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# EXPLORING LESBIAN HEALTH DISPARITIES: SOCIAL AND STRUCTURAL PREDICTORS OF ADIPOSITY AND THE METABOLIC SYNDROME

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University of Pittsburgh, 2015

## ABSTRACT

Lesbians in the U.S. are disproportionately affected by overweight and obesity compared to heterosexual women. However, there is little public health research examining the possible explanations for the disparity. In addition, there are few studies that have examined the related sequelae of obesity, such as metabolic syndrome. Three studies were conducted using the Epidemiologic Study of HEalth Risk Among Women (ESTHER), a cross-sectional cardiovascular risk study of lesbian and heterosexual women from Pittsburgh, PA and surrounding areas. Study 1 examined the influence of gender nonconformity on body image and satisfaction as well as weight. Butch lesbians reported a smaller difference between their current and ideal figure compared to femme lesbians, lesbians who were "neither" butch nor femme, and heterosexual women, although we did not note any significant differences between the lesbian subgroups in terms of ideal figure. Butch lesbians had significantly higher odds of both overweight and obesity (AOR = 2.15 and 5.57, respectively). Study 2 explored predictors of waist-to-hip ratio (WHR) and BMI status. We did not find any difference between lesbians and heterosexuals in terms of WHR. The odds of lesbians being obese compared to normal weight were 1.63 times higher than the odds of heterosexuals being obese compared to normal weight (*p=0.013*). Being in a committed relationship was associated with significantly lower odds of overweight and obesity for heterosexual women but not for lesbians. Importantly, lesbians who reported gender discrimination had over three times higher odds of being obese (AOR = 3.122, *p*

< 0.001). Study 3 extended the lesbian health disparities literature by quantifying the differential risk of the metabolic syndrome between lesbians and heterosexuals. After controlling for several factors, lesbians had a 44% higher risk of having the metabolic syndrome than heterosexuals.

Future research is needed to examine potential mediators and additional moderators of the relationship between gender nonconformity, sexual orientation, and obesity and the metabolic syndrome. Given the serious public health consequences of both obesity and the metabolic syndrome, public health should commit greater resources to studying these health disparities among lesbians.

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## PREFACE

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# 1.0 INTRODUCTION

Almost every analysis of a probability or cohort sample that measures sexual orientation in the past decade or two has noted that lesbians have higher mean body mass index (BMI) or higher odds of being obese compared to their heterosexual counterparts. However, studies rarely go beyond merely describing the disparity. There is very little known about what else is different between lesbians and heterosexuals that predicts obesity. The fact that lesbians are more likely to be obese suggests that they may also be at higher risk of mortality compared to heterosexual women given what we know about the association between obesity and increased risks of morbidity and mortality. However, there are few studies that have examined whether lesbians experience disparities in downstream health effects, such as cardiovascular disease (CVD) or mortality. Given the substantial body of research describing the weight disparity between lesbian and heterosexual women, the next step in researching lesbian health is to further explore *why* lesbians are more likely to be obese. In addition, research needs to explore whether lesbians also experience disparities in other measures of health that are strongly associated with mortality.

## 1.1 OVERVIEW OF PROBLEM

Overweight and obesity are critical health problems in the U.S. with clear links to long-term, costly chronic diseases and late-life disability. Currently, 35.7% of the U.S. population is

obese (Flegal, Carroll, Kit, & Ogden, 2012), a rate that has risen from 9.6% in the National Health Examination Survey I from 1960-1962 (Flegal, Carroll, Kuczmarski, & Johnson, 1998). The estimated cost of obesity-related illnesses is greater than 20% of annual U.S. healthcare expenditures, and costs are expected to continue to rise given the high and increasing rates of childhood obesity (Glickman, Parker, Sim, Cook, & Miller, 2012). The latest age-adjusted mean BMI for women was 28.7 and 35.8% of women in the U.S. are obese (Flegal et al., 2012).

Obesity is an important public health issue because of its clear links to morbidity and mortality. Childhood and adolescent obesity is associated with greater risk for the development of diabetes, stroke, and premature mortality in adulthood, with hazard ratios ranging from 1.1-5.1 (Reilly & Kelly, 2011). Among adults, obesity (defined as Body Mass Index (BMI) > 29.9) and morbid obesity (defined as BMI > 34.9) are associated with greater all-cause mortality compared to normal weight individuals (Flegal, Kit, Orpana, & Graubard, 2013).

While obesity is increasing across the U.S. in general, its pattern of distribution indicates that the problem is not solely individual or genetic in nature. Rather, it is also a social disease, affecting certain social positions more than others. For example, while the overall obesity rate among women has remained steady since 1999, rates are increasing for African American and Mexican American women (Flegal et al., 2012). Although the prevalence of obesity is increasing for all income and education levels, the relationship between income, education, and obesity differs by sex. There is no relationship between income and education levels and obesity among men, but there is a negative relationship between both income and education and obesity among women (Ogden, Carroll, Kit, & Flegal, 2012). In addition, where one lives affects obesity rates. Neighborhood characteristics such as disorder (Glass, Rasmussen, & Schwartz, 2006; Whitaker et al., 2013), low socioeconomic status, (Dubowitz et al., 2012), racial segregation (Cozier et al.,

2014; Kirby, Liang, Chen, & Wang, 2012), and lack of healthy food options (Auchincloss et al., 2013; Dubowitz et al., 2012; Lopez, 2007) are all associated with higher rates of obesity.

**Table 1-1: Odds of Being Overweight and/or Obese - Results from Recent Studies Comparing Lesbians to Heterosexual Women**

| Sample | Adjusted OR (CI) | |
|---|---|---|
| | **Overweight** | **Obesity** |
| Women's Health Initiative, 1997-98 baseline (Valanis et al., 2000) | 1.25 (1.10, 1.40)† | |
| National Survey of Family Growth, 2002 (Boehmer et al., 2007) | 2.69 (1.40, 5.18) | 2.47 (1.19, 5.09) |
| California Women's Health Survey, 2001-2005 (Boehmer et al., 2009) | 2.39 (1.43, 3.99) | 4.11 (2.53, 6.69) |
| Massachusetts BRFSS, 2001-2008 (Conron et al., 2010) | 1.08 (0.83, 1.40) | 2.05 (1.56, 2.69) |
| Washington State BRFSS, 2003-2006 (Dilley et al., 2010) | 1.6 (1.3, 2.0)‡ | |
| Washington State BRFSS, 2003-2010, women age 50+ (Fredriksen-Goldsen et al., 2013) | [not calculated] | 1.42 (1.18, 1.71) |

† Overweight/obese defined as BMI≥27.3

‡ Overweight/obese defined as BMI≥25

### 1.1.1 Obesity Among Lesbians

Lesbians in the U.S. are disproportionately affected by overweight and obesity compared to heterosexual women (Aaron et al., 2001; S. B. Austin, Ziyadeh, Corliss, Haines, et al., 2009; Boehmer & Bowen, 2009; Boehmer, Bowen, & Bauer, 2007; Bowen, Balsam, & Ender, 2008;

Case et al., 2004; Conron, Mimiaga, & Landers, 2010; Dilley, Simmons, Boysun, Pizacani, & Stark, 2010; Fredriksen-Goldsen, Kim, Barkan, Muraco, & Hoy-Ellis, 2013). Initial data on the lesbian weight disparity came from convenience samples that compared lesbians to heterosexuals in the same sample or national data (Bowen et al., 2008). However, the recent inclusion of sexual identity questions in probability and large cohort samples has allowed better measurement of lesbian health (Case et al., 2004; Conron et al., 2010; Dilley et al., 2010; Fredriksen-Goldsen, Kim, et al., 2013). These population-based samples confirm that lesbians have higher odds of overweight and obesity compared to heterosexual women. For example, data from the Massachusetts Behavioral Risk Surveillance Sample (BRFSS) found that lesbians had 2.05 greater odds of being obese compared to heterosexual women (Conron et al., 2010) and the Oregon BRFSS found that lesbians had 1.6 greater odds of being overweight (Dilley et al., 2010). The weight disparity persist among women age 50 and older, with lesbian women having 1.42 odds of being obese. Table 1.1 provides a more detailed illustration of the consistency and magnitude of the weight disparity.

### 1.1.2 Predictors of Obesity Among Lesbians

Although the existing literature makes clear that lesbians are at higher risk of obesity, there is little research examining the possible explanations for the disparity. There is no clear empirical evidence that lesbians differ from heterosexuals in eating and exercise behaviors (Valanis et al., 2000). One of the only studies to look at mediators of weight disparities between lesbians and heterosexual women found that energy intake and expenditure did not mediate the relationship between sexual orientation and weight (Boehmer & Bowen, 2009). Rates of

sedentary activity do not appear to differ between lesbians and heterosexuals (Aaron et al., 2001; Dilley et al., 2010) and, if anything, lesbians appear to be *more* physically active than heterosexuals, (Aaron et al., 2001; Case et al., 2004) although Dilley et al. (2010) and Conron et al. (2010) found that lesbians reported more physical limitations (Conron et al., 2010; Dilley et al., 2010). However, lesbians do differ from heterosexuals on some key behavioral and psychological factors associated with obesity. Lesbians appear to have both higher rates of binge eating disorder (S. B. Austin, Ziyadeh, Corliss, Rosario, et al., 2009; Heffernan, 1996) and higher rates of heavy alcohol consumption compared to heterosexuals (Aaron et al., 2001; Case et al., 2004; Valanis et al., 2000). Lesbians also report greater depression (Case et al., 2004; Valanis et al., 2000). Thus, any exploration into the reasons why lesbians have higher rates of obesity should examine the relationship between these disparities and weight.

Given that obesity is related to structural factors such as social position and place of residence, researchers should also consider social determinants as contributors to the lesbian weight disparity. Lesbians are both sexual minorities and women, two social groups that experience systematic disadvantages in society. As a group, LGBT individuals report significant levels of discrimination (McCabe, Bostwick, Hughes, West, & Boyd, 2010). Lesbians report greater levels of everyday and lifetime discrimination than other women (Mays & Cochran, 2001). A sample of older lesbians showed that sexual orientation discrimination remained salient even in later life, although it appears to taper off as lesbians age, presumably because objectification as women decreases (Averett, Yoon, & Jenkins, 2011).

### 1.1.3 Other Measures of Adiposity

BMI is the most common metric used to describe the lesbian weight disparity, but it may not be the only measure that is useful in accurately capturing risk related to adiposity (Heymsfield & Cefalu, 2013). BMI is the best measure of relative weight (Keys, Fidanza, Karvonen, Kimura, & Taylor, 1972) as it serves as a surrogate measure of fatness (Prentice & Jebb, 2001). As a normal part of aging, lean body mass decreases as fat increases. BMI can remain constant and fail to measure this important change (Prentice & Jebb, 2001). Visceral fat, the type that accumulates around the internal organs, has a clear association with metabolic complications, whereas lower body fat is actually protective against some cardiovascular risk factors (Jensen, 2008). The exact mechanisms of abdominal fat on health are unknown, but researchers hypothesize that abdominal fat is more metabolically active and therefore releases inflammatory substances (Jensen, 2008).

Other measures of adiposity may be as important as BMI in predicting morbidity and mortality. Higher waist circumference (WC) is associated with higher mortality risk, even among individuals at normal BMI (Pischon et al., 2008). Measures of abdominal obesity perform better than BMI in predicting morbid conditions such as renal function decline (Oh et al., 2013) and hypertension and dyslipidemia (Janssen, Katzmarzyk, & Ross, 2004). A recent meta-analysis of BMI, WC, and waist-to-hip ratio (WHR) indicated that each measure has a different relationship with all-cause mortality. BMI and mortality have a u-shaped relationship, with normal weight and obese individuals having higher risk of mortality compared to overweight individuals. WC's mortality curve was J-shaped and WHR was monotonically associated with mortality (Carmienke et al., 2013). Thus, both BMI and other measures of adiposity are important to examine when assessing risk among populations. However, we have little information as to how

lesbians differ from heterosexuals on these adiposity measures. Only one study using a convenience sample found that lesbians had higher WC and WHR compared to heterosexual women (S. A. Roberts, Dibble, Nussey, & Casey, 2003).

### 1.1.4 Metabolic Syndrome

Obesity is strongly associated with the metabolic syndrome (S. Grundy, 2004), a clustering of cardiovascular disease risk factors, is defined as the presence of insulin resistance or diabetes along with high blood pressure, high plasma triglycerides and/or low HDL cholesterol, and abdominal obesity (S. M. Grundy, Brewer, Cleeman, Smith, & Lenfant, 2004). In a recent systematic review, the MetS was associated with a 2.40 RR for CV death and 1.58 RR for all-cause mortality (Mottillo et al., 2010).

Given that a simple BMI measure might not capture the full risk of adiposity on morbidity and mortality, the metabolic syndrome might be a more accurate, comprehensive predictor to examine, although researchers continue to examine whether the effect of the metabolic syndrome is greater than its components alone (Mottillo et al., 2010). Approximately one-quarter of obese individuals (as defined by BMI) are considered metabolically healthy (Hamer & Stamatakis, 2012). Metabolically healthy individuals have no higher risk of cardiovascular disease (CVD) or mortality, regardless of whether they are obese or normal weight, and conversely, men and women who are metabolically unhealthy are at increased risk of all-cause mortality, regardless of whether they are obese or normal weight. In comparing the predictive ability of metabolic health compared to WC, only metabolic health is predictive of CVD (Hamer & Stamatakis, 2012).

The distribution of the metabolic syndrome across the population is not uniform. For example, population-based samples investigating the metabolic syndrome have found that prevalence is higher among certain racial/ethnic groups, such as Mexican-Americans (Park 2003, Razzouk 2009) or Hispanics in general (Jordan 2012), and other research shows that metabolic syndrome is more prevalent among women compared to men within certain racial/ethnic groups (Ford 2002). Rates of the metabolic syndrome among women increase over age 50, providing evidence that hormonal protection against developing the metabolic syndrome is reduced once women reach menopause (Razzouk 2009, Romaguera 2010). Evidence from the prospective Whitehall II study in England demonstrates a relationship between both low socioeconomic status and chronic work stress and the metabolic syndrome. Heath behaviors contributed to little of the social patterning of the metabolic syndrome (Brunner et al., 1997; Chandola, Brunner, & Marmot, 2006). Unfortunately, there is no research on metabolic syndrome among lesbians.

## 1.2 THEORETICAL MODELS

Given the evidence suggesting social causes of both obesity and the metabolic syndrome, a useful theoretical model to explain how lesbian identify might produce obesity and risk of the metabolic syndrome is Meyer's Minority Stress Model (I. H. Meyer, 1995, 2003b). Minority Stress Model assumes that 1) stressors as a result of sexual orientation are additive, above and beyond the stressors encountered and experienced by all individuals in society; 2) chronic, as the stressors are produced by stable underlying social norms and structures; and 3) socially based, stemming not from individual characteristics but from the larger societal forces (I. H. Meyer, 2003b).

In his model, Meyer distinguishes between distal and proximal stressors. Distal stressors are those that relate not to the individual in question but rather the group membership of that person. Thus, discrimination against someone because she is a lesbian is not related to that person's individual characteristics, but rather her lesbian status. With this type of discrimination, her self-identity as a lesbian is irrelevant; it is that the discriminating person or institution *perceives* her to be a lesbian that is the key factor. For example, many women may present or behave in ways that are consistent with the broader cultural consensus of what it means to be a lesbian without personally labeling themselves as one, but yet experience the same kinds of discrimination as women who do self-identify as lesbians. Meyer's concept of proximal stressors, then, relates to how the LGBT individual internalizes these distal stressors. Unlike distal discrimination, this internalization is related to how LGBT individuals identify. Distal stressors can cause internalized homophobia, concealment of one's status because one anticipates harm, and vigilance in social situations because one expects negative treatment.

The conceptualization and application of this model focuses largely on the emotional response to stressors. In defining minority stress related to the LGBT population, Meyer draws heavily upon the psychological literature that enumerates the ways in which the individual internalizes and responds to stress. Allison (1998) summarized research related to prejudice due to social group membership at several levels. At the environmental level, prejudice creates stress through either major or chronic experiences of discrimination. It also creates greater stress by indirectly impacting one's ability to access major resources, such as housing or employment. At the psychological level, stress is created through the individual's appraisal of prejudice, meaning how the individual interprets and internalizes prejudice. Here, an individual's perception of the availability of resources to deal with stress is also important. Restriction of resources at the

environmental level due to group membership can be harmful at the psychological level if the individual perceives that fewer resources are available. And, prejudice can interact at the biological level, resulting in depression or anger as a response to stress.

