can improve RA management and overall health outcomes for African American adults with obesity. By acknowledging the complex web of factors that influence RA and its cardiometabolic comorbidities, the analysis offers direction for holistic, population-specific strategies aimed at reducing disease burden and improving the quality of life for African American adults.

This study contributes to our scientific knowledge regarding the association between cardiovascular health and RA among African Americans with obesity and catalyzes positive social change. Moreover, it highlights the interconnectedness of chronic diseases and social determinants of health. Findings from this study call for more inclusive public health strategies, equitable healthcare practices, and community-centered interventions that can eliminate or alleviate disparities, improve quality of life, and create healthier, more resilient communities.

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Appendix: Multiple Regression Coefficient Table

Model		Unstandardized coefficients		Standardized coefficients		Collinearity statistics		
		B	Std. error	Beta	<i>t</i>	Sig.	Tolerance	VIF
1	(Constant)	.056	.004		12.947	<.001		
	Ethnicity	-.006	.001	-.031	-5.590	<.001	.948	1.055
	PIR2	.006	.002	.017	2.900	.004	.857	1.166
	EDUC	-.014	.001	-.062	-10.517	<.001	.847	1.181
	Obese	.010	.002	.025	4.645	<.001	.971	1.030
	HTN	.031	.002	.077	13.521	<.001	.904	1.107
	cvd2	.066	.004	.099	17.672	<.001	.923	1.084

a. Dependent Variable: RA