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# Influence of psychosocial factors, physical activity status and body composition on blood pressure in lesbian, gay, bisexual and heterosexual young adults

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BOSTON UNIVERSITY  
SARGENT COLLEGE OF HEALTH AND REHABILITATION SCIENCES

Thesis

**INFLUENCE OF PSYCHOSOCIAL FACTORS, PHYSICAL ACTIVITY STATUS  
AND BODY COMPOSITION ON BLOOD PRESSURE IN LESBIAN, GAY,  
BISEXUAL AND HETEROSEXUAL YOUNG ADULTS**

by

**EVAN JOSEPH NESSEN**

B.S., Gonzaga University, 2023

Submitted in partial fulfillment of the  
requirements for the degree of  
Master of Science

2025

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## **DEDICATION**

I would like to dedicate this work to my family, Tyler, Jesse, and my friends for the continuous supply of the mental, emotional, and physical resources that propelled me to this achievement.

## ACKNOWLEDGMENTS

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**INFLUENCE OF PSYCHOSOCIAL FACTORS, PHYSICAL ACTIVITY STATUS  
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BISEXUAL AND HETEROSEXUAL YOUNG ADULTS**

**EVAN JOSEPH NESSEN**

**ABSTRACT**

Hypertension (HTN) is a major risk factor for cardiovascular morbidity and mortality. While estimated to affect 1 in 2 adults in the general population, HTN has recently been found to be more prevalent in individuals who are lesbian, gay, bisexual, transgender, and queer (LGBTQ+). Sexual minority adults have also been found to take on greater levels of tobacco and alcohol use, achieve greater levels of physical inactivity, and may have higher body mass index (BMI) when compared to heterosexual counterparts. HTN in the LGBTQ+ community is additionally thought to be mediated by excessive levels of identity-dependent psychosocial stress, as posited in the Minority Stress Theory. Previous studies examining the relation of stress and blood pressure in LGBTQ+ populations have largely been retrospective or used self-report data. We sought to pilot a study directly measuring stress, anxiety, and depression levels, cuff-based blood pressure and heart rate, self-reported physical activity levels and alcohol and tobacco use, as well as waist to hip ratios in healthy cisgender lesbian, gay, bisexual, and queer (LGBQ) and heterosexual emerging adults. Participants had a mean age of 21.9 years, representing early emerging adults. We identified that both stress and anxiety levels were significantly higher in grouped LGBQ individuals than heterosexual participants. However, we did not identify any significant differences in mean systolic blood pressure,

diastolic blood pressure, mean arterial pressure, heart rate, physical activity status, waist to hip ratio, or alcohol and tobacco use. However, weekly minutes of moderate to strenuous cardiovascular physical activity had a significant inverse relationship with anxiety levels among LGB participants. This association was not significant among heterosexual participants. We conclude from these data that emerging adult LGBQ individuals may be at an elevated risk for HTN based on the excess stress and anxiety identified. Additionally, we conclude that physical activity is particularly effective at modulating anxiety levels among LGB emerging adults. The early twenties may represent a critical time point at which a risk factor for HTN (stress and anxiety) is present without the development of a hypertensive phenotype.

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## **LIST OF ABBREVIATIONS**

- A.C.C.** – American College of Cardiology
- ACC** – Anterior Cingulate Cortex
- AHA** – American Heart Association
- ANG-II** – Angiotensin-II
- ANOVA** – Analysis of Variance
- BIPOC** – Black, Indigenous, and People of Color
- BMI** – Body Mass Index
- BP** – Blood Pressure
- CO** – Cardiac Output
- DASS-21** – Depression, Anxiety, and Stress Scale – 21 Items
- DBP** – Diastolic Blood Pressure
- HPA** – Hypothalamic Adrenal Pituitary Axis
- HR** – Heart Rate
- HTN** – Hypertension
- LGB** – Lesbian, Gay, Bisexual
- LGBTQ** – Lesbian, Gay, Bisexual, Transgender, Queer
- MAP** – Mean Arterial Pressure
- MR** – Mineralocorticoid Receptor
- NE** – Norepinephrine
- NO** – Nitric Oxide
- PVN** – Paraventricular Nucleus

**RAAS** – Renin Angiotensin Aldosterone System

**RVLM** – Rostral Ventrolateral Medulla

**SBP** – Systolic Blood Pressure

**SNS** – Sympathetic Nervous System

**SV** – Stroke Volume

**TPR** – Total Peripheral Resistance

**TSST** – Trier Social Stress Test

## CHAPTER ONE: INTRODUCTION

### Overview of Hypertension Mechanisms

Hypertension (HTN) is both a cardiovascular disease and risk factor that is diagnosed through longitudinal and recurrent measurements of elevated blood pressure (BP). HTN is poorly understood, affects 1 in 2 American adults, and increases the risk of developing myocardial infarction, chronic kidney disease, heart failure and cerebrovascular disease (Whelton, Carey et al. 2018, Fuchs and Whelton 2020). The American Heart Association has defined categories of HTN which can be found in Table 1 (Reused with permission from Wolters Kluwer Health (Whelton, Carey et al. 2018)).

BP Category	SBP		DBP
Normal	<120 mm Hg	and	<80 mm Hg
Elevated	120–129 mm Hg	and	<80 mm Hg
<b>Hypertension</b>			
Stage 1	130–139 mm Hg	or	80–89 mm Hg
Stage 2	≥140 mm Hg	or	≥90 mm Hg

\*Individuals with SBP and DBP in 2 categories should be designated to the higher BP category.

BP indicates blood pressure (based on an average of ≥2 careful readings obtained on ≥2 occasions, as detailed in Section 4); DBP, diastolic blood pressure; and SBP systolic blood pressure.

**Table 1. Categories of BP in Adults. Reprinted with Permission from Wolters Kluwer Health.**

Essential HTN accounts for 90–95% (Unger, Borghi et al. 2020) of all cases of HTN and is diagnosed via exclusion, meaning HTN is considered essential if there is no identifiable cause of the elevated blood pressure. In cases where HTN can be attributed to anatomical and/or physiological defects such as renal artery stenosis or Cushing's

Syndrome it is considered secondary HTN which accounts for 5–10% of all HTN cases (Unger, Borghi et al. 2020).

Essential hypertension has no known cause but rather has unified underlying mechanisms that are thought to contribute to chronically elevated blood pressure. Most cases of essential HTN are seen to have excessive blood volume due to elevated reabsorption of sodium and water at the kidney (Hall, Mizelle et al. 1990). Blood pressure is regulated by two primary endogenous systems: the renin angiotensin aldosterone system (RAAS), and the sympathetic nervous system (SNS). The former sets the chronic blood pressure baseline in health, and the latter regulates moment-to-moment deviations in blood pressure. In setting the blood pressure, RAAS generally operates by controlling sodium and water balance, and therefore blood volume. RAAS begins with renin release at the juxtaglomerular apparatus found in nephrons of the kidney. Renin then initiates a cascade of sequential enzymatic cleavage resulting in the production of angiotensin-II (ANG-II). ANG-II increases vasomotor tone through enhancing sympathetic activity from the central nervous system and direct action on the vasculature, as well as increasing water retention, thereby increasing blood pressure (Young and Davisson 2015, Pellegrino, Schiller et al. 2016). ANG-II additionally stimulates the release of aldosterone from the adrenal cortex which can elevate blood pressure through sodium and water retention (Santos, Oudit et al. 2019). In moment-to-moment regulation, the SNS principally acts through feedback loops and utilizes catecholamines as effectors to enhance cardiac output, comprised of stroke volume (SV) and heart rate (HR), and total peripheral resistance (TPR).

While the mechanisms in essential HTN are unclear, there are distinct phenotypes observed in humans. Essential HTN can occur as a primarily neurogenic phenotype wherein excessive and/or chronic activation of stress pathways causes increased systemic vascular resistance and cardiac output. Mean arterial pressure is determined by factors influencing SV, HR and TPR, but is most strongly influenced by TPR (Hill and Thayer 2019). Chronic stress contributes to HTN independent of traditional risk factors such as age and BMI (Lagraauw, Kuiper et al. 2015) and is therefore an important risk factor to address particularly in marginalized communities that experience greater risk of developing HTN. Marginalization is defined as “the process through which persons are peripheralized based on their identities, associations, experiences, and environment” (Hall, Stevens et al. 1994).