Minority Stress Model constructs impact mental health outcomes. For example, internalized homophobia is directly linked to psychological distress among men who have sex with men (MSM) (Wong, Schrager, Holloway, Meyer, & Kipke, 2014) and substance use among lesbians (Lehavot & Simoni, 2011). Reduction of internalized homophobia over time is also related to a lower prevalence of psychological distress (Herrick, Stall, Goldhammer, Egan, & Mayer, 2014). There is also limited evidence of the relationship between distal and proximal stressors. Affiliation with a non-gay affirming religion is associated with higher levels of internalized homophobia (Barnes & Meyer, 2012) and gay men in legally recognized marriages report less internalized homophobia (Riggle, Rostosky, & Horne, 2010). However, the model has not been well utilized to examine distal stressors' impact on physical health disparities. A small body of research has used this model to examine physical outcomes, such as HIV serostatus among gay men and mortality among the LGB population (Halkitis, Wolitski, & Millett, 2013; Hatzenbuehler et al., 2014; Maulsby et al., 2014). Thus, the notion that the stressor of being a sexual minority contributes to obesity among lesbians is viable. One recent study using an online sample of lesbians found a relationship between heterosexist discrimination and obesity, but to our knowledge this is the only study that has attempted to link distal stressors to biological outcomes among lesbians (Mereish, 2014).

Other theoretical frameworks can supplement the biological orientation that Minority Stress Model lacks. Krieger's (2001) ecosocial theory posits that health is the result of an intricate interplay of social and biological processes across multiple levels and time points. The

notion of embodiment is a key construct in ecosocial theory in that it describes how individuals literally incorporate the physical and social world into their own bodies. In addition, the pathways by which individuals incorporate these processes include not only the social structure of their environment but also their own unique biology, which can be innate or shaped by history and social context (Krieger, 2001). Like ecosocial theory, life course epidemiology also explores the complex interplay of biological and social systems, and the transmission of risk by generations (Ben-Shlomo & Kuh, 2002; Kuh, Ben-Shlomo, Lynch, Hallqvist, & Power, 2003). Finally, syndemics theory extends both the Minority Stress Model and concepts of embodiment and life course perspective by describing how early adversity due to sexual minority status produces co-occurring, multiplicative behavioral and psychosocial health issues that produce biological consequences (Singer & Clair, 2003; Stall et al., 2003).

## 1.3 CHALLENGES IN MEASURING THE DISCRIMINATION CONSTRUCT

There are a number of conceptual challenges when measuring discrimination. First is the issue of what kind of discrimination is measured. *Institutional discrimination* refers to laws or policies enacted by legislative entities or other organizations such as employers. *Structural discrimination* refers to the broader social forces that produce and maintain discrimination. *Interpersonal discrimination* is that which is enacted from individual to individual (Krieger, 2000). Second, discrimination can happen on the basis of multiple stigmatized social positions. Individuals can be both black and female, or low-income and disabled, making it difficult to tease out whether discrimination based on one status, or both (or more) is related to disease.

Whether or not a person realizes they are subject to discrimination is another measurement challenge. Structural or institutional discrimination may be impossible for an individual to perceive, and subsequently report (Krieger, 2000; I. H. Meyer, 2003a). Still, the differential allocation of resources to minority groups has been demonstrated to have adverse health effects. Also, research by Hatzenbueller (described below) suggests that it is possible to measure the direct effect of institutional discrimination on individual health (Hatzenbuehler et al., 2014).

Perceived discrimination, or subjective discrimination (Meyer 2003), is also challenging to measure because there is a subtle distinction between what people experience and what they perceive. Individuals may experience discrimination but not attribute it as such. Indeed, there is empirical evidence to suggest that members of minority groups are less likely to attribute an experience as discrimination, theoretically in order to preserve self-esteem (Allison, 1998; I. H. Meyer, 2003b). The attribution of discrimination is also not homogenous across a marginalized group. Not all lesbians will receive the same amount of discrimination, and not all lesbians will attribute it in the same way. Alternately, an individual may have a non-discriminatory experience but attribute it to discrimination.

Similarly, perceived discrimination is distinct from self-reported experiences of discrimination, as self-reported discrimination is only what people are "willing or able to report" (p. 1491) versus what they consciously or unconsciously perceive (Krieger et al., 2010). Even unconscious perception of discrimination is associated with risk of hypertension among African Americans (Krieger et al., 2010). Thus, even if a population does not perceive discrimination it is plausible that they are still impacted by it and one would expect even imperceptible discrimination to contribute to health disparities. To what extent researchers are able to craft

measures of discrimination that accurately capture the breadth and depth of an individual's experiences, perceptions, and attributions is an important methodological consideration.

Finally, it is important to note that reported experiences of discrimination among individuals who are overweight could be capturing weight discrimination in addition to, or instead of, sexual orientation discrimination (Quinn & Crocker, 1998). This is an important methodological note, as weight discrimination is related to BMI and mental health correlates of obesity (Dutton et al., 2014; Hatzenbuehler, Keyes, & Hasin, 2009), and can increase compensatory eating behaviors. For example, overweight women exposed to a weight-stigmatizing video subsequently consumed more calories than overweight women who watched a neutral video and normal weight women who watched either the stigmatizing or neutral video (Schvey, Puhl, & Brownell, 2011). However, studies that control for weight discrimination still show an association between other types of discrimination and weight (Cozier, Wise, Palmer, & Rosenberg, 2009; Gee, Ro, Gavin, & Takeuchi, 2008), suggesting that discrimination based on other social positions influences weight independently of weight discrimination.

## 1.4 CAUSAL MECHANISMS

Given the existing lesbian literature, and studies of discrimination's effect on other social groups, there is evidence to support multiple pathways by which discrimination can contribute to obesity among lesbians. For the purposes of this review, I focus on discrimination on the basis of sexual orientation as the main stressor that ultimately impacts lesbian health. The literature discussed below explains in detail the evidence for the relationships between the constructs in the model. Specifically, I present evidence for:

1) The impact of institutional and structural discrimination on political and economic factors that influence the physical and mental health of the LGBT population;
2) Potential psychosocial and behavioral mediators of the link between discrimination and obesity among lesbians, focusing on depression, heavy alcohol use, and binge eating disorder, three issues that are overrepresented in lesbians compared to heterosexual women;
3) The direct biological effect of discrimination on weight, as studied in racial and ethnic minority groups.
4) Social and cultural contributors related to being a lesbian in society, such as availability of social support, connection to LGBT community, and gender conformity, that exacerbate and/or moderate the relationships between sexual orientation, obesity, and discrimination.

### 1.4.1 Institutional/Structural Discrimination and Obesity

*Access to resources:* Discrimination can impact access to resources that allow one to enact healthy behaviors or alleviate the health effects of obesity (Phelan, Link, Diez-Roux, Kawachi, & Levin, 2004). Discriminatory laws and policies that prohibit same-sex marriage and institutional policies that limit the provision of healthcare benefits to same-sex couples influence health by denying significant financial benefits and reducing access to healthcare. In fact, lack of health insurance is associated with higher BMI among lesbians (Boehmer & Bowen, 2009) and lesbians are less likely than heterosexual women to have health insurance (Dilley et al., 2010). Yet, healthcare screening and treatment is crucial to addressing the obesity epidemic (Glickman et al., 2012). On a smaller scale, institutional discrimination such as lack of access to family gym

memberships (because same sex households are not considered families) has been cited as a barrier to physical activity in lesbians (Brittain, Baillargeon, McElroy, Aaron, & Gyurcsik, 2006).

*Civil rights:* Marriage confers health benefits to the general population, presumably because it offers financial and other legal benefits. Historically, same-sex marriage has been prohibited in the U.S., but recent rapid change in state and federal laws means that all but 13 states now allow same-sex marriage (Human Rights Campaign, 2015). In the National Health Interview Survey, same-sex cohabitating partners reported poorer health than opposite-sex married partners, after controlling for the effects of socioeconomic status, which the authors hypothesized was due to discrimination and/or the inability to access the benefits of marriage (Liu, Reczek, & Brown, 2013).

*Relationship to physical and mental health:* Institutional discrimination, such as laws and policies, and anti-gay stigma affect the morbidity and mortality of the LGBT population. The enactment of same-sex marriage bans in certain states is associated with increases in mood disorders, generalized anxiety disorder, alcohol use disorder, and psychiatric comorbidity among the LGB population (Hatzenbuehler, McLaughlin, Keyes, & Hasin, 2010). The first study to examine the physical health effects of structural discrimination found that LGB individuals living in high anti-gay stigma communities had a mortality hazard ratio of 3.03, which translated into a 12-year shorter life expectancy. Living in a high-anti gay community was hazardous for all adults, but the effect was stronger for LGB individuals (Hatzenbuehler et al., 2014).

Support and acceptance of the LGBT population appears to influence behavioral and psychological risk factors. Living in counties with a higher proportion of schools that include sexual orientation in anti-bullying policies is associated with fewer suicide attempts among

lesbian and gay high school students in Oregon (Hatzenbuehler & Keyes, 2013). In the same sample, living in counties with a religious climate that supported homosexuality was associated with lower rates of alcohol abuse among lesbian and gay youth (Hatzenbuehler, Pachankis, & Wolff, 2012). Living in a state with a higher proportion of same sex couples also appears to be protective against major depression and generalized anxiety disorder (Hatzenbuehler, Keyes, & McLaughlin, 2011).

### 1.4.2 Depression & Obesity

*Depression in lesbians:* Research on lesbians consistently shows that they are more likely to be depressed than heterosexual women. Data from the National Comorbidity Survey showed that 34.5% of women with same-sex partners met the criteria for major depression versus 12.9% of women with opposite sex partners (Gilman et al., 2001). In the Women's Health Initiative, lesbians and bisexual women's odds ratio of reporting depressive symptoms was 1.22 compared to heterosexual women (Valanis et al., 2000). In Frederiksen-Goldsen's (2012) sample of LGBT adults age 50 and older, 27.3% of lesbians reported depressive symptoms.

*Depression and obesity*: The relationship between depression and obesity is not simple. Cross-sectional studies are mixed in terms of finding significant associations between depression and obesity (Faith, Matz, & Jorge, 2002). However, longitudinal studies indicate that the relationship is bidirectional. A meta-analysis of longitudinal studies found that obese individuals had a 55% greater chance of developing depression, and depressed individuals had a 58% risk of becoming obese (Luppino et al., 2010). The relationship differs by sex. Among adults in the Baltimore Longitudinal Study on Aging, weight gain did not predict depression's trajectory, but depression did predict weight gain trajectory. Specifically, women who scored high on the

depression scale were more likely to gain weight over time compared to women who scored low, but there was no difference for men (Sutin & Zonderman, 2012)

The effects of depression also extend to obesity's sequelae, with depression increasing risk for cardiovascular disease (Vaccarino et al., 2007; Whang et al., 2009). For example, there is a multiplicative effect of having both depression and diabetes on cardiovascular mortality. In the Nurses Health Study, the risk ratio for CVD morality for women with only depression was 1.81, with only diabetes, 2.67, but with both, 5.38 (Pan et al., 2011).

One hypothesized mechanism to explain this relationship is inflammation. Depression is associated with higher levels of C-reactive protein (CRP) and interleukin-6 (IL-6), both markers of inflammation, which could explain some of why depression is longitudinally associated with CVD outcomes (Vaccarino et al., 2007). Obesity in and of itself creates inflammation within the body, which could cause depression. Daly found that changes in CRP levels over a four-year span explained 20% of the relationship between obesity and depression. This effect was stronger for obese compared to overweight individuals, which suggests a dose-response relationship (Daly, 2013).

*Depression and discrimination:* Depression and discrimination are linked as well (Israel, Farquhar, Schulz, James, & Parker, 2002; Schulz et al., 2006). Pascoe's meta-analysis of the discrimination and health literature established that the vast majority of studies show an association between discrimination and poorer mental health (Pascoe & Smart Richman, 2009). Women who experience discrimination have 2.6 higher odds of having major depression (McLaughlin, Hatzenbuehler, & Keyes, 2010). Among LGBT individuals, perceived discrimination is related to poorer mental health (Mays & Cochran, 2001).

### 1.4.3 Heavy Alcohol Use and Obesity

*Heavy alcohol use and lesbians:* Lesbians appear to be more likely to report heavy alcohol use compared to heterosexual women. In the longitudinal Chicago Health and Life Experiences of Women (CHLEW) study, lesbians are more likely to report being in recovery from alcohol abuse, are more likely to report suffering adverse consequences of drinking, and are more likely to wonder if they have a drinking problem compared to heterosexual women (T. L. Hughes, 2003). In the general population, drinking decreases with age but it is unclear if this is true for lesbians (E. L. Austin & Irwin, 2010; T. L. Hughes et al., 2006). Additional probability and longitudinal samples show that lesbians are more likely to be heavy drinkers than heterosexual women (Farmer, Jabson, Bucholz, & Bowen, 2013; Hatzenbuehler, McLaughlin, & Slopen, 2013). For example, lesbians are 50-80% more likely than heterosexual women to report heavy drinking (Case et al., 2004; Dilley et al., 2010; Valanis et al., 2000).

*Alcohol use and obesity:* Alcohol use and obesity are related. While epidemiological studies of the relationship between alcohol and obesity show that moderate drinking may actually be protective against obesity (Yeomans, 2010), the development of metabolic syndrome (Freiberg, Cabral, Heeren, Vasan, & Curtis Ellison, 2004), and other measures of adiposity (Sayon-Orea, Martinez-Gonzalez, & Bes-Rastrollo, 2011), it appears that the intensity of drinking (i.e., binge drinking) versus the total number of drinks may be a key factor in predicting obesity (Tolstrup et al., 2008; Yeomans, 2010). Additionally, longitudinal studies show that heavy drinking is associated with WC and WHR among men and women (Sayon-Orea et al., 2011).

*Alcohol use and discrimination:* Evidence from the racial and ethnic disparities literature support the link between discrimination and alcohol use (Pascoe & Smart Richman, 2009). For

example, in the Multiethnic Study on Atherosclerosis (MESA), African Americans who experienced discrimination had a 51% greater odds, and Hispanics a 62% greater odds, of reporting heavy drinking compared to African Americans and Hispanics, respectively, who did not experience discrimination (Borrell et al., 2010). We know that LGBT individuals who reported experiencing three types of discrimination (gender, race, and sexual orientation) had a 3.85 OR of experiencing a past-year substance use disorder (McCabe et al., 2010) but we have little information on how discrimination impacts drinking among lesbians specifically (T. Hughes, 2011). Finally, historical discrimination and marginalization of the LGBT population has encouraged congregation in safe spaces, often bars (Gruskin, Byrne, Kools, & Altschuler, 2006), and this also increases alcohol consumption (Heffernan, 1998).

### 1.4.4 Binge Eating Disorder (BED) and Obesity

*BED and lesbians:* Lesbians have higher prevalence rates of binge eating disorder than heterosexual women. Heffernan compared BED among a convenience sample of lesbians and nationally reported prevalence data for heterosexual women and found that BED was more prevalent among lesbians (Heffernan, 1996). Among participants in the Growing Up Today Study (GUTS), a longitudinal cohort study of children of participants in the Nurses Health Study, binge eating was over twice as prevalent in lesbians compared to heterosexual women (S. B. Austin, Ziyadeh, Corliss, Rosario, et al., 2009).

*BED and obesity:* Individuals who binge eat are more likely to be obese, even though obese individuals with BED do not have worse health outcomes than obese individuals without BED, after controlling for obesity (de Zwaan, 2001). BED has a stronger association with weight gain over time compared to bulimia nervosa, another eating disorder involving overeating.

Women with BED followed prospectively for 5 years gained on average 9.25 pounds, which was greater than women in the same study with bulimia nervosa (Fairburn, Cooper, Doll, Norman, & O'Connor, 2000).

*BED and discrimination:* The research on whether discrimination impacts the development of binge eating disorder is sparse. Data from a convenience sample of U.S. adults indicated that more frequent experiences of discrimination were significantly associated with more frequent binge eating episodes (Durso, Latner, & Hayashi, 2012). Among a sample of U.S. adults seeking weight loss surgery, weight-based discrimination was significantly associated with higher severity of binge eating (Friedman, Ashmore, & Applegate, 2008) and other research suggests that the more general concept of perceived stress is associated with binge eating (Striegel-Moore et al., 2007). Although it is speculated that lesbians may cope with experiences of sexual orientation discrimination by developing unhealthy eating habits (Yancey, Cochran, Corliss, & Mays, 2003), there are no studies that have specifically tested this relationship.

### 1.4.5 Biological Processes in the Development of Obesity

*Allostatic load as a mediator between discrimination and adiposity:* Discrimination is hypothesized to have biological effects by being a chronic challenge to the process of maintaining stability within the body systems (McEwen & Stellar, 1993). Allostatic load, then, is the repeated stress, or wear and tear, placed on the body over time through the physiological arousal that results when confronted by a stressor (or repeated stressors). Greater allostatic load is hypothesized to predispose individuals to disease due to the gradual breakdown in body systems (McEwen & Stellar, 1993). Allostatic load involves disruption of the hypothalamus-pituitary-adrenal (HPA) axis, which is responsible for modulating cortisol levels in response to

stress in order to maintain allostatis. Under repeated stress, the HPA axis can become overly activated and produce downstream effects on the immune system, the cardiovascular system, and tissue, such as adipose tissue (Björntorp, 2001).

While there is no research examining whether discrimination based on sexual orientation affects allostatic load among lesbians, there is evidence that discrimination based on race influences allostatic load among racial and ethnic minorities. In one study, a one standard deviation increase in perceived discrimination was associated with 16% higher waking cortisol levels for African Americans but only 8% for whites. The main effect and slope of discrimination on cortisol levels was only significant for African Americans (Fuller-Rowell, Doan, & Eccles, 2012). Findings such as this are important because we know that high levels of cortisol are related to abdominal adiposity and obesity among women (Björntorp, 2001). Interestingly, one study analyzed measures of inflammation among the LGBT population and found that lesbian/bisexual women had lower levels of C-reactive protein (CRP) compared to heterosexual women. However, the population was young (24-32) and the study did not assess differences based on experiences of discrimination (Hatzenbuehler et al., 2013).

*Direct relationship to adiposity:* In the racial disparities literature, discrimination is also related to adiposity. In the Black Women's Health Study, a longitudinal cohort sample of over 59,000 women in the U.S., experiences of racial discrimination at baseline was significantly associated with increases in weight and waist circumference over time. There was evidence of a dose-response relationship, with women reporting higher levels of discrimination gaining more weight (or WC) compared to women reporting lower levels (Cozier et al., 2009). This relationship persists even after controlling for the degree of neighborhood racial segregation (Cozier et al., 2014).

Other recent research has measured both change in anthropometric measures and change in discrimination over time. In a longitudinal analysis of the Midlife Development in the United Status (MIDUS) study, a cohort of individuals in the U.S. age 25-74, women reporting high and stable amounts of discrimination had significantly higher WC compared to other women. Women who reported increasing levels of discrimination over time significantly increased WC by 1.88 cm. There was also an interaction effect by sex, with women's weight and WC being more affected by discrimination than men (Hunte, 2011). In the CARDIA study, a longitudinal cohort of over 5000 young African American individuals, increases in experiences of discrimination over an eight-year period was associated with a 0.67 increase in BMI and 1.09 cm increase in waist circumference for black women (Cunningham et al., 2013). The relationship between discrimination and weight is not unique to African American individuals, however. Other research has found similar associations in other racial and ethnic groups (Gee et al., 2008; Hunte & Williams, 2009; McCubbin & Antonio, 2012).

Internalized racism is also associated with weight, especially for women and girls. High internalized racism is significantly associated with waist circumference and insulin resistance (Chambers et al., 2004), and increases the odds of being abdominally obese by 180% (Tull et al., 1999). High internalized racism is also associated with higher resting glucose and this relationship persists even after controlling for weight (OR = 2.49), BMI (OR = 2.56), and WC (OR = 2.02) (Butler, Tull, Chambers, & Taylor, 2002). This evidence provides compelling support for the relationship between internalized homophobia and adiposity, though there are no studies examining this yet.

*Interaction of social factors:* The direct effect of discrimination on biology is moderated by social forces. There is a significant association between racial discrimination and BMI among

Latino and Asian Americans. However, the strength of the relationship increases the longer individuals live in the U.S., suggesting that acculturation also plays a role (Gee et al., 2008). Socioeconomic status (SES) moderates the relationship between discrimination and waking cortisol levels among African Americans. The effect of discrimination on waking cortisol is stronger among low-SES African Americans compared to high SES African Americans while there is no difference for high vs. low SES whites (Fuller-Rowell et al., 2012).

### 1.4.6 Sociocultural Factors

*Social Norms and Relationship to Heterosexual Ideals:* Lesbians are likely to be affected by unique factors specifically related to their sexual orientation group membership. Quantitative and qualitative studies strongly suggest that lesbians conceptualize weight and body image differently than heterosexual women, that they are more interested in fitness than thinness, and are less likely to endorse the heterosexual ideal female body type (Heffernan, 1996; Herzog, Newman, Yeh, & Warshaw, 1992; Moore & Keel, 2003; S. J. Roberts, Stuart-Shor, & Oppenheimer, 2010; Share & Mintz, 2002). Lesbians report less internalization of cultural ideals dictating women's appearance (Share & Mintz, 2002).

Research also suggests that variations in weight control and body satisfaction are associated with lesbians' gender nonconformity, the degree to which they deviate from traditional, heterosexual norms about women's appearance, dress, and demeanor. Lesbians who report a more feminine gender expression also report dieting more than (C. Meyer, Blissett, & Oldfield, 2001) and are less satisfied with their bodies compared to more masculine lesbians (Ludwig & Brownell, 1999). However, there is no research on whether gender nonconformity is associated with weight, and not just diet and body satisfaction.

Gender nonconformity is associated with several of the potential risk factors described above. Gay men and lesbians who report gender nonconformity as children report higher rates of depression and anxiety as adults (Alanko et al., 2009) and report lower rates of well-being (Rieger & Savin-Williams, 2012), although a study of adult lesbians found that gender nonconforming ("butch") and gender conforming ("femme") lesbians did not report different rates of depression (Levitt, Puckett, Ippolito, & Horne, 2012). Gender nonconformity is also associated with discrimination based on sexual orientation. Two studies found that gender non-conforming lesbians reported more discrimination than their more conformist counterparts (Gordon & Meyer, 2007; Levitt et al., 2012).

*Social Support and Connection to Lesbian Community:* Social support might be a potential moderator of risk factors' effects on lesbians' weight. In the general population, social support is associated with lower rates of depression (Israel et al., 2002; Komproe, Rijken, Ros, & Winnubst, 1997). Similarly, the presence of social support reduced the effect of racial discrimination on HIV risk behaviors in a sample of African American men (Bowleg et al., 2013). In a sample of LGBT older adults, greater social support was associated with lower rates of disability and depression (Fredriksen-Goldsen, Emlet, et al., 2013). However, there is still limited research in this area (Pascoe & Smart Richman, 2009) and inconsistent evidence about the ability of social support to moderate discrimination's effect for both the LGBT population and other subgroups (Gee et al., 2006; Hatzenbuehler et al., 2009; Israel et al., 2002).

Having more connection to the LGBT community is a component of social support for gay individuals, and is protective in many instances. For example, among gay men, having social support is significantly related to safer sex behaviors (Ayala, Bingham, Kim, Wheeler, & Millett,

2012). For young sexual minority women, greater connection the LGBT community is related to lower smoking rates (Johns et al., 2013).

However, connection to the LGBT community is potentially disadvantageous with regard to lesbians and weight. Much in the way that African American women systematically differ from white women by favoring a heavier body image ideal and experiencing less body dissatisfaction (independent of BMI) (Kronenfeld, Reba-Harrelson, Von Holle, Reyes, & Bulik, 2010), social norms specific to the lesbian community may be less critical and more endorsing of a heavier body weight. Greater connection to the LGBT community is associated with greater body satisfaction (Ludwig & Brownell, 1999) and less concern with one's weight (Heffernan, 1996) but the protective effect of association with lesbian culture regarding pressure to be thin is modest (Owens, Hughes, & Owens-Nicholson, 2002). In addition, some research suggests that weight is socially transmitted among social networks (Christakis & Fowler, 2007). But whether this rejection or diminution of the heterosexual ideal results in higher body satisfaction or better body image is unclear, as results suggest that body satisfaction and body image is the same overall for lesbians and heterosexual women (Heffernan, 1996; Moore & Keel, 2003; Share & Mintz, 2002).

To what extent sociocultural factors are related to obesity as stressors themselves, or responses to the discrimination stressor, is unknown. It is also possible that these sociocultural factors related to lesbian identity are not related to stress at all. This has not been examined, however. A comprehensive discussion of the diversity of lesbian culture is beyond the scope of this paper, but it is critical to acknowledge that the lesbian community is not homogenous. Thus, the construct of "connection to the LGBT community" can mean different things depending on the nature of which "community" is being referenced. Whether or not privilege is afforded to

gender nonconforming, or “butch”, lesbians in a community may influence experiences of discrimination, both within and outside of the lesbian community (Maltry & Tucker, 2002; Rifkin, 2002). Differing values placed on butch or femme identities at the subcultural level, the extent to which identities conform to heterosexual norms, and the amount by which an individual is connected to either lesbian or broader community can all interact to influence experiences of discrimination, body image, and weight.

## 2.0 CURRENT DISSERTATION RESEARCH

This dissertation seeks to address the significant gaps in the literature regarding the lack of predictors of obesity among lesbians and the virtual absence of studies on other mortality risk factors among lesbians. The data for this dissertation are from the Epidemiologic Study of Health Risk Among Women (ESTHER), a cross-sectional cardiovascular risk study of lesbian and heterosexual women from Pittsburgh, PA and surrounding areas. The advantage of this rich dataset is that it not only recorded data on myriad behavioral and psychosocial factors, but also collected health history information and clinically measured indicators, such as height, weight, and blood lipids. Study 1 examined the role of gender nonconformity in predicting differences in ideal body image, body satisfaction, and BMI status among lesbians. Study 2 explores predictors of both waist-to-hip ratio (WHR) and BMI status among lesbians compared to heterosexuals. In particular, I examine relationship status, discrimination, social support, and depression as moderators of the relationship between sexual orientation and WHR and BMI status. In Study 3, I extend the lesbian health disparities literature by quantifying the differential risk of the metabolic syndrome between lesbians and heterosexuals.

### 2.1 STUDY 1: SPECIFIC AIMS AND HYPOTHESES

Aim 1: Explore whether gender conformity influences ideal body image and body satisfaction.

Hypothesis 1.1: Self-identified butch lesbians will endorse a higher ideal body size and report greater body satisfaction, as measured by the discrepancy between the current and ideal body size, as compared to heterosexual women, femme lesbians, and lesbians who report being "neither" femme nor butch.

Aim 2: Explore whether gender conformity is associated with the odds of being overweight and obesity.

Hypothesis 2.1: Butch lesbians will have higher odds of overweight and obesity as compared to heterosexual women, femme lesbians, and lesbians who report being "neither" femme nor butch.

Aim 3: Explore connection to the gay community as a potential moderator of the relationship between gender conformity, ideal body size, body satisfaction, and overweight/obesity.

Hypothesis 3.1: Connection to gay community moderates the relationship between gender conformity, ideal body size, body satisfaction, and overweight/obesity.

## 2.2 STUDY 2: SPECIFIC AIMS AND HYPOTHESES

Aim 1: Determine whether lesbians have higher WHR compared to heterosexuals.

Hypothesis 1.1: Lesbian women would have higher WHR than heterosexual women after controlling for controlling for demographic, psychosocial, and behavioral covariates.

Aim 2: Explore psychosocial and structural determinants of WHR and BMI status among lesbians compared to heterosexual women.

Hypothesis 2.1: Discrimination and depression are positively associated with WHR and the odds of overweight and obesity among lesbians as compared to heterosexuals.

Hypothesis 2.2: Relationship status and social support are negatively associated with WHR and the odds of overweight and obesity among lesbians as compared to heterosexuals.

## 2.3 STUDY 3: SPECIFIC AIMS AND HYPOTHESES

Aim 1: Describe the prevalence of the metabolic syndrome and its individual factors in a sample of heterosexual and lesbian women.

Hypothesis 1.1: Lesbians will have a higher prevalence of the metabolic syndrome and its individual factors compared to heterosexuals.

Aim 2: Identify whether lesbians are at greater risk of having the metabolic syndrome.

Hypothesis 2.1: Compared to heterosexual women, lesbians will have a higher risk of having the metabolic syndrome after controlling for demographic, psychosocial, and behavioral covariates.

# 3.0 LESBIAN BODY IMAGE AND BMI STATUS: ASSOCIATION OF GENDER CONFORMITY AND CONNECTION TO GAY COMMUNITY

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## 3.1 INTRODUCTION

Overweight and obesity are associated with greater morbidity and mortality, and higher healthcare costs (Flegal et al., 2013; Glickman et al., 2012; Reilly & Kelly, 2011). Compared to heterosexual women, lesbian women in the U.S. have a higher prevalence of overweight and/or obesity (Case et al., 2004; Conron et al., 2010; Dilley et al., 2010; Fredriksen-Goldsen, Kim, et al., 2013), although the reasons why lesbians are disproportionately affected are unclear (Boehmer & Bowen, 2009; Boehmer et al., 2011; Valanis et al., 2000).

Difference in cultural ideals regarding body size and shape have been identified as potential drivers of higher prevalence of obesity among the African American women compared to Caucasian women (Padgett & Biro, 2003). In a similar vein, there is evidence that lesbian women share different standards regarding body size than heterosexual women. Lesbians report less internalization of cultural ideals to be thin (Share & Mintz, 2002; Yean et al., 2013). Lesbian magazines sexually objectify women, but to a less extreme than magazines targeting a

heterosexual female audience, and lesbian magazines present a more diverse spectrum of body weight, age, and gender expression (Gonsoulin, 2010). Lesbians are more accepting of different body types, are not as concerned with obtaining a thin body, and use exercise less than heterosexual women to control weight (Moore & Keel, 2003). Moreover, greater connection to the LGBT community is associated with greater body satisfaction (Ludwig & Brownell, 1999) and less concern with one's weight (Heffernan, 1996) but the protective effect of association with lesbian culture regarding pressure to be thin is modest (Owens et al., 2002).

Research is inconclusive about whether lesbians report higher satisfaction with their current size (Yean et al., 2013). A meta-analysis found no overall difference in satisfaction between lesbians and heterosexual women. However, among lesbians and heterosexuals of the same weight, lesbians reported higher satisfaction (Morrison, Morrison, & Sager, 2004).

Gender conformity, the extent to which an individual conforms to the cultural ideal for their gender within society, could moderate the association between sexual orientation and body satisfaction. For example, feminine lesbians report dieting more than masculine lesbians (C. Meyer et al., 2001) and are less satisfied with their bodies than masculine lesbians (Ludwig & Brownell, 1999). What has not been researched is whether lesbians' gender conformity influences weight itself. The Minority Stress Model would suggest that a greater proportion of gender-nonconforming, or butch lesbians, would be overweight or obese than gender conforming, or femme, lesbians and heterosexual women, due to the fact that not conforming to the heterosexual ideal is an additional stressor (I. H. Meyer, 2003b). In addition, Objectification Theory, which suggests that internalization of cultural standards of beauty cause women to become overly focused the external representation of their bodies (Fredrickson & Roberts, 1997), would suggest that butch lesbians are less concerned with maintaining a lower weight.

This study seeks to address this gap in the literature by exploring whether gender conformity influences both ideal body image and satisfaction, as well as overweight and obesity. Based on the extant literature, we hypothesize that butch lesbians will endorse a higher ideal body size and report greater body satisfaction, as measured by the discrepancy between the current and ideal body size, as compared to heterosexual women, femme lesbians, and lesbians who report being "neither" femme nor butch. In addition, we hypothesize that butch lesbians will have higher odds of overweight and obesity as compared to heterosexual women, femme lesbians, and lesbians who report being "neither" femme nor butch. Finally, we explore connection to the gay community as a potential moderator of the relationship between gender conformity, ideal body size, body satisfaction, and overweight/obesity.