Chronic psychosocial stress can result in the vasculature being exposed to high levels of glucocorticoids and catecholamines, which disrupt endothelial-dependent dilation and exacerbates smooth muscle contraction. Under normal physiological concentrations of cortisol, the mineralocorticoid receptors (MRs) on the vasculature do not bind cortisol due to enzymatic conversion of cortisol to cortisone by 11-beta-HSD2 (Isidori, Graziadio et al. 2015). When cortisol is in excess, this enzyme saturates leaving free cortisol to bind to MRs and induce fibrotic and hypertrophied smooth muscle in the vasculature, resulting in increased TPR and impaired vasodilation (Miljic, Miljic et al. 2012). Additionally, the catabolic effects of cortisol increase endothelin-1 sensitivity, in turn increasing vasomotor tone of the vasculature and further contributing to hypertrophy of vascular smooth muscle (Barbot, Ceccato et al. 2019). Excess cortisol induces

structural and molecular-mediated dysfunction that increases TPR and impairs vasodilation through inhibition of endothelial nitric oxide synthase, resulting in impaired endothelial-dependent vasodilation and further increasing resistance and blood pressure (McCurley and Jaffe 2012). The stress-mediated effects on blood pressure differ from the dogma of essential HTN, where there is not necessarily elevated sodium and water retention, yet may be more relevant for HTN seen in marginalized populations (Taweh and Moreira 2023).

Cortisol is the effector of the chronic stress response, whereas catecholamines released from the sympathetic nervous system drive the acute stress response through short-term regulation of blood pressure. Similar to chronic cortisol release, frequent and/or excessive sympathetic tone can contribute to chronically elevated blood pressure (Esler, Lambert et al. 2010, Sata, Head et al. 2018). The connection whereby external stressors evoke physiological consequences that raise blood pressure lies in the complex circuitry of the amygdala and associated sympathetic outflow nuclei such as the paraventricular nucleus (PVN) in the hypothalamus (Buijs and Van Eden 2000). The amygdala, a fear and stress response nucleus in the brain, has anatomical connections to sympathetic nuclei and is an essential brain structure that processes and anticipates psychological stressors and consolidates adverse memories (Godoy, Rossignoli et al. 2018). Further influencing BP, independent of heart rate, is the anterior cingulate cortex (ACC) (Burns and Michael Wyss 1985). The ACC is known to have important connections to the amygdala in response to fearful stimuli (Jhang, Lee et al. 2018) establishing the connection between emotional processing, amygdalar activity, and BP

control. Additionally, individual differences in BP reactivity to a mental stressor are related to anatomical and neurophysiological distinctions within the amygdala as well as degree of activation of the ACC and pons (Gianaros, Sheu et al. 2008). Furthermore, when corticotropin releasing hormones of the amygdala are inhibited, stress evoked increases in blood pressure are attenuated (Sheng, Zhang et al. 2023). These data further support the psychological stressors detected by the amygdala and ACC which modulate BP through cardiovascular control centers. If a threat is perceived (important to note a physical threat is not required for this to occur) then the amygdala, in conjunction with decreased GABAergic input to the PVN, will communicate with the rostral ventrolateral medulla (RVLM) and PVN to increase global sympathetic output (Fontes, Marins et al. 2023). The enhanced SNS activity subsequently raises BP and is thought to be a key mechanism in stress induced HTN (Seravalle and Grassi 2022).

### **Hypertension Epidemiology**

HTN is estimated to affect 1 in 2 individuals over 18 in the US; 1 in 4 adults 18–39; 3 in 4 over the age of 60 (Whelton, Carey et al. 2018). Around 10% of individuals with HTN experiencing resistance to antihypertensive treatment regimens (Noubiap, Nansseu et al. 2019, Yoon, You et al. 2022). Critically, HTN is the leading cause of chronic kidney disease, heart attack, and stroke (Martin, Aday et al. 2025). HTN disproportionately burdens marginalized individuals including those belonging to Black, Indigenous, and People of Color (BIPOC) and lesbian, gay, bisexual, transgender, and queer (LGBTQ+) communities. Gay men, bisexual men and women, and Black men and women face the highest chances of developing HTN (Caceres, Streed et al. 2020,

Aggarwal, Chiu et al. 2021). Additionally non-Hispanic Black individuals face the highest risk of cardiovascular disease when compared to other racial and ethnic groups (Stephens, Young et al. 2023). Specific to the topic of this thesis, gay men are twice as likely to have HTN compared to their heterosexual counterparts (Everett and Mollborn 2013). Sexual minority men have broadly been found to be twice as likely to have elevated BP as their heterosexual peers (Caceres, Brody et al. 2017). Bisexual women are more likely to have HTN compared to their heterosexual counterparts (Caceres, Ancheta et al. 2022).

Maladaptive coping behaviors (nicotine use and diet) are associated with lower cardiovascular health scores most among bisexual females (Caceres, Sharma et al. 2023). Poor cardiovascular health scores have been found among lesbian and bisexual females (Deraz, Caceres et al. 2023). In a separate report, Caceres et al. reported that internalized homophobia is associated with the development of incident HTN among sexual minority adults. Sexual minority adults were found to be less likely to decrease alcohol consumption and sexual minority women were less likely to be told by a doctor to medically manage their HTN (Veliz, McCabe et al. 2020). Altogether, these findings suggest that LGBTQ+ individuals may face elevated burden of HTN as a function of behavioral and social variables and be less likely to receive treatment. Supporting this notion, there is a decreased likelihood of antihypertensive medication use among bisexual women diagnosed with HTN (Sharma, Bhargava et al. 2022). Despite the above evidence from surveys and electronic health records, data on HTN in the LGBTQ+ population is limited in quantity and quality because most studies are retrospective and self-reported.

Nonetheless, an evident trend throughout the existing research is poor cardiovascular health in sexual minorities compared to heterosexual counterparts.

### **Proposed Mechanisms of Hypertension in the Queer Community**

#### *The Minority Stress Model*

The Minority Stress Theory (MST) is one of the principal theories that explains the increased cardiovascular risk that marginalized groups experience (Meyer 2003, Caceres, Streed et al. 2020). MST has provided a theoretical foundation for research exploring the stress-related health risks of sexual and gender minority individuals. MST posits that the experienced and anticipated stressors due to LGBTQ+ identity cause negative health outcomes at different rates than those observed in heterosexual individuals. The increased burden of stress faced by LGBTQ+ individuals converges on the hypothalamic-pituitary-adrenal (HPA) axis increasing the release of cortisol, as well as modulates activity of the sympathetic nervous system.

Ilan Meyer's seminal work first described MST to attempt to explain worse mental health outcomes seen in LGB individuals (Meyer 2003). MST posits that stressors unique to individuals belonging to sexual minority groups converge on distal and proximal experienced and anticipated stressors that worsen mental health outcomes (Meyer 2003). Since then, further research has found increased risk of cardiovascular disease among LGBTQ+ individuals, with heightened psychological stress as a primary proposed contributor for physical illness, and has adapted and expanded MST to explain this risk (Caceres, Streed et al. 2020, Taweh and Moreira 2023). The expanded MST model describes how minority identity, in this case being LGBTQ+, can expose a person

to structural/institutional, interpersonal, and intrapersonal stressors. These stressors can then result in poor mental health, maladaptive coping behaviors such as tobacco use and excessive alcohol consumption, as well as heightened stress responses driven by cortisol and norepinephrine. The expanded MST model posits an increase in cardiovascular disease risk among LGBTQ individuals through the accumulation of cardiovascular risk factors (Caceres, Streed et al. 2020). With this theoretical framework in mind, it is likely that hypertension seen among LGBTQ individuals is mediated by excess cortisol and norepinephrine, rather than excess sodium and fluid retention as seen in the general population. However, there is likely contribution from both RAAS, and sympathetically driven pathways given that they exhibit reciprocal relationships (Blankestijn, London et al. 2011). This balance and pharmacological management need to be further interrogated among LGBTQ+ individuals.

### *Stress-Mediated Pathways*

Studies measuring cortisol levels among LGBTQ+ participants have produced confounding results. Studies report no difference in diurnal cortisol between sexual minority and heterosexual counterparts (Figueroa, Zoccola et al. 2021). Higher cortisol response to a tier social stress test (TSST) in lesbian and bisexual women compared to heterosexual women has also been found (Juster, de Torre et al. 2019, Figueroa, Zoccola et al. 2021). Gay men have been found to exhibit lower cortisol, but higher heart rate reactivity compared to heterosexual men (Figueroa, Zoccola et al. 2021). In response to a TSST with an antigay condition, LGBTQ+ individuals exhibit increased heart rate reactivity and elevated systolic blood pressure that remains even after the TSST

is over (Huebner, McGarrity et al. 2021), whereas their heterosexual counterparts did not. Additionally, cortisol reactivity is higher among young adult gay men and remains elevated following a TSST compared to heterosexual comparison groups (Mijas, Blukacz et al. 2021). LGBT adults from rural areas demonstrate elevated morning cortisol in relation to the number of LGBT-related stressors encountered (Figueroa, Zoccola et al. 2021). Through measurements of salivary alpha-amylase, one study has reported lesbian and bisexual women demonstrate dysregulated autonomic activity throughout the day compared to heterosexual women, but these findings did not exist among gay and bisexual men (Austin, Rosario et al. 2018). Escalated cortisol release in response to stressors combined with increased encounters of stressors as seen in the LGBTQ+ population likely results in chronically elevated cortisol. Overall, 42% of the existing studies as of 2020 detected a relationship between minority stress and cortisol (Flentje, Heck et al. 2020).