## 3.2 METHODS

Data for the study is from the Epidemiologic Study of HEalth Risk Among Women (ESTHER), a cardiovascular risk study of a convenience sample of women from Pittsburgh, PA and surrounding areas. Participants were recruited through newspaper and radio advertisements, community health events, LGBT events, and the University of Pittsburgh broadcast phone-message system. A total of 1084 women were recruited; approximately half were lesbian. Because of the disproportionate number of black heterosexual women compared to black lesbian women, a random sample of black heterosexuals was selected to match the proportion of black lesbians for analysis. Also, due to the disproportionate number of older heterosexuals compared to lesbians, women over age 65 were excluded from analysis. The final sample consisted of 479 lesbian and 400 heterosexual women. During a first clinic visit, participants completed a series of

written questionnaires that assessed a number of psychosocial and demographic variables. They also completed a medical history, physical activity interview, and fasting blood draws. At a second visit, participants reviewed a three-day diet and exercise diary and underwent a Dual Energy X-ray Absorptiometry (DEXA) scan of the hip, spine, and whole body. Participants were offered a $50 incentive for their time. The research was approved by the University of Pittsburgh Institutional Review Board.

*Measures*

Sexual orientation: Women were classified as lesbian if they 1) identified as anything other than heterosexual, and 2) reported either being only or primarily emotionally, physically, and romantically attracted to women in the past five years or having only or primarily female sexual partners in the past five years. Heterosexual women were those who identified as "heterosexual/straight" and reported only male sexual partners since the age of 18. Women who reported attraction men and women and/or men and women sexual partners in the past five years were excluded. Sexual orientation was a dichotomous variable.

Gender conformity: Lesbian participants were asked, "Many lesbians use terms such as "butch" and "femme" either to describe themselves or to describe other women in their appearance or behavior. How would you describe yourself?" and choices included "Very femme," "Somewhat femme," "Neither femme nor butch," "somewhat butch," "Very butch," or "Other." After removing the "Other" and non-respondents, we collapsed "Very" and "Somewhat" femme and butch categories into "femme" and "butch." Throughout the paper, we refer to "neither" lesbians as those who answered "Neither femme nor butch." Because heterosexual women were not asked about gender conformity, they were considered a single type of gender conformity. Responses were dummy-coded.

Race: Participants reported their race as Black, Native American, Asian or Pacific Islander, White or Other. After removing Native American, Asian or Pacific Islander, or Other respondents due to small numbers (n=32), race was recoded into a dichotomous variable.

Age: Age categories were calculated using participants' dates of birth and were entered as dummy variables.

Education: Education was assessed using a 5-point scale and collapsed to a dichotomous variable.

Relationship status: Participants self-reported whether they were in a committed relationship, not in a committed relationship, or other. Responses of other were collapsed into the "not in a committed relationship" category to create a dichotomous variable.

Depression: Depression was assessed using the CES-D 10 scale (Cronbach's alpha = .86) (Miller, Anton, & Townson, 2008). The scale has the same reliability for lesbians compared to heterosexuals (Birnholz & Young, 2012). Depression was a dichotomous variable where any participant who scored over 10 was coded as reporting depressive symptoms.

Binge eating: Participants were coded as engaging in binge eating in the past 6 months if they: 1) reported eating within a two-hour period what most people would consider an unusually large amount of food, and 2) reported feeling a loss of control during these events, for 3) an average of at least two to three days per week. Binge eating was a dichotomous variable.

Hazardous drinking: Hazardous drinking was assessed with four types of questions that assessed drinking behaviors over the past 12 months. Participants were asked about: heavy episodic drinking ("During the last 12 months, how often did you have 6 or more drinks of wine, beer, or liquor in a single day?"); intoxication ("About how often in the last 12 months did you drink enough to feel drunk"); consequences of drinking (driving drunk, accident in the home, harmful

effect on housework, partner/spouse, friends or relatives complained about drinking, hurt chances of getting a job or promotion, people annoyed you by criticizing your drinking, guilt about drinking, and not remembering things done/said while drinking); and, possible alcohol dependence (drinking fast for quicker effect, morning drinking, inability to stop drinking before intoxication, inability to quit or cut down drinking, and surreptitious drinking). Responses were summed and dichotomized for each of the four types of questions (0 = no behaviors, 1 = any behaviors) to create an index of 0-4. Hazardous drinking was dichotomized using a cutoff of 2 or more on the index (T.L. Hughes, Johnson, Steffen, Wilsnack, & Everett, 2014).

Current smoking: Respondents who answered "yes" to "Do you currently smoke cigarettes" were coded as current smokers.

Connection to gay community: Connection to gay community was assessed of lesbian participants with a single questions, "On a scale from 0 to 10, with 0 being "not at all" and 10 being "very much", how connected do you feel to the lesbian community in the greater Pittsburgh area?"

Current, Ideal, Partner ideal, and Discrepancy: Body image was assessed using the Stunkard scale, which consists of 9 silhouettes of female body shapes ranging from 1 (very thin) to 9 (very obese) (Stunkard, 2000). Participants were asked to circle the body silhouettes that most closely matched 1) their current figure, 2) the figure their partner would prefer, and 3) the figure they would ideally prefer. The variables were continuous, with each figure corresponding to a numeric value. To calculate figure discrepancy, we subtracted the ideal figure rating from the current figure rating.

Body Mass Index (BMI): Height and weight data were collected during participants' first clinic visit. BMI was categorized using the formula $weight\ (lb) / [height\ (in)]^2 \times 703$ (Centers for

Disease Control and Prevention, 2011). Using the National Heart, Lung, and Blood Institute (NHLBI) standards, we categorized BMI as <18.5=underweight, 18.5-24.9=normal weight, 25-29.9=overweight, and >30=obese (National Heart, 2012). BMI categories were entered as dummy variables.

*Data Analysis*

We ran descriptive statistics to assess the entire sample and conducted chi-square tests (for categorical variables) and analysis of variance (ANOVA) (for continuous variables) to examine differences between heterosexuals and femme, "neither", and butch lesbians. To address the hypotheses related to gender conformity's influence on ideal figure, partner ideal figure, and discrepancy, we constructed linear regression models. First, we ran univariable models regressing the dummy-coded gender conformity variables on ideal figure, partner ideal figure, and discrepancy. Then we created adjusted models, controlling for gender conformity, race, age, education, parity, depression, hazardous alcohol use, current smoking, binge eating, and BMI. Next, we built a model to examine the role of connection to gay community. Because only lesbian participants answered the question about connection the gay community, we followed procedures regarding conditionally relevant variables to add interaction terms of butch identify and/or sexual orientation and connection to gay community to our models (Gee et al., 2008; Ross & Mirowsky, 1992). This allowed us to retain heterosexual participants in the model.

To address the next set of hypotheses related to gender conformity's influence on BMI status, we created multinomial regression models. Following the methods described for the previous models, we created univariable and fully adjusted models. Then, we added connection to gay community to the model.

## 3.3 RESULTS

Lesbians who did not respond to the gender conformity question or who answered "other" were removed from the dataset. Because the small number of underweight individuals (n=6) prohibited inclusion in the multivariable models, they were also eliminated from the dataset. The final analytic sample was 820 women.

Sample characteristics of the heterosexual and femme, "neither", and butch lesbian women are displayed in Table 3.1. There was a slight difference in age distribution across the categories. As expected, heterosexual women reported giving birth in significantly higher proportions than the lesbian categories. The proportion of butch lesbians who smoked was approximately double that of the other categories of women.

Lesbians endorsed slightly larger size current figures and ideal figures. However, we did not observe differences across the sample in discrepancy between current and ideal figure size. Finally, we saw significantly higher proportions of obesity in all lesbian categories.

Ideal Figure and Figure Discrepancy

The results of the first set of analyses are presented in Tables 3.2 – 3.4. We present both unadjusted models, regressing just gender expression on ideal figure and figure discrepancy, and adjusted models, controlling for gender expression, race, age, education, parity, depression, hazardous alcohol use, current smoking, binge eating, and BMI. In these models, the regression coefficient represents the difference on the Stunkard scale compared to the reference group.

*Ideal Figure*

Using heterosexual as the reference model, femme, "neither", and butch lesbians endorsed a significantly higher ideal figure in both the unadjusted and adjusted models (Table 3.2). To ensure that the differences in the regression coefficients could be interpreted as true

differences among the lesbian sub-categories, we re-ran models with each of femme, “neither”, and butch as reference categories. In the unadjusted models, we observed significant differences in that butch lesbians endorsed higher ideal figures compared to femme and “neither” lesbians. However, once covariates were added to the model these differences became insignificant, suggesting that sexual orientation and not gender conformity was the driver of differences compared to heterosexuals.

Therefore, we decided to run an additional set of models using sexual orientation as the key covariate (Table 3.3). In these models, lesbians endorsed significantly higher ideal figures. In the fully adjusted model, lesbians reported preferring an ideal figure rating that was 0.19 higher on the Stunkard scale compared to heterosexual women ($p < 0.001$).

To test whether connection to gay community influenced ideal figure, we added an additional covariate to the model that represented the interaction of sexual orientation and connection to gay community (Table 3.4). This was not significant ($p$=0.095).

*Discrepancy*

In the analysis examining the association of gender expression and figure discrepancy, there were no differences between the lesbian sub-categories and heterosexual women in the unadjusted model (Table 3.2). In the fully adjusted model (Table 3.2), both “neither” and butch lesbians were significantly different than heterosexual women. The regression coefficients were negative, indicating that there was a significantly smaller difference between current and ideal figure for “neither” and butch lesbians compared to heterosexual women.

When exploring femme, “neither”, and butch as reference categories, we observed that the difference between butch lesbians’ current and ideal figure was significantly smaller than femme lesbians (Beta = -0.234, $p$=0.042). There was no difference in discrepancy between butch

and “neither” lesbians or between “neither” and femme lesbians. We added a covariate representing the interaction of butch identity and connection to gay community, but the results were insignificant ($p$=0.134, data not shown).

To further explore differences between lesbians overall compared to heterosexuals, we re-ran the models using sexual orientation as the key covariate (Table 3.3). In the fully adjusted model, lesbians reported that the difference between their current and ideal figures was 0.218 smaller compared to heterosexual women, which was significant at $p$=0.001. Connection to gay community was insignificant ($p$=0.586).

BMI Status

The second set of analyses focused on BMI status as a function of gender conformity. Using heterosexual women as the reference category in the unadjusted model (Table 3.5), butch lesbian women had 2.256 higher odds of being overweight compared to normal weight than heterosexual women ($p$=0.025) and 5.399 higher odds of being obese compared to normal weight than heterosexual women ($p$<0.001). After adjusting for covariates, the odds ratios were virtually the same, with butch women having 2.148 ($p$=0.049) and 5.570 ($p$<0.001) higher odds of being overweight and obese compared to normal weight than heterosexual women, respectively (Table 3.5). Femme lesbians had 1.759 ($p$=0.032) higher odds of obesity compared to normal weight than heterosexual women while “neither” lesbians’ odds of being overweight and obese were not significantly different.

To confirm the differences between the lesbian sub-categories, we re-ran the model using femme, “neither”, and butch as reference categories. Here, we observed that butch lesbians were significantly different than their femme and “neither” counterparts. Butch lesbians were not significantly different than femme lesbians but had 2.767 times the odds of being overweight

than “neither” lesbians. In terms of the odds of being obese compared to normal weight, butch lesbians were significantly higher odds than femme or “neither” lesbians (3.167 and 3.855, respectively).

We added a covariate to the fully adjusted model to test whether connection to the gay community moderated the relationship between butch identity and the odds of being overweight or obese. As before, the results were non-significant (Table 3.6).

## 3.4 DISCUSSION

This study supports prior research that sexual orientation influences body image and satisfaction and provides the first evidence that lesbians’ gender conformity is associated with weight. Our initial hypothesis that butch lesbians would endorse a higher ideal figure and report lower discrepancy between their current and ideal figure than femme or “neither” lesbians and heterosexual women was partially supported. Overall, we found that femme, “neither”, and butch lesbians wanted significantly higher ideal figures compared to heterosexuals, and butch and “neither” lesbians reported significantly smaller differences between current and ideal figures compared to heterosexuals after controlling for demographic and behavioral factors. When examining differences within the lesbian sub-categories, we did not find a significant difference between any of the sub-categories for ideal figure, but did find that butch lesbians reported a small difference between their current and ideal figure compared to femme lesbians. In models with sexual orientation as the key predictor, we found that lesbians reported preferring a figure that was 0.19 higher on the Stunkard scale. Lesbians also reported that the discrepancy between

their current figure and ideal figure was 0.218 lower than heterosexual women, indicating greater satisfaction with their current body size.

While other studies have explored the relationship between gender conformity and body image, to our knowledge none have gone a step further to connect gender conformity to weight. This research confirms our hypothesis that gender nonconforming, or butch, lesbians have higher odds of overweight and obesity compared to femme and "neither" lesbians and heterosexual women. After controlling for psychosocial and demographic factors, butch lesbians had 2.15 higher odds of being overweight compared to normal weight than heterosexual women and 5.57 higher odds of being obese compared to normal weight than heterosexual women. In addition, butch lesbians had higher odds of being overweight compared to normal weight than "neither" lesbians, and higher odds of being obese compared to normal weight than both femme and "neither" lesbians.

This research provides evidence that satisfaction with one's size could be a driver of the difference in odds of overweight and obesity in butch lesbians. Following other research that suggests that weight might be influenced by lesbian culture or social norms (Heffernan, 1996; Ludwig & Brownell, 1999), we hypothesized that greater connection to the gay community would predict ideal figure, body satisfaction, and BMI status for butch lesbians. However, our results were insignificant. Research could examine other factors related to butch identity that may further explain the association between gender expression and weight.

Minority stress may be a mediating factor of gender conformity and weight. Gender conformity, or the degree to which an individual adheres to the dominant form of masculinity or femininity in their culture, has been demonstrated to be a stressor or contribute to greater stress (Alanko et al., 2009; Rieger & Savin-Williams, 2012). In minority racial/ethnic groups,

experiences of prejudice and discrimination are associated with weight gain (Cozier et al., 2009; Flegal et al., 2012). The nuanced social construction of gender and the fact that gender expression can signal membership or grant entre to a group can associate butch identity with positive or negative outcomes (West & Zimmerman, 1987). The subversion of enacting a masculine gender expression can grant a form of privilege within the lesbian community but also identify oneself as lesbian. Thus, being butch may influence experiences of discrimination, both within and outside of the lesbian community (Maltry & Tucker, 2002; Rifkin, 2002). Future studies should investigate not only whether butch lesbians experience more minority stress but also if this minority stress mediates weight or BMI status.

High rates of smoking among butch lesbians in this sample could also mediate the relationship between GNC and weight. A prior study on smoking and weight among sexual minority women found that smoking was not related to BMI (Yancey et al., 2003). However, in the general population smoking is associated with weight gain over time, central adiposity, and glucose intolerance and diabetes (Canoy et al., 2005; Colditz et al., 1992; Eliasson, 2003; Houston et al., 2006). Studies of smoking or other behavioral mediators would be useful to further explain our finding.

There are several limitations to this study. The fact that the sample was a convenience sample limits generalizability. Because recruitment was conducted in part via community groups, including LGBT groups, the lesbians recruited likely had a greater connection to gay community than the region's general lesbian population. Heterosexual women were not asked about their gender nonconformity so we are unable to compare gender non-conforming heterosexuals to gender non-conforming lesbians. Finally, connection to the gay community

could also reflect the availability of resources or opportunities to connect to gay community. A sample from a city or region with more LGBT resources might yield different results.

However, this sample has many strengths compared to other convenience or population-based samples. While population-based samples may have better generalizability, but most do not go further than asking about sexual orientation. In ESTHER, we have a greater depth of information about the lesbian participants, including gender conformity. The fact that height and weight were clinically measured eliminates the self-report bias from the tendency for women tend to underreport weight (Craig & Adams, 2009; Merrill & Richardson, 2009).

This study is an additional step toward understanding the lesbian weight disparity. The finding that gender nonconformity is associated with weight provides evidence that obesity among lesbians may have a complex etiology. With a clear link between obesity and morbidity and mortality, identifying the factors associated with obesity among lesbians and which lesbian subgroups are more at risk is critical.

**Table 3-1: Sample Characteristics**

| Variable | Total (N=820) | Heterosexual (N=397) | Femme (N=156) | Neither (N=172) | Butch (N=95) | p |
|---|---|---|---|---|---|---|
| | | | N (%) | | | |
| Race | | | | | | |
| White | 755 (92.1%) | 365 (89.7%) | 140 (89.7%) | 166 (96.5%) | 84 (88.4%) | 0.056 |
| African American | 65 (7.9%) | 32 (8.1%) | 16 (10.3%) | 6 (3.5%) | 11 (11.6%) | |
| Age | | | | | | |
| 35-39 | **119 (14.5%)** | **58 (14.6%)** | **25 (16.0%)** | **18 (10.5%)** | **18 (18.9%)** | **0.006** |
| 40-44 | **198 (24.1%)** | **89 (22.4%)** | **24 (15.4%)** | **52 (30.2%)** | **33 (34.7%)** | |
| 45-49 | **195 (23.8%)** | **94 (23.7%)** | **39 (25.0%)** | **42 (24.4%)** | **20 (21.1%)** | |
| 50-54 | **148 (18.0%)** | **65 (16.4%)** | **37 (23.7%)** | **33 (19.2%)** | **13 (13.7%)** | |
| 55-65 | **160 (19.5%)** | **91 (22.9%)** | **31 (19.9%)** | **27 (15.7%)** | **11 (11.6%)** | |
| Education | | | | | | |
| <BS | 288 (35.1%) | 151 (38.0%) | 47 (30.1%) | 52 (30.2%) | 38 (40.0%) | 0.112 |
| >=BS | 532 (64.9%) | 246 (62.0%) | 109 (69.9%) | 120 (69.8%) | 57 (60.0%) | |
| Ever Given Birth | | | | | | |
| Yes | **390 (47.6%)** | **272 (68.5%)** | **61 (39.1%)** | **33 (19.2%)** | **24 (25.3%)** | **<.001** |
| No | **430 (52.4%)** | **125 (31.5%)** | **95 (60.9%)** | **139 (80.8%)** | **71 (74.7%)** | |
| Hazardous drinking (N=812) | | | | | | |
| Yes | 207 (25.5%) | 90 (22.8%) | 36 (23.2%) | 48 (28.2%) | 33 (35.5%) | 0.059 |
| No | 605 (74.5%) | 304 (77.2%) | 119 (76.8%) | 122 (71.8%) | 60 (64.5%) | |
| Currently Smoke (N=814) | | | | | | |
| Yes | **85 (10.4%)** | **29 (7.4%)** | **18 (11.6%)** | **18 (10.5%)** | **20 (21.1%)** | **0.001** |
| No | **729 (89.6%)** | **364 (92.6%)** | **137 (88.4%)** | **153 (89.5%)** | **75 (78.9%)** | |
| Currently Depressed (N=814) | | | | | | |
| Yes | 158 (19.4%) | 69 (17.4%) | 38 (24.5%) | 27 (16.0%) | 24 (25.5%) | 0.069 |
| No | 656 (80.6%) | 327 (82.6%) | 117 (75.5%) | 142 (84.0%) | 70 (74.5%) | |
| Binge Eating (N=766) | | | | | | |
| Yes | 99 (12.9%) | 55 (14.6%) | 17 (87.9%) | 19 (11.6%) | 8 (9.4%) | 0.521 |
| No | 667 (87.1%) | 321 (85.4%) | 124 (87.9%) | 145 (88.4%) | 77 (90.6%) | |
| Connection to Gay Community (N=422) | | | | | | |
| Mean (SD) | 4.99 (2.80) | --- | 5.22 (2.81) | 4.91 (2.75) | 4.74 (2.87) | 0.364 |
| **OUTCOME VARIABLES** | | | | | | |
| Current Figure | | | | | | |
| Mean (SD) | **4.93 (1.45)** | **4.80 (1.36)** | **5.01 (1.61)** | **4.87 (1.49)** | **5.43 (1.35)** | **0.001** |
| Ideal Figure | | | | | | |
| Mean (SD) | **3.39 (0.81)** | **3.25 (0.76)** | **3.48 (0.82)** | **3.43 (0.77)** | **3.78 (0.91)** | **<.001** |
| Discrepancy (Current - Ideal) | | | | | | |
| Mean (SD) | 1.53 (1.09) | 1.55 (1.05) | 1.53 (1.23) | 1.44 (1.11) | 1.65 (0.93) | 0.484 |
| BMI Category | | | | | | |
| Normal (18.5 - 24.9) | **276 (33.7%)** | **149 (37.5%)** | **50 (32.1%)** | **64 (37.2%)** | **13 (13.7%)** | **<.001** |
| Overweight (25.0 - 29.9) | **238 (29.0%)** | **127 (32.0%)** | **43 (27.6%)** | **43 (25.0%)** | **25 (26.3%)** | |
| Obese (>=30.0) | **306 (37.3%)** | **121 (30.5%)** | **63 (40.4%)** | **65 (37.8%)** | **57 (60.0%)** | |

**Table 3-2: Ideal Figure and Figure Discrepancy as a Function of Gender Expression**

| | | Ideal Figure | | Figure Discrepancy | |
|---|---|---|---|---|---|
| | | Unadjusted Beta (95% CI) | Adjusted[a] Beta (95% CI) | Unadjusted Beta (95% CI) | Adjusted[a] Beta (95% CI) |
| Gender Expression | | | | | |
| | Heterosexual | Ref. | Ref. | Ref. | Ref. |
| | Femme | **0.234 (0.087, 0.381)**** | **0.169 (0.032, 0.306)*** | -0.023 (-0.225, 0.178) | -0.142 (-0.306, 0.022) |
| | Neither | **0.183 (0.041, 0.325)*** | **0.149 (0.010, 0.288)*** | -0.107 (-0.302, 0.087) | **-0.206 (-0.372, -0.040)*** |
| | Butch | **0.532 (0.354, 0.710)***** | **0.316 (0.143, 0.490)***** | 0.104 (-0.140, 0.347) | **-0.376 (-0.584, -0.168)***** |
| Butch (vs. Femme) | | **0.298 (0.096, 0.501)**** | 0.147 (-0.041, 0.335) | 0.127 (-0.151, 0.405) | **-0.252 (-0.459, -0.009)*** |
| Butch (vs. Neither) | | **0.349 (0.150, 0.548)***** | 0.167 (-0.016, 0.351) | 0.211 (-0.062, 0.483) | -0.170 (-0.389, 0.050) |
| Neither (vs. Femme) | | -0.051 (-0.223, 0.122) | -0.020 (-0.178, 0.137) | -0.084 (-0.320, 0.152) | -0.064 (-0.252, 0.124) |

[a] Model adjusted for race, age, education, parity, depression, hazardous alcohol use, current smoking, binge eating, and BMI

* $p \leq .05$

** $p \leq .01$

*** $p \leq .001$

**Table 3-3: Ideal Figure and Figure Discrepancy as a Function of Sexual Orientation**

| | | Ideal Figure | | Figure Discrepancy | |
|---|---|---|---|---|---|
| | | **Unadjusted Beta (95% CI)** | **Adjusted[a] Beta (95% CI)** | **Unadjusted Beta (95% CI)** | **Adjusted[a] Beta (95% CI)** |
| Sexual Orientation | | | | | |
| | Heterosexual | Ref. | Ref. | Ref. | Ref. |
| | Lesbian | **0.280 (0.171, 0.390)*** ** | **0.190 (0.082, 0.299)*** ** | -0.029 (-0.178, 0.120) | **-0.213 (-0.343, -0.083)*** ** |

[a]Model adjusted for race, age, education, parity, depression, hazardous alcohol use, current smoking, binge eating, and BMI

* $p \leq .05$

** $p \leq .01$

*** $p \leq .001$

**Table 3-4: Ideal Figure and Figure Discrepancy as a Function of the Interaction of Sexual Orientation and Connection to Gay Community**

| | Ideal Figure Adjusted[b] Beta (95% CI) | Figure Discrepancy Adjusted[b] Beta (95% CI) |
|---|---|---|
| Sexual Orientation * Connection to Gay Community | -0.021 (-0.046, 0.004) | -0.008 (-0.038, 0.021) |

[b] Model adjusted for sexual orientation, race, age, education, parity, depression, hazardous alcohol use, current smoking, binge eating, connection to gay community, and BMI

* $p \leq .05$

** $p \leq .01$

*** $p \leq .001$

**Table 3-5: BMI Status as a Function of Gender Expression**

| | Unadjusted | | Adjusted | |
|---|---|---|---|---|
| | **Overweight OR (95% CI)** | **Obese OR (95% CI)** | **Overweight[a] AOR (95% CI** | **Obese[a] AOR (95% CI)** |
| Gender Expression | | | | |
| Heterosexual | Ref. | Ref. | Ref. | Ref. |
| Femme | 1.009 (0.630, 1.617) | 1.552 (0.997, 2.414) | 1.055 (0.627, 1.777) | **1.759 (1.050, 2.946)*** |
| Neither | 0.788 (0.501, 1.240) | 1.251 (0.821, 1.904) | 0.776 (0.459, 1.312) | 1.445 (0.868, 2.405) |
| Butch | **2.256 (1.108, 4.593)*** | **5.399 (2.823, 10.326)***** | **2.148 (1.002, 4.603)*** | **5.570 (2.714, 11.431)***** |
| Butch (vs. Femme) | **2.236 (1.021, 4.900)*** | **3.480 (1.715, 7.061)***** | 2.035 (0.895, 4.627) | **3.167 (1.471, 6.821)**** |
| Butch (vs. Neither) | **2.862 (1.320, 6.204)**** | **4.317 (2.156, 8.644)***** | **2.767 (1.242, 6.166)*** | **3.855 (1.838, 8.084)***** |
| Neither (vs. Femme) | 0.781 (0.445, 1.370) | 0.806 (0.486, 1.338) | 0.735 (0.402, 1.344) | 0.822 (0.463, 1.458) |

[a] Model adjusted for race, age, education, parity, depression, hazardous alcohol use, current smoking, and binge eating

* $p \leq .05$

** $p \leq .01$

*** $p \leq .001$

**Table 3-6: BMI Status as a Function of the Interaction of Butch Identity and Connection to Gay Community**

| | Adjusted | |
|---|---|---|
| | Overweight[b] AOR (95% CI) | Obese[b] AOR (95% CI) |
| Butch * Connection to Gay Community | 0.973 (0.765, 1.239) | 0.922 (0.738, 1.152) |

[b] Model adjusted for gender expression, race, age, education, parity, depression, hazardous alcohol use, current smoking, connection to gay community, and binge eating

* p ≤ .05

**p ≤ .01

*** p ≤ .001

# 4.0 FACTORS PREDICTING BMI AND WAIST-TO-HIP RATIO AMONG A SAMPLE OF LESBIAN AND HETEROSEXUAL WOMEN

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## 4.1 INTRODUCTION

There is clear evidence in the literature that lesbian women are at higher risk of overweight and obesity compared to heterosexual women (Aaron et al., 2001; S. B. Austin, Ziyadeh, Corliss, Haines, et al., 2009; Boehmer & Bowen, 2009; Boehmer et al., 2007; Bowen et al., 2008; Case et al., 2004; Conron et al., 2010; Dilley et al., 2010; Fredriksen-Goldsen, Kim, et al., 2013), which is concerning given obesity's strong relationship with all-cause mortality (Flegal et al., 2013). However, little research has been conducted to identify reasons for the disparity. There is no clear empirical evidence that lesbians differ from heterosexuals in eating and exercise behaviors (Valanis et al., 2000). One of the only studies to look at mediators of weight disparities between lesbian and heterosexual women found that energy intake and expenditure did not mediate the relationship between sexual orientation and weight (Boehmer & Bowen, 2009). Rates of sedentary activity do not appear to differ between lesbians and heterosexuals (Aaron et al., 2001; Dilley et al., 2010) and, if anything, lesbians appear to be *more*

physically active than heterosexuals, (Aaron et al., 2001; Case et al., 2004) although they also report more physical limitations (Conron et al., 2010; Dilley et al., 2010).

A number of factors associated with obesity among the general population disproportionately impact lesbians. For example, lesbians appear to have both higher rates of binge eating disorder (S. B. Austin, Ziyadeh, Corliss, Rosario, et al., 2009; Heffernan, 1996) and higher rates of heavy alcohol consumption compared to heterosexuals (Aaron et al., 2001; Case et al., 2004; Valanis et al., 2000). Lesbians also report greater depression (Case et al., 2004; Valanis et al., 2000) and experiences of discrimination (Mays & Cochran, 2001) compared to heterosexuals. Also, relationship status may be a factor that contributes to the weight disparity. Marriage for heterosexuals is associated with lower mortality (Lund et al., 2002), although longitudinal studies show that entry into a marriage or relationship is associated with increased odds for obesity (Sobal, Rauschenbach, & Frongillo, 2003; The & Gordon-Larsen, 2009). Same-sex marriage rights are only recently available to a subset of lesbians depending on residence (Human Rights Campaign, 2015) and research has shown that same-sex cohabitating couples have poorer health than opposite-sex cohabitating couples, perhaps due to lack of financial and legal benefits conferred to heterosexuals via marriage (Liu et al., 2013).

The literature uses BMI to describe the weight disparity between lesbian and heterosexual women, but BMI may not be the only measure that is useful in accurately capturing risk related to adiposity (Heymsfield & Cefalu, 2013). BMI is the best measure of relative weight (Keys et al., 1972) as it serves as a surrogate measure of fatness (Prentice & Jebb, 2001). Yet visceral fat, the type that accumulates around the internal organs, has a clear association with metabolic complications (Jensen, 2008). The exact mechanisms of abdominal fat on health are unknown, but researchers hypothesize that abdominal fat is more metabolically active and therefore

releases inflammatory substances (Jensen, 2008).Thus, other measures of adiposity may be as important as BMI in predicting morbidity and mortality. For example, waist-to-hip ratio (WHR) is a better measure of fat distribution and shares a slightly different relationship with mortality compared to BMI. A recent meta-analysis indicated that BMI and mortality have a u-shaped relationship, with normal weight and obese individuals having higher risk of mortality compared to overweight individuals. However, WHR is monotonically associated with mortality (Carmienke et al., 2013). There is only one published study that examined differences WHR in lesbians and found that lesbians had higher WHR compared to heterosexual women (S. A. Roberts et al., 2003).

As the Minority Stress Model predicts, distal stressors related to being a sexual minority (such as discrimination) impact mental and physical health. Because lesbians are a sexual minority and historically highly stigmatized population in the U.S., we hypothesize that several factors related to minority status moderate the weight disparity between lesbians and heterosexual women. Specifically, we suggest that discrimination, depression, social support, and relationship status are factors that can potentially explain the weight disparity between lesbians and heterosexual women.

Given the dearth of exploration into lesbian adiposity compared to heterosexuals, this research aims to fill a significant gap by determining whether lesbians have higher WHR compared to heterosexuals. Given the existing evidence related to higher BMI among lesbians, we predicted that lesbian women would have higher WHR than heterosexual women. In addition, this study advances the existing research on BMI disparities between lesbians and heterosexuals by exploring psychosocial and structural determinants of WHR and BMI status. Specifically, we predict that discrimination and depression are positively associated, and

relationship status and social support are negatively associated, with WHR and the odds of overweight and obesity among lesbians as compared to heterosexuals.

## 4.2 METHODS

Data for the study is from the Epidemiologic Study of HEalth Risk Among Women (ESTHER), a cardiovascular risk study of a convenience sample of women from Pittsburgh, PA and surrounding areas. Participants were recruited through newspaper and radio advertisements, community health events, LGBT events, and the University of Pittsburgh broadcast phone-message system. A total of 1084 women were recruited; approximately half were lesbian. Because of the disproportionate number of black heterosexual women compared to black lesbian women, a random sample of black heterosexuals was selected to match the proportion of black lesbians for analysis. Also, due to the disproportionate number of older heterosexuals compared to lesbians, women over age 65 were excluded for analysis. The final sample consisted of 479 lesbian and 400 heterosexual women. During a first clinic visit, participants completed a battery of written questionnaires that assessed a number of psychosocial and demographic variables. They also completed a physical activity interview and a two-week medicine history and provided blood draws. At a second visit, participants reviewed a three-day diet and exercise diary and underwent a Dual Energy X-ray Absorptiometry (DEXA) scan of the hip, spine, and whole body. Participants were offered a $50 incentive for their time. The research was approved by the University of Pittsburgh Institutional Review Board.