### **Physical Activity and Cardiovascular Health**

Regular, moderate-intensity aerobic exercise of 150 minutes per week has been shown to decrease risk of all-cause mortality by 30% (Kraus, Powell et al. 2019) and regular physical activity has been found to be equally effective in reducing mortality as contemporary drug interventions (Naci and Ioannidis 2013). As of 2020, less than one fourth of the US adult population met the guidelines for physical activity as set by the American College of Sports Medicine (Elgaddal N 2022). Directly pertaining to blood pressure, SBP and DBP have been found to decrease by 3.2mmHg and 1.8mmHg respectively up to 24 hours following one bout of aerobic exercise (Carpio-Rivera,

Moncada-Jimenez et al. 2016). The mechanisms that primarily mediate the positive effects of exercise on blood pressure are improved NO-mediated vascular remodeling, decreased angiotensin levels, and decreased sympathetic tone at rest (Farrell et al, 2023). Improvements in sympathetic control during rest are likely due to increased inhibitory balance of nuclei responsible for sympathetic output in the brainstem (Ferreira-Junior, Ruggeri et al. 2019). The effects of exercise on sympathetic tone and vascular remodeling are particularly salient due to evidence that LGB individuals display greater vasoconstriction and poorer vascular compensation compared to heterosexual adults (Rosati, Williams et al. 2021).

LGBTQ+ American Adults have reported greater barriers to achieving regular physical activity compared to their heterosexual counterparts due to fear of discrimination, societal stereotypes, and decreased perceived benefit to physical activity (Herrick and Duncan 2018, Frederick, Castillo-Hernandez et al. 2022). High anticipation of minority stress and high rates of experienced minority stress reduces minutes of moderate to vigorous physical activity among sexual minority individuals (Lopez Veneros, Ensari et al. 2024). Among college aged students, LGBTQ+ students have been reported to achieve less aerobic and resistance training physical activity levels compared to their heterosexual counterparts (Frederick, Castillo-Hernandez et al. 2022, Fortnum, Gomersall et al. 2024) Young people who identify as LGBTQ+ are less likely to participate in organized sports(Parchem, Poquiz et al. 2024). Among sexual minority adults, physical activity has been found to improve BMI, alcohol use, tobacco use, and reduce stress and anxiety levels (Allen, Wiginton et al. 2023). The ameliorating effect of

physical activity on risk factors in the LGBTQ+ community is particularly important given that those risk factors have been well documented to be higher among LGBTQ+ individuals and promote HTN risk. It is worth noting that studies have reported that gay men and lesbian women achieve higher levels of physical activity compared to their heterosexual counterparts (Fricke, Gordon et al. 2019). However, this is likely due to more compulsive weight control and nutrition behaviors related to body image (e.g. muscularity and thinness) and may not relate to better mental health outcomes (Lucassen, Nunez-Garcia et al. 2022). Assessing physical activity status among sexual minority individuals is crucial given that exercise is effective at improving cardiovascular function, even among individuals with known severe CVD (Roveda, Middlekauff et al. 2003, Green, Hopman et al. 2017).

## **CHAPTER TWO: METHODS**

### **Ethical Approval and Participants**

Ethical approval was granted for this study through Boston University's Institutional Review Board under protocol # 7272E.

#### **Participant Recruitment**

Participants were recruited through fliers that were placed in public spots of academic buildings on Boston University's campus. To be eligible for the study, participants had to provide their age, gender identity, sexual orientation, name, and contact information. QR code on recruitment fliers was linked to a Qualtrics survey, used to screen for study eligibility. Participants were contacted via email to schedule an intake if they were between the ages of 18 to 35 years old and were cisgender men or women, and identified as either lesbian, gay, bisexual, or heterosexual.

#### **Participant Consenting Process**

All study visits were scheduled to occur between 11:00 AM and 1:00 PM local time to remove any effects of circadian rhythmicity of blood pressure on our results. Upon each study visit, participants were walked through a consent form outlining the background, procedures, risks, benefits, and withdrawal options. After consent was given, participants were further screened through questions assessing any current diagnosis of cardiovascular disease or chronic kidney disease. Participants were excluded if they reported a diagnosis of cardiovascular disease such as heart failure, stroke, or myocardial infarction. Additionally, participants were excluded if they reported chronic or congenital kidney disease. Following a participant signature on the consent form in addition to

clearing of disease history participants began each study visit with answering our first survey.

### **Blood Pressure Measurements**

Blood pressures were acquired using the Microlife BPM3 Deluxe Blood Pressure Monitor, Upper Arm Cuff, Digital Blood Pressure Machine. To decrease variability between study personnel we utilized an automated BP cuff. Device calibration was performed, and accuracy was compared to manual blood pressure before use. During each BP recording participants were seated with their feet flat on the floor in a chair with back support. The BP cuff was placed 2–3 cm above the antecubital fossa in line with the participant's right atrium with the artery marker in line with the brachial artery as assessed via palpation by the study personnel. The first BP recording was acquired from the left arm, the second BP recording was acquired from the right arm, and the third and final BP recording was performed on whichever arm resulted in the highest systolic recording (Whelton, Carey et al. 2018).

### **Demographics and Health History Questionnaire**

Each study visit began with our Demographics and Health History Questionnaire (Appendix A) to ensure that participants were sitting quietly for 5 minutes prior to the first blood pressure (BP) recording in line with the AHA/A.C.C. Blood Pressure Guidelines (Whelton, Carey et al. 2018).

### **Physical Activity Questionnaire**

Participants were asked to fill out the Physical Activity Questionnaire to gain a cross-sectional understanding of their attitudes towards physical activity as well as capture their recent physical activity behaviors (Appendix B).

### **Depression, Anxiety, and Stress Questionnaire**

The DASS-21 (Appendix C), a validated clinical tool used to assess stress anxiety, and depression, was employed to gain a cross-sectional measurement of the mental health state of each study participant (Ng, Trauer et al. 2007).

### **Anthropometrics**

A waist to hip measurement was taken using a soft measuring tape to assess relative body composition. This was done with the participant standing with nothing in their pockets and without any excessively baggy clothing. Measurements were taken at the narrowest part of a participant's waist and the widest part of a participant's hip (Janssen, Katzmarzyk et al. 2002) (Ardern, Katzmarzyk et al. 2003).

### **Analysis**

Statistical analyses were performed using SPSS (V 29) and GraphPad Prism (v10). Normality was assessed using a Kolmogorov-Smirnov test and outliers were tested for with a Grubbs' test. The primary identity categories for our statistical tests were queer men, queer women, heterosexual men, and heterosexual women. Participants were considered queer if they indicated their sexual orientation as anything other than heterosexual on our demographics survey (Appendix A) and as heterosexual if they indicated heterosexual. The primary outcomes of interest were mean systolic blood

pressure calculated as the average of the systolic BP recording across all three measurements, mean diastolic blood pressure calculated as the average of the diastolic BP recording across all three measurements, mean arterial pressure calculated as one third of mean systolic blood pressure added to two thirds of mean diastolic blood pressure, mean heart rate calculated as the average heart rate recording across all three measurements, and stress, anxiety, and depression scores as calculated using the DASS-21 scoring guide. A one-way ANOVA was used to assess differences in our primary outcomes of interest between groups based on sexual orientation (queer and heterosexual) and gender identity (man and woman). One-way ANOVA assessments were also used to determine group differences in weekly minutes of aerobic exercise, resistance exercise, waist to hip ratio, and days per month of consuming alcohol. Student T-tests were used when only comparing between two groups (men vs women; queer vs heterosexual). Pearson correlations were also run within sexual identity groups (e.g. within-group for queer and heterosexual respondents) to assess correlation between weekly minutes of aerobic activity and stress scores, anxiety scores, and depression scores. Lastly, participants were split into high, medium, and low tertile groups for scores in each category from the DASS-21. Correlations with physical activity were run for each tertile of each DASS-21 category.