*Measures*

Sexual orientation: Women were classified as lesbian if they 1) identified as anything other than heterosexual, and 2) reported either being only or primarily emotionally, physically, and romantically attracted to women in the past five years or having only or primarily female sexual partners in the past five years. Heterosexual women were those who identified as "heterosexual/straight" and reported only male sexual partners since the age of 18. Women who reported attraction men and women and/or men and women sexual partners in the past five years were excluded. Sexual orientation was a dichotomous variable.

Race: Participants reported their race as Black, Native American, Asian or Pacific Islander, White or Other. After removing Native American, Asian or Pacific Islander, or Other respondents due to small numbers (n=32), race was recoded into a dichotomous variable.

Age: Age categories were calculated using participants' dates of birth and were entered as dummy variables.

Education: Education was assessed using a 5-point scale and collapsed to a dichotomous variable.

Height: Height was measured twice at the first clinic visit using a standard protocol that averaged repeated measures.

Relationship status: Participants self-reported whether they were in a committed relationship, not in a committed relationship, or other. Responses of other were collapsed into the "not in a committed relationship" category to create a dichotomous variable.

Social support: Social support was measured using the Interpersonal Support Evaluation List (ISEL) 12-item scale. The ISEL measures the perceived availability of different types of social support (Cohen, Mermelstein, Kamarck, & Hoberman, 1985). We summed the responses to create a continuous variable (Cronbach's alpha range.84-.90) (Cohen, 2014).

Depression: Depression was assessed using the CES-D 10 scale (Cronbach's alpha = .86) (Miller et al., 2008). The scale has the same reliability for lesbians compared to heterosexuals (Birnholz & Young, 2012). Depression was a dichotomous variable where any participant who scored over 10 was coded as reported depressive symptoms.

Discrimination: Discrimination was assessed using an adapted version of the Experiences of Discrimination (EOD) 7-item scale (Cronbach's alpha >.74) (Krieger, 1990; Krieger & Sidney, 1996; Krieger, Smith, Naishadham, Hartman, & Barbeau, 2005). Participants answered yes/no questions about whether they had ever experienced discrimination in the domains of race (7 questions), gender (6 questions), and "sexual preference" (7 questions). We summed the number of "yes" responses for each domain. Because responses were heavily right skewed and lesbians reported significantly higher gender and sexual preference discrimination, we dichotomized discrimination for each domain into "none" or "any".

Binge eating: Participants were coded as engaging in binge eating in the past 6 months if they: 1) reported eating within a two-hour period what most people would consider an unusually large amount of food, and 2) reported feeling a loss of control during these events, for 3) an average of at least two to three days per week. Binge eating was a dichotomous variable.

Hazardous drinking: Hazardous drinking was assessed with four types of questions that assessed drinking behaviors over the past 12 months. Participants were asked about: heavy episodic drinking ("During the last 12 months, how often did you have 6 or more drinks of wine, beer, or liquor in a single day?"); intoxication ("About how often in the last 12 months did you drink enough to feel drunk"); consequences of drinking (driving drunk, accident in the home, harmful effect on housework, partner/spouse, friends or relatives complained about drinking, hurt chances of getting a job or promotion, people annoyed you by criticizing your drinking, guilt

about drinking, and not remembering things done/said while drinking); and, possible alcohol dependence (drinking fast for quicker effect, morning drinking, inability to stop drinking before intoxication, inability to quit or cut down drinking, and surreptitious drinking). Responses were summed and dichotomized for each of the four types of questions (0 = no behaviors, 1 = any behaviors) to create an index of 0-4. Hazardous drinking was dichotomized using a cutoff of 2 or more on the index (T.L. Hughes et al., 2014).

Current smoking: Respondents who answered "yes" to "Do you currently smoke cigarettes" were coded as current smokers.

Data for outcome measures were collected during participants' first clinic visit. Waist circumference (WC) and hip circumference (HC) were measured in centimeters using a standard protocol that averaged repeated measures. WHR was calculated as WC/HC. BMI was categorized using the formula *weight (lb) / [height (in)]$^2$ x 703* (Centers for Disease Control and Prevention, 2011). Using the National Heart, Lung, and Blood Institute (NHLBI) standards, we categorized BMI as <18.5=underweight, 18.5-24.9=normal weight, 25-29.9=overweight, and >30=obese (National Heart, 2012). BMI categories were entered as dummy variables.

*Data Analysis*

We ran descriptive statistics to assess the entire sample and conducted chi-square tests (for categorical variables) and independent sample t-tests (for continuous variables) to examine differences between heterosexuals and lesbians. Univariable multinomial regression was used to examine the relationship between BMI status and predictors, and univariable linear regression was used to examine the relationship between WHR and predictors. Because all proposed covariates were theoretically and empirically associated with WHR and BMI, they were retained for multivariable models regardless of significance in bivariate tests.

Multivariable linear regression models (for WHR) and multinomial regression models (for BMI category) were constructed to assess the influence of demographic and behavioral factors. First, we examined differences by sexual orientation after controlling for race, age, education and parity. For WHR, we also added height as a covariate at this step. Second, additional demographic and behavioral covariates were added to the models (relationship status, social support, depression, hazardous drinking, current smoking, binge eating, and race, gender, and sexual preference discrimination). Finally, interactions of sexual orientation and key covariates (gender, race, and sexual preference discrimination, depression, social support, and relationship status) were tested. If there was a significant interaction, the models were stratified by sexual orientation to examine conditional effects.

## 4.3 RESULTS

The final analytic sample was limited to individuals who had data on key covariates of interest: hazardous drinking, discrimination, relationship status, and binge eating and consisted of 808 women (374 heterosexuals and 434 lesbians). WHR data was available for 797 individuals. Because the small number of underweight individuals (n=6) prohibited inclusion in the multinomial models, they were eliminated from all multinomial analyses.

Descriptive statistics of the entire sample as well as comparisons of lesbians and heterosexuals are shown in Table 4.1. There was no difference between lesbians and heterosexuals in distribution of age and race. Overall, the sample was well-educated although a higher proportion of lesbians had a bachelor's degree or higher (69.6%) compared to heterosexuals (62.8%) ($p$=0.043). Additionally, a much higher proportion of heterosexuals had

ever given birth (69.5%) than lesbians (26.7%) ($p$<0.001). On psychosocial covariates, lesbians and heterosexuals were largely comparable. Exceptions were current smoking, where the proportion of lesbians who were current smokers was over double that of heterosexuals (14.6% vs. 7.0%) ($p$=0.001), and discrimination, where lesbians reported more occurrences of gender and sexual preference discrimination (67.7% and 76.0%, respectively) than heterosexuals (47.9% and 5.9%, respectively). Heterosexuals reported binge eating more than lesbians (14.7% vs. 10.1%) ($p$=0.048). A higher proportion of lesbians were obese (39.9% vs. 29.1%) ($p$=0.016). However, the two groups did not differ on mean WHR ($p$=0.159).

Univariable regression results of covariates and outcome variables are shown in Tables 4.2 and 4.3. For WHR, individuals aged 55-65 had significantly higher WHR compared to those aged 35-40. Higher education was negatively associated, and depression was positively associated, with WHR and BMI. All types of discrimination were positively associated with WHR, as was binge eating. Lesbian and African American women were significantly more likely to be obese than heterosexual women and white women, respectively, but not more likely to be overweight. Being depressed was associated with higher odds of obesity while higher education was associated with lower odds of obesity. Gender discrimination was not predictive of BMI status, but both race and sexual preference discrimination was associated with higher odds of obesity. Binge eating was predictive of both overweight and obesity.

*Waist-to-Hip Ratio (WHR)*

The results of model building for the WHR outcome is shown in Table 4.4. Model 1 predicted WHR based on sexual orientation while controlling for age, race, education, parity, and height. Lesbians and heterosexuals did not differ in WHR ($p$=0.101). Adding additional psychosocial variables to the model (Model 2) did not change the results. Lesbians and

heterosexuals remained the same in terms of WHR ($p$=0.467). Holding the other predictors constant, reporting any gender discrimination was associated with a 0.013 increase in WHR ($p$=0.003). Binge eating was also associated with an increased WHR of 0.020 ($p$=0.001).

Interaction terms of sexual orientation and several covariates were tested but all were insignificant: gender discrimination ($p$=0.477), race discrimination ($p$=0.088), sexual orientation discrimination ($p$=0.772), depression ($p$=0.411), social support ($p$=0.556), and relationship status ($p$=0.962) (data not shown). Despite the lack of significant interaction terms, stratified models were run to examine the effects of discrimination on WHR for lesbians and heterosexuals given the fact that lesbians reported significantly more discrimination than heterosexuals (Table 4.5). Binge eating was significantly associated with increased WHR. In both the heterosexual and lesbian models, those who reported binge eating had WHR increased by 0.020 (heterosexuals: $p$=0.023, lesbians: $p$=0.034). However, gender discrimination was only significantly associated with increased WHR for lesbians ($p$=0.013) such that for lesbians who reported experiencing gender discrimination, WHR increased by 0.016.

*Body Mass Index (BMI)*

Multinomial regression model results for BMI categories are shown in Table 4.6. After controlling for age, race, education, and parity there was no difference in the likelihood of lesbians being overweight than normal weight compared to heterosexuals ($p$=0.775). However, the odds of lesbians being obese compared to normal weight were 1.63 times higher than the odds of heterosexuals being obese compared to normal weight ($p$=0.013).

Next, psychosocial variables were added to the model to further predict BMI status. Binge eaters had higher odds of being overweight (AOR=2.304, $p$=0.014) and obese (AOR = 4.530, $p$< 0.001) than non-bingers compared to normal weight. Current smokers had higher odds

of being overweight (AOR = 2.142, $p$=0.017) but not obese. Depression was marginally associated with higher odds of being overweight compared to normal weight (AOR = 1.648, $p$=0.074) but significantly increased the odds of being obese (AOR = 2.137, $p$=0.004). None of the three discrimination variables was related to higher odds of overweight status, but any race discrimination had a positive relationship with obese status (AOR = 2.768, $p$<0.001). Gender and sexual preference discrimination were not associated with the odds of being obese.

To assess the potential moderating effects of sexual orientation and psychosocial predictors, we tested interaction terms of sexual orientation with gender, race, and sexual orientation discrimination, depression, social support, and relationship status. Both gender discrimination and relationship status significantly interacted with sexual orientation. Lesbians who reported experiencing gender discrimination had over three times the odds of being obese compared to normal weight ($p$=0.003) and lesbians who were in a committed relationship had a nearly four times greater odds of being obese compared to normal weight ($p$=0.001). A three-way interaction term of sexual orientation, gender discrimination, and relationship status was not significant ($p$=0.410).

Next, we ran stratified models by sexual orientation to examine the conditional effects of gender discrimination and relationship status (Table 4.7). For heterosexuals, none of the predictors was significantly related to being overweight. However, binge eating (AOR = 4.778, $p$<0.001), any race discrimination (AOR = 2.909, $p$=0.006), and greater social support (AOR = 1.058, $p$=0.050) were associated with higher odds of being obese compared to normal weight. Being in a committed relationship was significantly protective of being obese for heterosexuals, such that women in a committed relationship had only 0.381 odds of being obese compared to normal weight than women not in a committed relationship ($p$=0.006). As with the

heterosexuals, none of the predictors in the stratified model for lesbians were predictive of being overweight. Binge eating was associated with higher odds of being obese (AOR = 4.178, $p$=0.003). Depressed lesbians were over two times more likely to be obese than normal weight compared to non-depressed lesbians (AOR = 2.126, $p$=0.027). Lesbians who reported experiencing any gender discrimination (AOR = 2.001, $p$=0.013) and any race discrimination (AOR = 3.295, $p$=0.002) were also more likely to be obese. Relationship status was not associated with the odds of being obese ($p$=0.063). Thus, the significant interaction term of relationship status and sexual orientation was due to the highly protective association between obesity and being in a committed relationship for heterosexual women in this sample. Being in a committed relationship had no risk or protective association for lesbians. Finally, we ran models using obese as the reference category to confirm that there was a difference between overweight and obese categories, which we confirmed.

## 4.4 DISCUSSION

In our investigation of WHR in this sample, we did not find any evidence to support our hypothesis that that lesbian and heterosexual women differed on waist-to-hip ratio, unlike the one prior study of WHR in lesbians (S. A. Roberts et al., 2003). Examining the effects of hypothesized moderators for WHR and BMI produced mixed results. Depression and social support did not influence WHR or risk of overweight or obesity among lesbians, perhaps not surprising given that lesbians and heterosexuals in this sample were comparable in prevalence of depression and level of social support.

The most significant finding of this research is support for the hypothesis that discrimination contributes to the weight disparity between lesbians and heterosexuals. Lesbians who reported gender discrimination had three times higher odds of being obese. Although the interaction term was insignificant, we do note that gender discrimination in lesbians was significantly associated with higher WHR in the stratified models. Sexual preference discrimination was not a significant predictor, likely due to low variability because few heterosexuals reported this type of discrimination. Our finding of the relationship between discrimination and obesity among lesbians is similar to a recent paper about heterosexist discrimination and weight in an online sample of lesbians (Mereish, 2014). Although this association is cross-sectional and we are unable to determine if prior discrimination led to increased weight, there are two theories that hypothesize a causal relationship. From a psychosocial perspective, Minority Stress Theory suggests that distal stressors such as prejudice and discrimination contribute to adverse psychological and health problems (I. H. Meyer, 2003b). There are few applications of Minority Stress Theory connecting distal stressors and physical health disparities, but this study could be an indicator that discrimination impacts lesbians' feelings and behaviors, which leads to weight gain. Because we found that gender, and not sexual preference, discrimination was the key moderator for lesbians in terms of BMI status, one could argue the applicability of the Minority Stress Model. However, representation of gender is incredibly nuanced for sexual minorities (West & Zimmerman, 1987) and gender discrimination could very well be a marker of societal response to sexual minority status and/or gender nonconformity.

From a biological perspective, the concept of allostatic load suggests that stress related to discrimination disrupts the hypothalamus-pituitary-adrenal (HPA) axis, which is responsible for

modulating cortisol levels in response to stress in order to maintain allostatis (McEwen & Stellar, 1993). Under repeated stress, the HPA axis can become overly activated and produce downstream effects on the immune system, the cardiovascular system, and tissue, such as adipose tissue (Björntorp, 2001). Discrimination is associated with high cortisol levels in African Americans (Fuller-Rowell et al., 2012) and elevated cortisol is also associated with increased abdominal fat accumulation and BMI among African American women (Björntorp, 2001).

Another important finding was that of relationship status's effect on obesity. We discovered a moderating effect of relationship status on BMI status, though not in the direction anticipated. Being in a committed relationship was protective against the odds of obesity for heterosexual women, but made no difference for lesbians. This finding does not concur with results from longitudinal studies that show that entry into a marriage or relationship confers obesity risk (Dinour, Leung, Tripicchio, Khan, & Yeh, 2012). However, due to the cross-sectional design of this study, we could only look at static relationship status and were unable to investigate the effect of relationship status transition on weight.

While study design is one factor that can explain these results, other explanations grounded in social and cultural aspects are also plausible. Heterosexuals could be more exposed to or influenced by societal pressures to be thin in order to be attractive to a mate (Wetsman & Marlowe, 1999). Thus, heterosexual women who are attached to a mate may try to conform to an ideal weight that societal norms deem attractive in order to maintain the relationship. Studies of body satisfaction and ideals among lesbians, however, provide some evidence that lesbians are accepting of a wider variety of body sizes (Herzog et al., 1992) and feel less inclined to meet heterosexual ideals (Share & Mintz, 2002). The association between being in a committed relationship and obesity could work in the other direction as well. It is plausible that

heterosexual women who are not obese have a greater chance of obtaining a committed partner (Sobal, Rauschenbach, & Frongillo, 1992). Finally, the financial and legal benefits conferred to married heterosexuals could mediate the relationship between relationship status and weight. For example, married individuals have greater access to health insurance (Wetsman & Marlowe, 1999) and lack of health insurance is associated with higher BMI among lesbians (Boehmer & Bowen, 2009).