## CHAPTER THREE: RESULTS

## Participant Demographics

<b>Participant Demographics</b>		<b>N=42</b>
		<b>Data N (%)</b>
<i>Self-Identified Gender</i>		
<b>Man</b>		<b>13 (31)</b>
<b>Woman</b>		<b>29 (69)</b>
<i>Age</i>		
<b>All</b>		<b>21.9 ± 1.8</b>
<b>LGB</b>		<b>21.4 ± 1.5</b>
<b>Heterosexual</b>		<b>22.3 ± 2</b>
<i>Self-Identified Race</i>		
<b>Asian</b>		<b>14 (33)</b>
<b>Black</b>		<b>1 (2)</b>
<b>Indigenous/Native American</b>		<b>1 (2)</b>
<b>Middle Eastern</b>		<b>0 (0)</b>
<b>White</b>		<b>25 (61)</b>
<b>Write In</b>		<b>1 (2)</b>
<i>Self-Identified as Latiné/Hispanic</i>		
<b>Yes</b>		<b>4 (10)</b>
<b>No</b>		<b>38 (90)</b>
<i>Self-Identified Sexual Orientation</i>		
<b>Queer</b>		<b>18 (52)</b>
<b>Bisexual</b>		<b>11 (26)</b>
<b>Gay/Lesbian</b>		<b>6 (14)</b>
<b>Queer/ Questioning</b>		<b>1 (2)</b>
<b>Straight/Heterosexual</b>		<b>24 (58)</b>

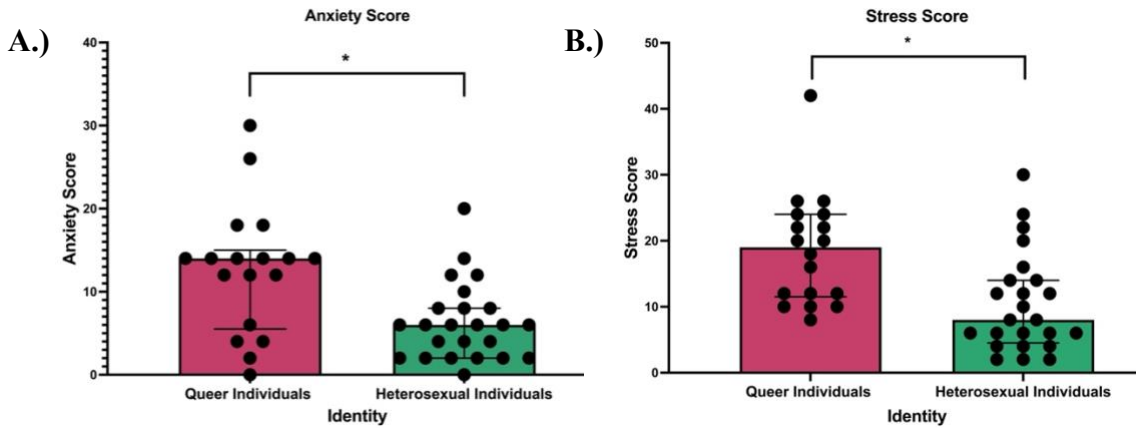
Table 2: Participant Demographics

Among our sample of 42 total participants 13 (31%) identified as a man with a mean age of  $21.9 \pm 1.8$  among all participants,  $21.4 \pm 1.5$  among LGB participants, and  $22.3 \pm 2$  among heterosexual participants. 14 (33%) identified as Asian, 1 (2%) identified as Black, 1 (2%) identified as Indigenous/Native American, 25 (61%) identified as White, and 1 (2%) answered with a write in option. 11 (26%) identified as bisexual, 6 (14%) identified as gay/lesbian, 24 (58%) as straight/heterosexual, and 1 (2%) as queer/questioning.

### **DASS-21**

In response to the DASS-21 survey, we found a significant difference in anxiety score for individuals who identify as LGB compared to those who identify as heterosexual ( $12.67 \pm 7.731$  vs  $6.333 \pm 4.669$ , unpaired t-test,  $p < 0.05$ ). Additionally, stress scores were significantly different between individuals who identify as LGB compared to those who identify as heterosexual ( $18.56 \pm 8.452$  vs  $10.42 \pm 7.529$ , unpaired t-test,  $p < 0.05$ ).

Depression scores did not differ by sexual orientation group.

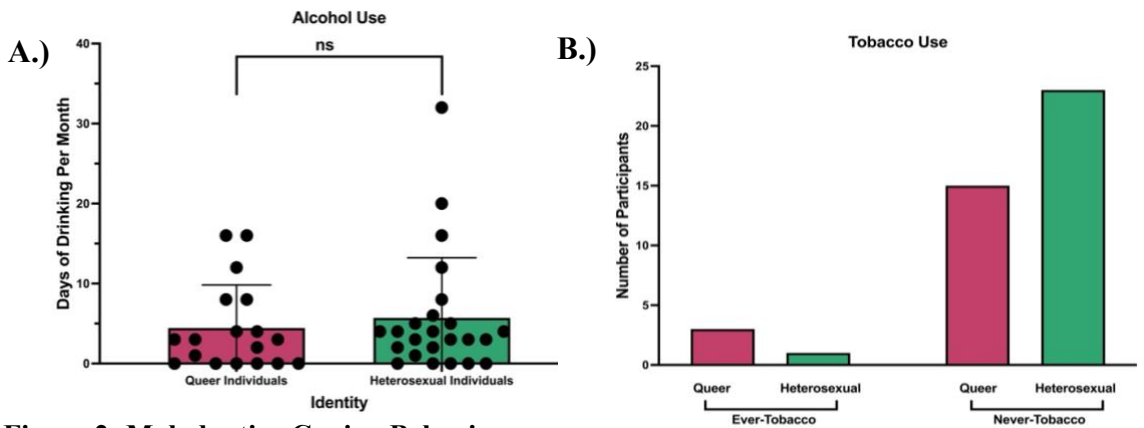


**Figure 1: DASS-21 Scores.**

A) Scatter plot of anxiety scores plotted for queer (n=18) and heterosexual (n=24) participants. B) Scatter plot of stress scores plotted for queer (n=18) and heterosexual (n=24) participants \* indicating a significant difference between the two groups (p<0.05, unpaired student t-test).

### Maladaptive Coping Behavior

We found no significant difference in alcohol use or tobacco use between participants who identify as LGB and participants who identify as heterosexual.