This study was a convenience sample obtained from a limited geographic area, so generalizability is limited. The convenience sampling strategy likely missed subpopulations of lesbians who were unaware of the existence of the study because they were not connected to the community groups through which the study was advertised or who were unwilling to participate in this research. Thus, the fact that this study did not find higher rates of depression, binge eating, or hazardous drinking among lesbians compared to heterosexuals, which is inconsistent with the broader literature (S. B. Austin, Ziyadeh, Corliss, Rosario, et al., 2009; T. L. Hughes, 2003; Valanis et al., 2000), could be an artifact of the way the sample was obtained. Bisexual women were excluded from the sample, though recent studies have shown that bisexual or "mostly heterosexual" women report risk behaviors and health disparities that are as great or greater than lesbians (Conron et al., 2010). In addition, women with pre-existing diseases such as angina or heart disease were not included due to the focus of the original study. Finally, the ESTHER study did not obtain data on weight discrimination, which could confound the effects of discrimination on BMI status. For example, perhaps overweight lesbians experience more discrimination *because* they are fat. However, studies that control for weight discrimination still show an association between other types of discrimination and weight (Cozier et al., 2009; Gee

et al., 2008), suggesting that discrimination based on other social positions influences weight independently of weight discrimination.

This sample has many strengths compared to other convenience or population-based samples. The presence of an equivalent heterosexual comparison group among convenience samples is a weakness in the existing literature (Bowen et al., 2008) but significantly strengthens our ability to assess disparities. The quantity of the information collected by ESTHER is much greater than that could be obtained by population-based samples seeking to answer the same questions. Clinically measured data, such as waist and hip circumference, height, and weight, reduces self-report bias, and the breadth of psychosocial measures enhances our ability to test predictors associated with health outcomes.

## 4.5 CONCLUSION

This research marks a first step toward understanding the observed weight disparity between lesbian and heterosexual women. For example, a longitudinal study comparing heterosexual to lesbian women could better explore the discrepant effect of relationship status found in this sample. In addition, future studies are needed to explore the impact of discrimination on lesbians. Whether feelings and behaviors or allostatic load (or both) mediates the relationship between discrimination and adiposity should be explored in additional studies. For example, biomarkers of inflammation, such as cortisol, could provide evidence of a biological link between discrimination and weight. Finally, the field is only recently beginning to move toward examining disparities in cardiovascular risk and mortality among sexual minorities (Farmer et al., 2013; Hatzenbuehler et al., 2014; Hatzenbuehler et al., 2013). Additional research

should explore whether the increased prevalence of obesity among lesbians leads to higher rates of mortality.

**Table 4-1: Sample Characteristics**

| Variable | | Total (N=808) | Heterosexual (N=374) N (%) | Lesbian (N=434) | p |
|---|---|---|---|---|---|
| Race | | | | | |
| | White | 749 (92.7%) | 346 (92.5%) | 403 (92.9%) | 0.851 |
| | African American | 59 (7.3%) | 28 (7.5%) | 31 (7.1%) | |
| Age | | | | | |
| | 35-39 | 116 (14.4%) | 56 (15.0%) | 60 (13.8%) | 0.49 |
| | 40-44 | 184 (22.8%) | 83 (22.2%) | 101 (23.3%) | |
| | 45-49 | 197 (24.4%) | 85 (22.7%) | 112 (25.8%) | |
| | 50-54 | 141 (17.5%) | 62 (16.6%) | 79 (18.2%) | |
| | 55-65 | 170 (21.0%) | 88 (23.5%) | 82 (18.9%) | |
| Education | | | | | |
| | <BS | 271 (33.5%) | 139 (37.2%) | 132 (30.4%) | **0.043** |
| | >=BS | 537 (66.5%) | 235 (62.8%) | 302 (69.6%) | |
| In a Committed Relationship | | | | | |
| | Yes | 570 (70.5%) | 252 (67.4%) | 318 (73.3%) | 0.067 |
| | No | 238 (29.5%) | 122 (32.6%) | 116 (26.7%) | |
| Ever Given Birth | | | | | |
| | Yes | 376 (46.5%) | 260 (69.5%) | 116 (26.7%) | **<0.001** |
| | No | 432 (53.5%) | 114 (30.5%) | 318 (73.3%) | |
| Hazardous drinking | | | | | |
| | Yes | 198 (24.5%) | 85 (22.7%) | 113 (26.0%) | 0.275 |
| | No | 610 (75.5%) | 289 (77.3%) | 321 (74.0%) | |
| Currently Smoke | | | | | |
| | Yes | 89 (11.0%) | 26 (7.0%) | 63 (14.6%) | **0.001** |
| | No | 714 (88.4%) | 345 (93.0%) | 369 (85.4%) | |
| Currently Depressed | | | | | |
| | Yes | 146 (18.1%) | 62 (16.6%) | 84 (19.4%) | 0.306 |
| | No | 662 (81.9%) | 312 (83.4%) | 350 (80.6%) | |
| Social Support | | | | | |
| | Mean (SD) | 35.51 (5.54) | 35.25 (5.73) | 35.73 (5.37) | 0.212 |
| Gender Discrimination | | | | | |
| | Yes | 473 (58.5%) | 179 (47.9%) | 294 (67.7%) | **<0.001** |
| | No | 335 (41.5%) | 195 (52.1%) | 140 (32.3%) | |
| Race Discrimination | | | | | |
| | Yes | 139 (17.2%) | 68 (18.2%) | 71 (16.4%) | 0.494 |
| | No | 669 (82.8%) | 306 (81.8%) | 363 (83.6%) | |
| Sexual Preference Discrimination | | | | | |
| | Yes | 352 (43.6%) | 22 (5.9%) | 330 (76.0%) | **<0.001** |
| | No | 456 (56.4%) | 352 (94.1%) | 104 (24.0%) | |
| Binge Eating | | | | | |
| | Yes | 99 (12.3%) | 55 (14.7%) | 44 (10.1%) | **0.048** |
| | No | 709 (87.7%) | 319 (85.3%) | 390 (89.9%) | |
| OUTCOME VARIABLES | | | | | |
| Waist-to-hip ratio | | | | | |
| | Mean (SD) | 0.909 (0.058) | 0.906 (0.057) | 0.912 (0.060) | 0.159 |
| BMI Category | | | | | |
| | Underweight (<18.5) | 6 (0.7%) | 3 (0.8%) | 3 (0.7%) | 0.016 |
| | Normal (18.5 - 24.9) | 286 (35.4%) | 142 (38.0%) | 144 (33.2%) | |

**Table 4-2: Bivariate Relationships, WHR and Predictors**

| Covariate | | WHR<br>Beta (95% CI) |
|---|---|---|
| Sexual Orientation | | |
| | Heterosexual | Ref. |
| | Lesbian | 0.066 (-0.002, 0.014) |
| Race | | |
| | White | Ref. |
| | African American | 0.004 (-0.011, 0.020) |
| Age | | |
| | 35-39 | Ref. |
| | 40-44 | -0.004 (-0.017, 0.010) |
| | 45-49 | 0.001 (-0.012, 0.015) |
| | 50-54 | 0.005 (-0.009, 0.020) |
| | 55-65 | **0.017 (0.003, 0.031)*** |
| Education | | |
| | <BS | Ref. |
| | >=BS | **-0.011 (-0.019, -0.002)*** |
| In a Committed Relationship | | |
| | Yes | -0.007 (-0.015, 0.002) |
| | No | Ref. |
| Ever Given Birth | | |
| | Yes | 0.003 (-0.005, 0.011) |
| | No | Ref. |
| Hazardous drinking | | |
| | Yes | 0.003 (-0.006, 0.013) |
| | No | Ref. |
| Currently smoke | | |
| | Yes | 0.008 (-0.005, 0.021) |
| | No | Ref. |
| Depression | | |
| | Yes | **0.014 (0.003, 0.024)*** |
| | No | Ref. |
| Social Support | | -0.001 (-0.001, 0.000) |
| Gender Discrimination | | |
| | Yes | **0.016 (0.007, 0.024)***** |
| | No | Ref. |
| Race Discrimination | | |
| | Yes | **0.012 (0.001, 0.023)*** |
| | No | Ref. |
| Sexual Preference Discrimination | | |
| | Yes | **0.008 (0.000, 0.017)*** |
| | No | Ref. |
| Binge Eating | | |
| | Yes | **0.022 (0.010, 0.034)***** |
| | No | Ref. |

* Significant at the p≤0.05 level
** Sigificant at the p≤0.01 level
***Significant at the p≤0.001 level

**Table 4-3: Bivariate Relationships, BMI Status and Predictors**

| Covariate | Overweight‡ OR (95% CI) | Obese‡ OR (95% CI) |
|---|---|---|
| Sexual Orientation | | |
| Heterosexual | Ref. | Ref. |
| Lesbian | 0.937 (0.663, 1.324) | **1.565 (1.121, 2.185)**** |
| Race | | |
| White | Ref. | Ref. |
| African American | 0.977 (0.379, 2.517) | **4.695 (2.303, 9.575)***** |
| Age | | |
| 35-39 | Ref. | Ref. |
| 40-44 | 0.999 (0.552, 1.809) | 1.042 (0.606, 1.792) |
| 45-49 | 1.070 (0.598, 1.915) | 0.972 (0.567, 1.665) |
| 50-54 | 1.248 (0.667, 2.337) | 1.233 (0.692, 2.197) |
| 55-65 | 1.777 (0.983, 3.211) | 1.094 (0.617, 1.938) |
| Education | | |
| <BS | Ref. | Ref. |
| >=BS | 0.883 (0.601, 1.299) | **0.455 (0.320, 0.646)***** |
| In a Committed Relationship | | |
| Yes | 0.975 (0.662, 1.435) | 0.774 (0.540, 1.110) |
| No | Ref. | Ref. |
| Ever Given Birth | | |
| Yes | 1.071 (0.758, 1.514) | 0.970 (0.697, 1.349) |
| No | Ref. | Ref. |
| Hazardous drinking | | |
| Yes | 0.819 (0.550, 1.221) | 0.783 (0.535, 1.146) |
| No | Ref. | Ref. |
| Currently smoke | | |
| Yes | 1.767 (0.989, 3.155) | 1.715 (0.979, 3.005) |
| No | Ref. | Ref. |
| Depression | | |
| Yes | 1.637 (0.992, 2.701) | **2.824 (1.795, 4.444)***** |
| No | Ref. | Ref. |
| Social Support | 1.007 (0.975, 1.040) | 0.982 (0.953, 1.011) |
| Gender Discrimination | | |
| Yes | 1.026 (0.724, 1.454) | 1.271 (0.908, 1.778) |
| No | Ref. | |
| Race Discrimination | | |
| Yes | 1.664 (0.989, 2.801) | **3.095 (1.940, 4.939)***** |
| No | Ref. | Ref. |
| Sexual Preference Discrimination | | |
| Yes | 1.028 (0.722, 1.463) | **1.553 (1.113, 2.166)**** |
| No | Ref. | Ref. |
| Binge Eating | | |
| Yes | **2.201 (1.156, 4.192)*** | **4.181 (2.334, 7.491)***** |
| No | Ref. | Ref. |

‡ Reference group is normal weight individuals

* Significant at the p≤0.05 level

** Sigificant at the p≤0.01 level

***Significant at the p≤0.001 level

**Table 4-4: Multivariable Models of Waist-to-Hip Ratio**

| Covariate | Model 1<br>Beta (95% CI)† | Model 2<br>Beta (95% CI)† |
|---|---|---|
| Sexual Orientation | | |
| Heterosexual | Ref. | Ref. |
| Lesbian | 0.008 (-0.001, 0.017) | 0.005 (-0.008, 0.017) |
| Relationship Status | | |
| In a committed relationship | | -0.003 (-0.012, 0.006) |
| Not in a committed relationship | | Ref. |
| Depression | | |
| Yes | | 0.007 (-0.004, 0.019) |
| No | | Ref. |
| Social Support | | 0.000 (-0.001, 0.001) |
| Gender Discrimination | | |
| Yes | | **0.013 (0.005, 0.022)**** |
| No | | Ref. |
| Race Discrimination | | |
| Yes | | 0.008 (-0.005, 0.020) |
| No | | Ref. |
| Sexual Preference Discrimination | | |
| Yes | | 0.003 (-0.009, 0.015) |
| No | | Ref. |
| Binge Eating | | |
| Yes | | **0.020 (0.008, 0.033)***** |
| No | | Ref. |
| Hazardous drinking | | |
| Yes | | 0.006 (-0.003, 0.016) |
| No | | Ref. |
| Current Smoking | | |
| Yes | | 0.007 (-0.006, 0.020) |
| No | | Ref. |

†All models adjusted for age, race, education, parity, and height (in)

* Significant at the p≤0.05 level

** Sigificant at the p≤0.01 level

***Significant at the p≤0.001 level

**Table 4-5: Stratified Multivariable Models of Waist-to-Hip Ratio by Sexual Orientation**

| Covariate | Heterosexual<br>Beta (95% CI)† | Lesbian<br>Beta (95% CI)† |
|---|---|---|
| Relationship Status | | |
| In a committed relationship | -0.003 (-0.017, 0.011) | -0.005 (-0.018, 0.008) |
| Not in a committed relationship | Ref. | Ref. |
| Depression | | |
| Yes | -0.001 (-0.019, 0.017) | 0.011 (-0.004, 0.026) |
| No | Ref. | Ref. |
| Social Support | -0.001 (-0.002, 0.001) | 0.000 (-0.001, 0.001) |
| Gender Discrimination | | |
| Yes | 0.012 (0.000, 0.025) | **0.016 (0.003, 0.029)*** |
| No | Ref. | Ref. |
| Race Discrimination | | |
| Yes | -0.001 (-0.018, 0.016) | 0.017 (-0.001, 0.035) |
| No | Ref. | Ref. |
| Sexual Preference Discrimination | | |
| Yes | 0.011 (-0.015, 0.038) | 0.000 (-0.014, 0.014) |
| No | Ref. | Ref. |
| Binge Eating | | |
| Yes | **0.020 (0.003, 0.037)*** | **0.020 (0.002, 0.039)*** |
| No | Ref. | Ref. |
| Hazardous drinking | | |
| Yes | 0.012 (-0.002, 0.026) | 0.004 (-0.009, 0.017) |
| No | Ref. | Ref. |
| Current Smoking | | |
| Yes | 0.012 (-0.011, 0.036) | 0.004 (-0.013, 0.021) |
| No | Ref. | Ref. |

†All models adjusted for age, race, education, parity, and height (in)