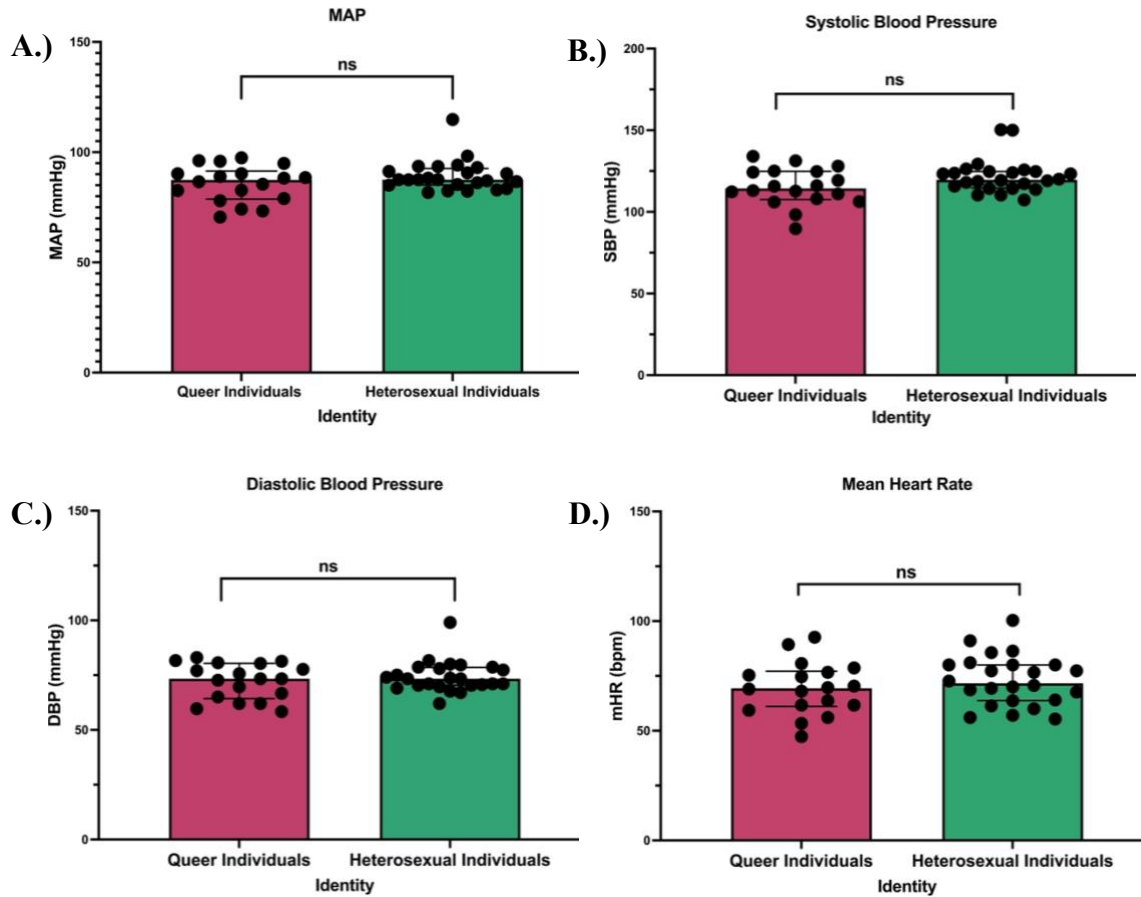


**Figure 2: Maladaptive Coping Behaviors**

A) Scatter-bar plot of the average number of days of alcohol use per week over the past year for queer and heterosexual participants. ns indicates no significant difference between the two groups (p>0.05, unpaired student t-test, queer n = 18, heterosexual n = 26). B) Contingency bar graph of tobacco use status (ever vs. never used tobacco products) for queer and heterosexual participants (queer n = 18, heterosexual n = 24; Chi-squared test of independence; Baptista-Pike odds ratio; p>0.05).

### Cardiovascular Analysis

We found no significant difference in MAP, SBP, DBP, and mHR between participants who identify as LGB and participants who identify as heterosexual.

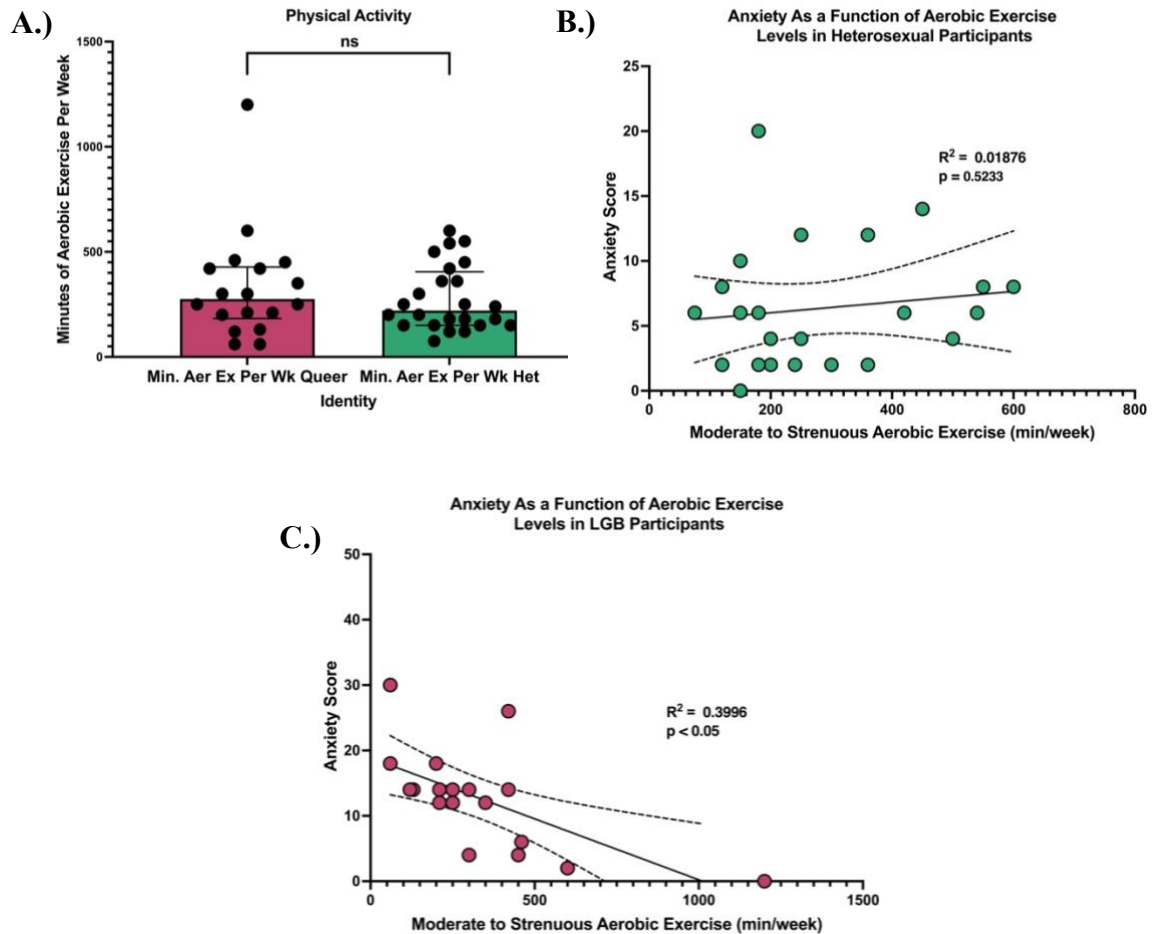


**Figure 3: Cardiovascular Indices**

A) Scatter-bar plot of mean arterial pressure plotted for queer and heterosexual participants. B) Scatter-bar plot of mean systolic blood pressure plotted for queer and heterosexual participants. C) Scatter-bar plot of mean diastolic blood pressure plotted for queer and heterosexual participants. D) Scatter-bar plot of mean heart rate plotted for queer and heterosexual participants. ns indicates no significant difference ( $p > 0.05$ , unpaired student t-test, queer  $n = 18$ , heterosexual  $n = 24$ ).

### **Physical Activity Analysis**

We found no significant difference in the minutes per week of moderate intensity cardiovascular exercise between participants who identify as LGB and participants who identify as heterosexual. Additionally, there was no significant correlation between minutes per week of moderate intensity cardiovascular exercise and SBP, DBP, HR, stress scores, or anxiety scores among all participants. When stratified by sexual orientation, minutes per week of moderate intensity cardiovascular exercise has a significant, strong, negative correlation with anxiety scores in LGB participants ( $r=0.6$ ,  $p<0.05$ , simple linear regression). This correlation is not significant among heterosexual participants.

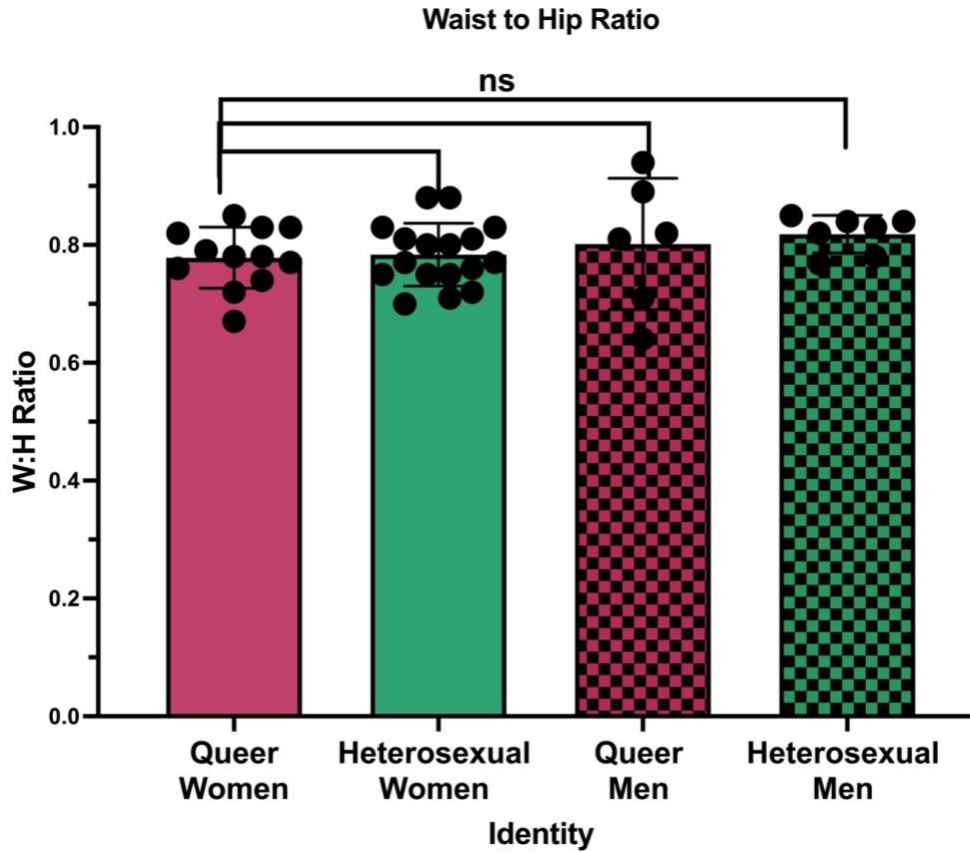


**Figure 4: Physical Activity and Effects on Anxiety**

A) Scatter-bar plot of minutes per week of moderate intensity cardiovascular exercise plotted for queer and heterosexual participants. ns indicates no significant difference ( $p > 0.05$ , unpaired student t-test, queer  $n = 18$ , heterosexual  $n = 26$ ). B) Simple linear regression plot of anxiety as a function of minutes of moderate to strenuous cardiovascular exercise per week among heterosexual participants ( $N = 24$ ,  $R^2 = 0.01876$ ,  $p = 0.5233$ ). C) Simple linear regression plot of anxiety as a function of minutes of moderate to strenuous cardiovascular exercise per week among LGB participants ( $N = 18$ ,  $R^2 = 0.3996$ ,  $p < 0.05$ ).

### Body Composition Analysis

We found no significant difference in waist to hip ratio between participants who identify as LGB and participants who identify as heterosexual, including when separated out by gender.

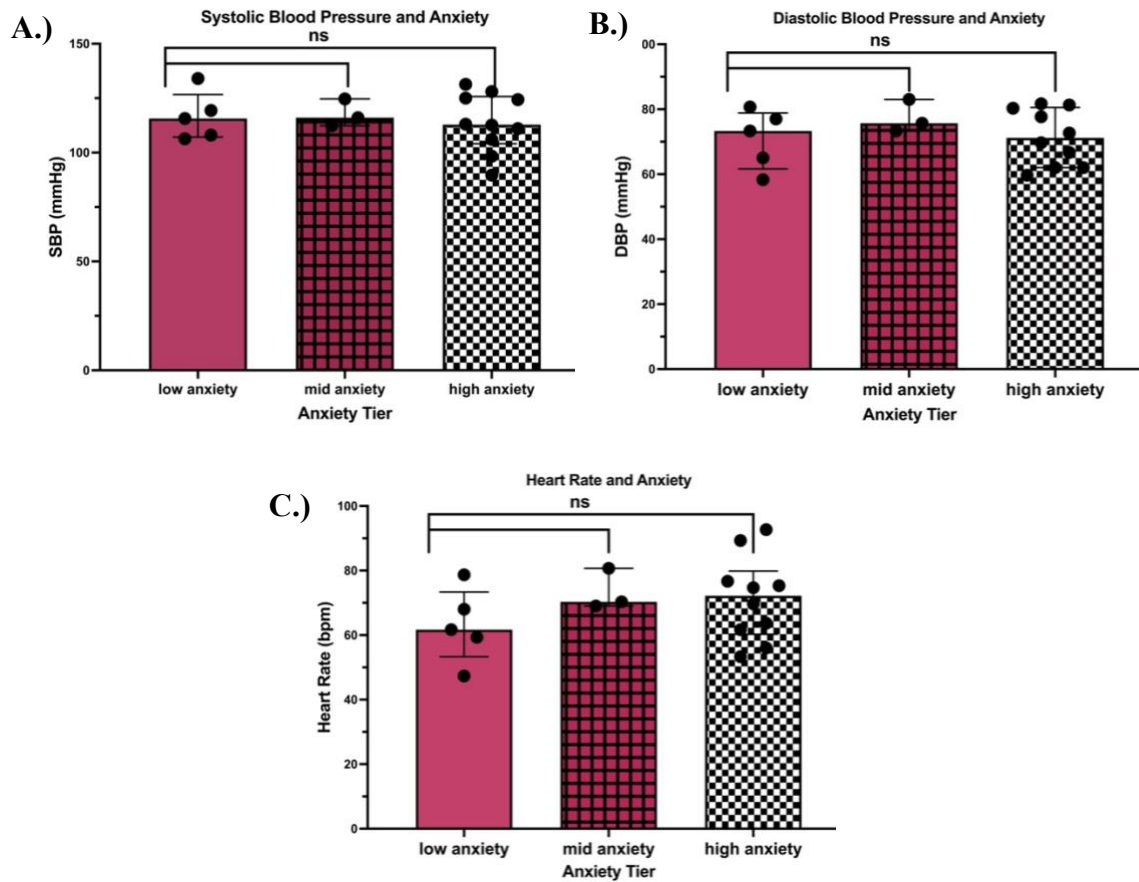


**Figure 5: Body Composition**

Scatter-bar plot of mean arterial pressure plotted for queer and heterosexual participants. ns indicates no significant difference ( $p > 0.05$ , one way ANOVA, queer  $n = 18$ , heterosexual  $n = 24$ ).

### **Analysis of Psychosocial Factors with Blood Pressures**

We stratified LGB identifying individuals into tertiles for stress and anxiety scores. Subsequently, we compared the SBP, DBP, and mHR between the highest and lowest tertiles. We found no significant difference in any cardiovascular indices between tertiles.



**Figure 6: Psychosocial Factors with Cardiovascular Indices**

A) Scatter-bar plot of systolic blood pressure plotted against anxiety among queer participants. B) Scatter-bar plot of diastolic blood pressure plotted against anxiety among queer participants. C) Scatter-bar plot of heart rate plotted against anxiety among queer participants. ns indicates no significant difference ( $p > 0.05$ , one way ANOVA, post-hoc Tukey, low anxiety  $n = 5$ , moderate anxiety  $n = 3$ , high anxiety  $n = 10$ ).

## CHAPTER 4: DISCUSSION

The purpose of this study was to investigate cardiovascular health, stress, anxiety, depression, and physical activity status among healthy young adults. Moreover, we aimed to interrogate differences in these variables based on sexual orientation, surveying young adults between 18–35 who are cisgender and who identify as lesbian, gay, or bisexual (LGB) or heterosexual. Previous work indicates greater risk of HTN among sexual minority adults (Everett and Mollborn 2013, Lopez Castillo, Tfirm et al. 2021), related to increased maladaptive coping behaviors (Schuler and Collins 2019) and minority stress (Caceres, Sharma et al. 2023). However, much of this work was done in a retrospective fashion. We sought to further this burgeoning area of study through cross-sectional surveys and cardiovascular and body composition measurements. Moreover, our study seeks to understand HTN prevalence in a sample of young adults, compared to literature that primarily examines adults over 30.

We first identified that LGB participants in this sample do not demonstrate greater cardiovascular risk when compared to heterosexual participants, having similar blood pressure, heart rate, and waist-to-hip ratios. LGB participants in this study also do not demonstrate increased maladaptive coping behaviors. While we found no significant difference in blood pressure, these data are from a sample of particularly young adults in a principally liberal area of the US, who all report moderate to vigorous cardiovascular exercise on a weekly basis. Living within a more liberal area is likely to be an ameliorating factor for minority-related stressors and thus may contribute to a decrease in CVD risk (Hatzenbuehler, Keyes et al. 2009). Moreover, while some previous studies

have found that sexual minority individuals are at higher risk of HTN, some have also failed to find HTN differences among subgroups of sexual minority adults compared to heterosexual individuals (Veliz, McCabe et al. 2020, Sharma, Bhargava et al. 2022) (Sharma et al, 2023, Veliz et al, 2021). The heterogeneity in our sample with respect to gender identity and the relatively small sample size may underlie our observed lack of blood pressure difference. A primary mechanism thought to contribute to increased CVD risk seen among sexual minority adults is increased maladaptive coping behaviors (Foley, Stanton et al. 2022). We did not observe differences in the number of days per week alcohol is consumed or tobacco use status between LGB and heterosexual participants in our study. These findings suggest that the participants in our study may not display the maladaptive coping behaviors thought to increase CVD risk, which may further explain the observed lack of difference in BPs.

Stress and anxiety scores are significantly higher among LGB participants compared to heterosexual participants. These data confirm previous studies finding elevated levels of stress in sexual minority individuals (Meyer 2003, Cohen, Blasey et al. 2016, Poteat and Toribio 2023). These data highlight a population in need of mental health support. Considering the consensus across studies that sexual minority adults are at greater risk of developing CVD (Caceres, Brody et al. 2018, Lopez Castillo, Tfirm et al. 2021, Caceres, Ancheta et al. 2022, Sharma, Bhargava et al. 2022) and are less likely to be treated (Sharma, Bhargava et al. 2022), we believe these data point towards a potential critical time point for a preventative mental health intervention to potentially mitigate future HTN development and CVD risk. Through excess cortisol and NE, increased stress

and anxiety increases CVD risk, particularly HTN.

Contrary to our hypotheses, we found no significant difference in minutes of moderate to strenuous cardiovascular exercise per week between the two groups. Interestingly, we found that minutes of moderate to strenuous cardiovascular exercise has a significant negative correlation with anxiety scores among LGB, but not heterosexual, participants. This finding highlights how exercise is a particularly salient ameliorating factor for mental health among young, healthy LGB individuals. This study adds to the existing literature indicating the need for intervention increasing physical activity participation among sexual minorities. Anxiety scores are still higher among LGB participants despite this strong correlation, suggesting the need for additional mental health support for sexual minority young adults.

### **Limitations**

There are several limitations to this study both in design and technical execution. The cross-sectional approach to this study is limited compared to a longitudinal design that would more thoroughly interrogate these findings. Additionally, our assessment of stress, anxiety, and depression did not consider individual differences in susceptibility to stressors (Rosner, Tuscher et al. 2024) nor did it directly measure minority stress. Waist to hip measurements, while superior to BMI, are not considered the gold standard of body composition assessment. Similarly, self-reported physical activity levels are limited compared to the most reliable method of accelerometry (Serra, Balraj et al. 2017). Our study lacks direct measures of an individual's stress response such as muscle sympathetic nerve activity or plasma NE levels which are strongly correlated to CVD risk (Cohn,

Levine et al. 1984). A power analysis suggests that we would need 45 participants per group (queer and heterosexual) to be appropriately powered to detect a difference in SBP suggesting we may be underpowered. Moving forward, we will be recruiting 100 participants for this study.

**APPENDIX**

**Appendix A: Demographics and Health History Questionnaire**

Q0 Please enter your participant number

---

Q1 What is your gender? (Select multiple is possible)

- Agender (1)
- Genderqueer (2)
- Man (3)
- Nonbinary/nonconforming (4)
- Two-spirit (5)
- Woman (6)
- I self-describe as (7) \_\_\_\_\_
- Prefer not to answer (8)

Q2 Transgender is an umbrella term that refers to people whose gender identity or expression differs from those typically associated with their assigned sex at birth. These identities may include nonbinary people, trans men, trans women, people,

trans men, trans women, people who are Two-Spirit, as well as many more possibilities. Do you identify as transgender?

- Yes (1)
- No (2)
- Prefer not to answer (3)
- 

Q3 Sexual orientation: Which of the following best describes how you think of yourself? (Select multiple is possible)

- Asexual (1)
- Bisexual (2)
- Gay (3)
- Lesbian (4)
- Pansexual (5)
- Queer (6)
- Questioning (7)
- Straight/heterosexual (8)
- I self-describe as (9) \_\_\_\_\_
- Prefer not to say (10)
-

Q4 Race (Select multiple is possible)

- American Indian or Alaskan Native (1)
  - Asian (2)
  - Black or African American (3)
  - Native Hawaiian or other Pacific Islander (4)
  - White (5)
  - I am racialized as (6) \_\_\_\_\_
- 

Q5 Ethnicity

- Latiné (1)
  - Not Latiné (2)
- 

Q6 Age

\_\_\_\_\_

---

Q7 How tall are you without shoes (in feet and inches)?

\_\_\_\_\_

---

Q8 Approximately how much do you currently weight without shoes on (in pounds)?

\_\_\_\_\_

Q9 Would you say your health is Excellent, Very Good, Good, Fair, or Poor

- Excellent (1)
- Very Good (2)
- Good (3)
- Fair (4)
- Poor (5)
- Refused (6)
- Don't Know (7)

Q10 Has a doctor or medical professional ever told you that you that have high blood pressure or hypertension?

- Yes (1)
- No (2)

Q11 If yes, are you currently taking any medicine for your high blood pressure?

Yes (1)

No (2)

---

Q12 Has a doctor or medical professional ever told you that you had a heart attack, coronary, or myocardial infarction?

Yes (1)

No (2)

---

Q13 Has a doctor or medical professional ever told you that you have a congenital heart disease?

Yes (1)

No (2)

---

Q14 Has a doctor or medical professional ever told you that you have had heart failure, congestive heart failure, or coronary artery disease (CAD)?

Yes (1)

No (2)

---

Q15 Has a doctor or medical professional ever told you that you had chronic renal or kidney failure?

Yes (1)

No (2)

---

Q16 Has a doctor or medical professional told you that you have an active infection?

Yes (1)

No (2)

---

Q17 Has a doctor or medical professional told you that you have a chronic illness?

Yes (1)

No (2)

---

Q18 Are you currently pregnant?

Yes (1)

No (2)

---

Q19 Do you use tobacco products?

- Never (1)
  - Yes, but I stopped (2)
  - Yes, I currently use tobacco products (3)
- 

Q20 In the past year how many days per week, per month, or per year did you consume alcohol?

\_\_\_\_\_

**End of Block: Default Question Block**

---

**Appendix B: Physical Activity Questionnaire**

Q0 Please enter your participant number

\_\_\_\_\_

-----

Q1 On average, how many days per week do you engage in moderate to strenuous cardiovascular exercise (like a brisk walk)? (Choose One)

0 (1)

1 (2)

2 (3)

3 (4)

4 (5)

5 (6)

6 (7)

7 (8)

-----

Q2 On average, how many minutes per week do you engage in moderate to strenuous cardiovascular exercise (like a brisk walk)? (write in)

\_\_\_\_\_

-----

Q3 How many days a week do you perform muscle strengthening exercises, such as bodyweight exercises or resistance training? (Choose One)

- 0 (1)
- 1 (2)
- 2 (3)
- 3 (4)
- 4 (5)
- 5 (6)
- 6 (7)
- 7 (8)
- 

Q4 On average, how many minutes per week do you engage in resistance training exercise? (write in)

\_\_\_\_\_

---

Q5 Are you regularly physically active? Note: For activity to be regular, it must add up to a total of 30 minutes or more per day and be done at least 5 days per week.

- Yes (1)
- No (2)

*Skip To: Q8 If Are you regularly physically active? Note: For activity to be regular, it must add up to a total... = Yes*

*Skip To: Q6 If Are you regularly physically active? Note: For activity to be regular, it must add up to a total... = No*

---

Q6 If you are currently NOT physically active, do you intend to be in the next 30 days?

- Yes (1)
- No (2)

*Skip To: Q7 If If you are currently NOT physically active, do you intend to be in the next 30 days? = No*  
*Skip To: QID9 If If you are currently NOT physically active, do you intend to be in the next 30 days? = Yes*

---

Q7 Do you intend to become physically active within the next 6 months?

- Yes (1)
- No (2)

*Skip To: QID9 If Do you intend to become physically active within the next 6 months? = Yes*  
*Skip To: QID9 If Do you intend to become physically active within the next 6 months? = No*

---

Q8 Have you been physically active for more than 6 months?

- Yes (1)
  - No (2)
- 

Instructions: The following set of questions will ask about you attitudes and feelings towards physical activity. Please select the answer that generally describes how you feel about physical activity

---

Q10 I look forward to physical activity

- Strongly Disagree (1)
  - Disagree (2)
  - Neither agree nor disagree (3)
  - Agree (4)
  - Strongly agree (5)
- 

Q11 Physical activity is a chore

- Strongly Disagree (1)
  - Disagree (2)
  - Neither agree nor disagree (3)
  - Agree (4)
  - Strongly agree (5)
-

Q12 I do not enjoy physical activity

- Strongly Disagree (1)
  - Disagree (2)
  - Neither agree nor disagree (3)
  - Agree (4)
  - Strongly agree (5)
- 

Q13 Physical activity is very important to me

- Strongly Disagree (1)
  - Disagree (2)
  - Neither agree nor disagree (3)
  - Agree (4)
  - Strongly agree (5)
-

Q14 Life is more fulfilling as a result of physical activity

- Strongly Disagree (1)
  - Disagree (2)
  - Neither agree nor disagree (3)
  - Agree (4)
  - Strongly agree (5)
- 

Q15 Physical activity is pleasant

- Strongly Disagree (1)
  - Disagree (2)
  - Neither agree nor disagree (3)
  - Agree (4)
  - Strongly agree (5)
-

Q16 I dislike the thought of doing regular physical activity

- Strongly Disagree (1)
  - Disagree (2)
  - Neither agree nor disagree (3)
  - Agree (4)
  - Strongly agree (5)
- 

Q17 I would arrange or change my schedule to participate in physical activity

- Strongly Disagree (1)
  - Disagree (2)
  - Neither agree nor disagree (3)
  - Agree (4)
  - Strongly agree (5)
-

Q18 I have to force myself to participate in physical activity

- Strongly Disagree (1)
  - Disagree (2)
  - Neither agree nor disagree (3)
  - Agree (4)
  - Strongly agree (5)
- 

Q19 To miss a day of physical activity is a relief

- Strongly Disagree (1)
  - Disagree (2)
  - Neither agree nor disagree (3)
  - Agree (4)
  - Strongly agree (5)
-

Q20 Physical activity is a high point in my day

- Strongly Disagree (1)
  - Disagree (2)
  - Neither agree nor disagree (3)
  - Agree (4)
  - Strongly agree (5)
- 

Q21 Physical fitness is a set of attributes that are either health- or skill- related and relates one's ability to perform physical activity. According to this definition, how would you rate your level of physical fitness?

- Excellent (1)
  - Very Good (2)
  - Good (3)
  - Fair (4)
  - Poor (5)
- 

Instructions: The next few questions will ask with whom and where do you engage in physical activity

---

Q23 Do you typically engage in physical activity with others? Select all that apply

- No, I workout alone (1)
- Yes, with a partner or a friend (2)
- Yes, with a group that is affiliated with a fitness facility (3)
- Yes, with a group/organization/club that is not affiliated with a fitness facility (e.g., local running or cycling clubs) (4)
- Yes, with my family (5)
- Yes, write in (6) \_\_\_\_\_
- 

Q24 In your community, do you often see others engaging in physical activity?

- Yes (1)
- No (2)
-

Q25 Safety is a determining factor when choosing if and/or where I engage in physical activity

- Strongly Disagree (1)
  - Disagree (2)
  - Neither agree nor disagree (3)
  - Agree (4)
  - Strongly agree (5)
- 

Q26 Where do you primarily engage in physical activity?

- At home (1)
- At work (2)
- At a fitness or recreation facility (i.e., gym, YMCA, etc...) (3)
- At a park (4)
- Outside my neighborhood (5)
- Other (write in answer) (6) \_\_\_\_\_

**End of Block: Default Question Block**

**Appendix C: Depression, Anxiety and Stress Questionnaire**

Q0 Please enter your participant number

---

-----

Please read each statement and circle a number 0, 1, 2 or 3 which indicates how much the statement applied to you over the past week. There are no right or wrong answers. Do not spend too much time on any statement. The rating scale is as follows: 0 Did not apply to me at all 1 Applied to me to some degree, or some of the time 2 Applied to me to a considerable degree or a good part of time 3 Applied to me very much or most of the time

-----

Q1 I found it hard to wind down The rating scale is as follows: 0 Did not apply to me at all 1 Applied to me to some degree, or some of the time 2 Applied to me to a considerable degree or a good part of time 3 Applied to me very much or most of the time

0 (5)

1 (6)

2 (7)

3 (8)

-----

Q2 I was aware of dryness of my mouth The rating scale is as follows: 0 Did not apply to me at all 1 Applied to me to some degree, or some of the time 2 Applied to

me to a considerable degree or a good part of time 3 Applied to me very much or most of the time

0 (1)

1 (2)

2 (3)

3 (4)

---

Q3 I couldn't seem to experience any positive feeling at all The rating scale is as follows: 0 Did not apply to me at all 1 Applied to me to some degree, or some of the time 2 Applied to me to a considerable degree or a good part of time 3 Applied to me very much or most of the time

0 (1)

1 (2)

2 (3)

3 (4)

---

Q4 I experienced breathing difficulty (e.g. excessively rapid breathing, breathlessness in the absence of physical exertion) The rating scale is as follows: 0 Did not apply to me at all 1 Applied to me to some degree, or some of the time 2

Applied to me to a considerable degree or a good part of time 3 Applied to me very much or most of the time

0 (1)

1 (2)

2 (3)

3 (4)

---

Q5 I found it difficult to work up the initiative to do things The rating scale is as follows: 0 Did not apply to me at all 1 Applied to me to some degree, or some of the time 2 Applied to me to a considerable degree or a good part of time 3 Applied to me very much or most of the time

0 (1)

1 (2)

2 (3)

3 (4)

---

Q6 I tended to over-react to situations The rating scale is as follows: 0 Did not apply to me at all 1 Applied to me to some degree, or some of the time 2 Applied to

me to a considerable degree or a good part of time 3 Applied to me very much or most of the time

0 (1)

1 (2)

2 (3)

3 (4)

---

Q7 I experienced trembling (e.g. in the hands) The rating scale is as follows: 0 Did not apply to me at all 1 Applied to me to some degree, or some of the time 2 Applied to me to a considerable degree or a good part of time 3 Applied to me very much or most of the time

0 (1)

1 (2)

2 (3)

3 (4)

---

Q8 I felt that I was using a lot of nervous energy The rating scale is as follows: 0 Did not apply to me at all 1 Applied to me to some degree, or some of the time 2

Applied to me to a considerable degree or a good part of time 3 Applied to me very much or most of the time

0 (1)

1 (2)

2 (3)

3 (4)

---

Q9 I was worried about situations in which I might panic and make a fool of myself  
The rating scale is as follows: 0 Did not apply to me at all 1 Applied to me to some degree, or some of the time 2 Applied to me to a considerable degree or a good part of time 3 Applied to me very much or most of the time

0 (1)

1 (2)

2 (3)

3 (4)

---

Q10 I felt that I had nothing to look forward to The rating scale is as follows: 0 Did not apply to me at all 1 Applied to me to some degree, or some of the time 2

Applied to me to a considerable degree or a good part of time 3 Applied to me very much or most of the time

0 (1)

1 (2)

2 (3)

3 (4)

---

Q11 I found myself getting agitated The rating scale is as follows: 0 Did not apply to me at all 1 Applied to me to some degree, or some of the time 2 Applied to me to a considerable degree or a good part of time 3 Applied to me very much or most of the time

0 (1)

1 (2)

2 (3)

3 (4)

---

Q12 I found it difficult to relax The rating scale is as follows: 0 Did not apply to me at all 1 Applied to me to some degree, or some of the time 2 Applied to me to a

considerable degree or a good part of time 3 Applied to me very much or most of the time

0 (1)

1 (2)

2 (3)

3 (4)

---

Q13 I felt down-hearted and blue The rating scale is as follows: 0 Did not apply to me at all 1 Applied to me to some degree, or some of the time 2 Applied to me to a considerable degree or a good part of time 3 Applied to me very much or most of the time

0 (1)

1 (2)

2 (3)

3 (4)

---

Q14 I was intolerant of anything that kept me from getting on with what I was doing The rating scale is as follows: 0 Did not apply to me at all 1 Applied to me to some

degree, or some of the time 2 Applied to me to a considerable degree or a good part of time 3 Applied to me very much or most of the time

0 (1)

1 (2)

2 (3)

3 (4)

---

Q15 I felt I was close to panic The rating scale is as follows: 0 Did not apply to me at all 1 Applied to me to some degree, or some of the time 2 Applied to me to a considerable degree or a good part of time 3 Applied to me very much or most of the time

0 (1)

1 (2)

2 (3)

3 (4)

---

Q16 I was unable to become enthusiastic about anything The rating scale is as follows: 0 Did not apply to me at all 1 Applied to me to some degree, or some of the

time 2 Applied to me to a considerable degree or a good part of time 3 Applied to me very much or most of the time

0 (1)

1 (2)

2 (3)

3 (4)

---

Q17 I felt I wasn't worth much as a person The rating scale is as follows: 0 Did not apply to me at all 1 Applied to me to some degree, or some of the time 2 Applied to me to a considerable degree or a good part of time 3 Applied to me very much or most of the time

0 (1)

1 (2)

2 (3)

3 (4)

---

Q18 I felt that I was rather touchy The rating scale is as follows: 0 Did not apply to me at all 1 Applied to me to some degree, or some of the time 2 Applied to me to a

considerable degree or a good part of time 3 Applied to me very much or most of the time

0 (1)

1 (2)

2 (3)

3 (4)

---

Q19 I was aware of the action of my heart in the absence of physical exertion (e.g. sense of heart rate increase, heart missing a beat) The rating scale is as follows: 0 Did not apply to me at all 1 Applied to me to some degree, or some of the time 2 Applied to me to a considerable degree or a good part of time 3 Applied to me very much or most of the time

0 (1)

1 (2)

2 (3)

3 (4)

---

Q20 I felt scared without any good reason The rating scale is as follows: 0 Did not apply to me at all 1 Applied to me to some degree, or some of the time 2 Applied to

me to a considerable degree or a good part of time 3 Applied to me very much or most of the time

0 (1)

1 (2)

2 (3)

3 (4)

---

Q21 I felt that life was meaningless The rating scale is as follows: 0 Did not apply to me at all 1 Applied to me to some degree, or some of the time 2 Applied to me to a considerable degree or a good part of time 3 Applied to me very much or most of the time

0 (1)

1 (2)

2 (3)

3 (4)

End of Block: Default Question Block

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**CURRICULUM VITAE**