* Significant at the p≤0.05 level

** Sigificant at the p≤0.01 level

***Significant at the p≤0.001 level

**Table 4-6: Multivariable Regression Models of BMI Status**

| | Model 1 | | Model 2 | | Model 3 | | Model 4 | |
|---|---|---|---|---|---|---|---|---|
| | Overweight | Obese | Overweight | Obese | Overweight | Obese | Overweight | Obese |
| Covariate | AOR (95% CI)† | AOR (95% CI)† | AOR (95% CI)† | AOR (95% CI)† | AOR (95% CI)† | AOR (95% CI)† | AOR (95% CI)† | AOR (95% CI)† |
| Sexual Orientation | | | | | | | | |
| Heterosexual | Ref. | Ref. | Ref. | Ref. | Ref. | Ref. | Ref. | Ref. |
| Lesbian | 0.945 (0.641, 1.393) | **1.630 (1.111, 2.392)*** | 0.861 (0.498, 1.488) | **1.953 (1.146, 3.327)*** | 0.651 (0.337, 1.257) | 1.087 (0.570, 2.075) | 0.734 (0.339, 1.587) | 0.782 (0.370, 1.652) |
| Relationship Status | | | | | | | | |
| In a committed relationship | | | 1.150 (0.750, 1.763) | 0.901 (0.596, 1.364) | 1.113 (0.725, 1.710) | 0.880 (0.578, 1.340) | 0.976, 0.533, 1.787) | **0.422 (0.228, 0.783)**** |
| Not in a committed relationship | | | Ref. | Ref. | Ref. | Ref. | Ref. | Ref. |
| Depression | | | | | | | | |
| Yes | | | 1.648 (0.952, 2.854) | **2.137 (1.272, 3.592)**** | 1.662 (0.958, 2.883) | **2.043 (1.208, 3.455)**** | 1.649 (0.952, 2.856) | **1.997 (1.181, 3.377)**** |
| No | | | Ref. | Ref. | Ref. | Ref. | Ref. | Ref. |
| Social Support | | | 1.032 (0.995, 1.071) | 1.022 (0.986, 1.059) | 1.033 (0.996, 1.072) | 1.025 (0.989, 1.063) | 1.032 (0.994, 1.070) | 1.023 (0.987, 1.060) |
| Gender Discrimination | | | | | | | | |
| Yes | | | 0.993 (0.677, 1.458) | 1.114 (0.756, 1.640) | 0.736 (0.440, 1.232) | 0.635 (0.363, 1.109) | 0.988 (0.673, 1.452) | 1.142 (0.771, 1.693) |
| No | | | Ref. | Ref. | Ref. | Ref. | Ref. | Ref. |
| Race Discrimination | | | | | | | | |
| Yes | | | 1.523 (0.884, 2.627) | **2.768 (1.667, 4.596)***** | 1.741 (0.969, 3.128) | **2.270 (1.285, 4.011)**** | 1.653 (0.924, 2.955) | **2.020 (1.148, 3.555)*** |
| No | | | Ref. | Ref. | Ref. | Ref. | Ref. | Ref. |
| Sexual Preference Discrimination | | | | | | | | |
| Yes | | | 1.115 (0.650, 1.911) | 0.947 (0.564, 1.589) | 1.016 (0.589, 1.753) | 0.863 (0.507, 1.468) | 1.093 (0.635, 1.880) | 0.966 (0.572, 1.631) |
| No | | | Ref. | **Ref.** | Ref. | Ref. | Ref. | **Ref.** |
| Binge Eating | | | | | | | | |
| Yes | | | **2.304 (1.186, 4.474)*** | **4.530 (2.442, 8.402)***** | **2.279 (1.170, 4.438)*** | **4.684 (2.516, 8.721)***** | **2.246 (1.155, 4.365)*** | **4.479 (2.405, 8.340)***** |
| No | | | Ref. | Ref. | Ref. | Ref. | Ref. | Ref. |
| Hazardous Drinking | | | | | | | | |
| Yes | | | 0.806 (0.528, 1.232) | 0.806 (0.530, 1.225) | 0.811 (0.530, 1.241) | 0.821 (0.537, 1.254) | 0.805 (0.526, 1.232) | 0.813 (0.532, 1.243) |
| No | | | Ref. | Ref. | Ref. | Ref. | Ref. | Ref |
| Current Smoking | | | | | | | | |
| Yes | | | **2.142 (1.146, 4.004)*** | 1.301 (0.696, 2.431) | **2.119 (1.130 3.972)*** | 1.222 (0.648, 2.305) | **2.158 (1.152, 4.041)*** | 1.278 (0.676, 2.414) |
| No | | | Ref. | Ref. | Ref. | Ref. | Ref. | Ref. |
| SO x Gender Discrimination | | | | | 1.875 (0.892, 3.940) | **3.122 (1.455, 6.657)**** | | |
| SO x Relationship Status | | | | | | | 1.310 (0.577, 2.974) | **3.955 (1.747, 8.954)***** |

†All models adjusted for age, race, education, and parity

* Significant at the p≤0.05 level

** Sigificant at the p≤0.01 level

***Significant at the p≤0.001 level

**Table 4-7: Stratified Multivariable Models of BMI Status by Sexual Orientation**

| | Heterosexual | | Lesbian | |
|---|---|---|---|---|
| | Overweight | Obese | Overweight | Obese |
| Covariate | AOR (95% CI)† | AOR (95% CI)† | AOR (95% CI)† | AOR (95% CI)† |
| Relationship Status | | | | |
| In a committed relationship | 1.095 (0.566, 2.115) | **0.381 (0.192, 0.756)**** | 1.291 (0.711, 2.346) | 1.720 (0.971, 3.046) |
| Not in a committed relationship | Ref. | Ref. | Ref. | Ref. |
| Depression | | | | |
| Yes | 2.265 (0.963, 5.329) | 2.470 (1.010, 5.040)* | 1.352 (0.638, 2.863) | **2.126 (1.087, 4.155)*** |
| No | Ref. | Ref. | Ref. | Ref. |
| Social Support | 1.050 (0.995, 1.108) | **1.058 (1.000, 1.119)*** | 1.020 (0.966, 1.076) | 0.997 (0.950, 1.047) |
| Gender Discrimination | | | | |
| Yes | 0.734 (0.425, 1.268) | 0.627 (0.344, 1.141) | 1.531 (0.869, 2.698) | **2.001 (1.161, 3.484)*** |
| No | Ref. | Ref. | Ref. | Ref. |
| Race Discrimination | | | | |
| Yes | 1.532 (0.720, 3.261) | **2.909 (1.354, 6.247)**** | 1.702 (0.744, 3.893) | **3.295 (1.570, 6.916)**** |
| No | Ref. | Ref. | Ref. | Ref. |
| Sexual Preference Discrimination | | | | |
| Yes | 1.543 (0.463, 5.138) | 0.930 (0.250, 3.457) | 0.766 (0.408, 1.440) | 0.724 (0.395, 1.329) |
| No | Ref. | Ref. | Ref. | Ref. |
| Binge Eating | | | | |
| Yes | 2.274 (0.954, 5.420) | **4.778 (2.057, 11.100)***** | 2.208 (0.760, 6.412) | **4.178 (1.612, 10.830)**** |
| No | Ref. | Ref. | Ref. | Ref. |
| Hazardous Drinking | | | | |
| Yes | 0.815 (0.439, 1.511) | 0.507 (0.251, 1.025) | 0.739 (0.403, 1.353) | 1.048 (0.602, 1.825) |
| No | Ref. | Ref. | Ref. | Ref. |
| Current Smoking | | | | |
| Yes | 2.302 (0.795, 6.663) | 1.235 (0.382, 3.998) | 2.020 (0.910, 4.486) | 1.146 (0.532, 2.469) |
| No | Ref. | Ref. | Ref. | Ref. |

†All models adjusted for age, race, education, and parity

* Significant at the p≤0.05 level

** Sigificant at the p≤0.01 level

***Significant at the p≤0.001 level

# 5.0 RISK OF THE METABOLIC SYNDROME IN LESBIANS: RESULTS FROM THE ESTHER STUDY

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## 5.1 INTRODUCTION

Between 20-25% of U.S. adults have the metabolic syndrome (Ford 2002, Park 2003), which is a condition characterized by a constellation of risk factors, including elevated blood pressure and triglycerides, diabetes, low high-density lipoprotein cholesterol (HDL-C), and abdominal obesity. The metabolic syndrome is closely linked to obesity (S. Grundy, 2004) and has a clear positive relationship with mortality. For example, a recent meta-analysis of the relationship between the metabolic syndrome and cardiovascular disease (CVD) showed a risk ratio (RR) of 2.35 for CVD disease, 2.40 for CVD mortality, and 1.65 for all-cause mortality (Mottillo et al., 2010).

The distribution of the metabolic syndrome across the population is not uniform. For example, population-based samples investigating the metabolic syndrome have found that prevalence is higher among certain racial/ethnic groups, such as Mexican-Americans (Park 2003, Razzouk 2009) or Hispanics in general (Jordan 2012), and other research shows that metabolic

syndrome is more prevalent among women compared to men within certain racial/ethnic groups (Ford 2002). Rates of the metabolic syndrome among women increase over age 50, providing evidence that hormonal protection against developing the metabolic syndrome is reduced once women reach menopause (Razzouk 2009, Romaguera 2010).

Several psychosocial risk factors for the metabolic syndrome have been identified. A meta-analysis found that current smoking was associated with a 26% higher risk of the metabolic syndrome (Sun 2012). Depression is also strongly associated with the metabolic syndrome (Pan 2012, Goldbacher 2009). While light or low-risk drinking seems to be protective against the metabolic syndrome (Slagter 2014), heavy drinking is a significant risk for having the metabolic syndrome (Clerc 2010, Fan 2008).

Compared to heterosexual women, lesbian women have demonstrated higher rates of obesity (Dilley et al., 2010), smoking (Conron et al., 2010), heavy drinking (Case et al., 2004), and depression (Valanis et al., 2000). Yet, no research has examined whether lesbians have higher rates of the metabolic syndrome. The aim of this study is to describe the prevalence of the metabolic syndrome and its individual factors in a sample of heterosexual and lesbian women, and identify whether lesbians are at greater risk of having the metabolic syndrome.

## 5.2 METHODS

Data for the study is from the Epidemiologic Study of HEalth Risk Among Women (ESTHER), a cross-sectional cardiovascular risk study of a convenience sample of women from Pittsburgh, PA and surrounding areas. Participants were recruited through newspaper and radio advertisements, community health events, LGBT events, and the University of Pittsburgh

broadcast phone-message system. A total of 1084 women were recruited; approximately half were lesbian. Because of the disproportionate number of black heterosexual women compared to black lesbian women, a random sample of black heterosexuals was selected to match the proportion of black lesbians for analysis. Also, due to the disproportionate number of older heterosexuals compared to lesbians, women over age 65 were excluded for analysis. The final sample consisted of 479 lesbian and 400 heterosexual women. During a first clinic visit, participants' weight, height, and blood pressure was measured and they provided a blood sample to measure data including fasting glucose, cholesterol, and triglycerides. At this visit, they also completed a battery of written questionnaires that assessed a number of psychosocial and demographic variables, a physical activity interview, and a two-week medicine history. At a second visit, participants reviewed a three-day diet and exercise diary and underwent a Dual Energy X-ray Absorptiometry (DEXA) scan of the hip, spine, and whole body. Participants were offered a $50 incentive for their time. The research was approved by the University of Pittsburgh Institutional Review Board.

*Measures*

Sexual orientation: Women were classified as lesbian if they 1) identified as anything other than heterosexual, and 2) reported either being only or primarily emotionally, physically, and romantically attracted to women in the past five years or having only or primarily female sexual partners in the past five years. Heterosexual women were those who identified as "heterosexual/straight" and reported only male sexual partners since the age of 18. Women who reported attraction men and women and/or men and women sexual partners in the past five years were excluded. Sexual orientation was a dichotomous variable.

Metabolic Syndrome: The presence of the metabolic syndrome was assessed using the 2004 revised National Cholesterol Education Program's (rNCEP) definition (S. M. Grundy et al., 2004; Mottillo et al., 2010). To meet the criteria for the metabolic syndrome, participants had to meet at least three of the following criteria for females: fasting glucose of 100 mg/dl or above or receiving treatment for diabetes; triglycerides of 150 mg/dl or above, or currently receiving treatment for high triglycerides; blood pressure of >=130/85 mm Hg, or currently receiving treatment for high blood pressure; waist circumference of 88cm or greater; and, high density lipoprotein (HDL-C) < 50 mg/dl or currently receiving treatment for cholesterol.

Race: Participants reported their race as Black, Native American, Asian or Pacific Islander, White or Other. After removing Native American, Asian or Pacific Islander, or Other respondents due to small numbers ($n$=32), race was recoded into a dichotomous variable.

Age: Age categories were calculated using participants' dates of birth and were entered as dummy variables.

Education: Education was assessed using a 5-point scale and collapsed to a dichotomous variable.

Relationship status: Participants self-reported whether they were in a committed relationship, not in a committed relationship, or other. Responses of other were collapsed into the "not in a committed relationship" category to create a dichotomous variable.

Menopausal: Menopause was defined as not having a period within the past 12 months (Soules et al., 2001).

Current smoking: Respondents who answered "yes" to "Do you currently smoke cigarettes" were coded as current smokers.

Hazardous drinking: Hazardous drinking was assessed with four types of questions that assessed drinking behaviors over the past 12 months. Participants were asked about: heavy episodic drinking ("During the last 12 months, how often did you have 6 or more drinks of wine, beer, or liquor in a single day?"); intoxication ("About how often in the last 12 months did you drink enough to feel drunk"); consequences of drinking (driving drunk, accident in the home, harmful effect on housework, partner/spouse, friends or relatives complained about drinking, hurt chances of getting a job or promotion, people annoyed you by criticizing your drinking, guilt about drinking, and not remembering things done/said while drinking); and, possible alcohol dependence (drinking fast for quicker effect, morning drinking, inability to stop drinking before intoxication, inability to quit or cut down drinking, and surreptitious drinking). Responses were summed and dichotomized for each of the four types of questions (0 = no behaviors, 1 = any behaviors) to create an index of 0-4. Hazardous drinking was dichotomized using a cutoff of 2 or more on the index (T.L. Hughes et al., 2014).

Depression: Depression was assessed using the CES-D 10 scale (Cronbach's alpha = .86) (Miller et al., 2008). The scale has the same reliability for lesbians compared to heterosexuals (Birnholz & Young, 2012). Depression was a dichotomous variable where any participant who scored over 10 was coded as reporting depressive symptoms.

BMI Status: Height and weight were measured at the first clinic visit. BMI was categorized using the formula $weight\ (lb) / [height\ (in)]^2 \times 703$ (Centers for Disease Control and Prevention, 2011). Using the National Heart, Lung, and Blood Institute (NHLBI) standards, we categorized BMI as <18.5=underweight, 18.5-24.9=normal weight, 25-29.9=overweight, and >30=obese (National Heart, 2012) and created dummy variables. Due to the small number of underweight individuals (n=6) they were collapsed into the normal weight category.

*Analysis*

The analysis was limited to women who had complete data on all the components of the metabolic syndrome. Data was analyzed using SPSS version 21.0. We ran descriptive statistics to assess the entire sample and conducted chi-square tests (for categorical variables) and independent sample t-tests (for continuous variables) to examine differences between heterosexuals and lesbians. We attempted to obtain risk ratios using generalized linear models but the model failed to converge. Therefore, we obtained risk ratios using Cox regression with a time constant (Barros & Hirakata, 2003; Diaz-Quijano, 2012).

## 5.3 RESULTS

After removing the four participants who did not have complete data to allow us to identify the metabolic syndrome, the final analytic sample was 875 women, 379 heterosexuals and 478 lesbians. Sample characteristics are shown in Table 5.1. In terms of demographic and psychosocial variables, heterosexual women and lesbians were largely similar, except that lesbians were more significantly more likely to be in a committed relationship, depressed, and current smokers. Heterosexuals and lesbians were not significantly different on mean triglyceride levels or HDL-C, but lesbians had higher mean waist circumference, fasting glucose, and systolic and diastolic blood pressure. Figure 5.1 shows the number of risk factors for the metabolic syndrome for heterosexual and lesbian women. On average, lesbians had more risk factors for the metabolic syndrome compared to heterosexuals (1.46 vs. 1.16, respectively, $p < 0.001$). The overall prevalence of the metabolic syndrome in the sample was 20.3%, although nearly one-

quarter (24.3%) of lesbians had the metabolic syndrome compared to 15.6% of heterosexual women (Chi-square = 10.015, $p = 0.002$).

The unadjusted risk ratio (RR) for the metabolic syndrome among lesbians compared to heterosexual women was 1.55 (95% CI (1.14, 2.12), $p = .005$) (Table 5.2). After controlling for race, age, education, relationship status, menopause, current smoking, hazardous drinking, depression, and BMI status, the RR for lesbians decreased slightly to 1.44 but remained significantly higher compared to heterosexual women (95% CI (1.03, 1.99), $p = .031$). In the adjusted model, overweight (RR = 3.88, $p = <0.001$) and obesity (RR = 8.85, $p < 0.001$) also carried a higher risk for the metabolic syndrome. Conversely, higher education was associated with a reduced risk (RR = 0.69, $p = 0.018$).

## 5.4 DISCUSSION

In this sample of women, lesbians had a 44% greater risk of having the metabolic syndrome compared to their heterosexual counterparts. To our knowledge, this is the first study to identify this health disparity in lesbians. The greater risk of the metabolic syndrome was evident even after controlling for several risk factors that are associated with the metabolic syndrome, including overweight and obesity, one of the most significantly health disparities between lesbians and heterosexuals (Bowen et al., 2008; Fredriksen-Goldsen, Kim, et al., 2013). The higher risk of the metabolic syndrome for lesbians in this sample seems to be driven by the fact that, compared to heterosexual women, lesbians had higher mean waist circumference, fasting glucose levels, and blood pressure.

Given the metabolic syndrome's association with CVD or all-cause mortality, this study's finding would suggest that lesbians might be at higher risk of mortality compared to heterosexual women. Research is limited, but two studies have found evidence that lesbians have higher prevalence of CVD risk factors compared to heterosexual women (Farmer et al., 2013; Hatzenbuehler et al., 2013).

One study reported a link between community-level LGBT stigma and higher all-cause mortality rates among sexual minorities (Hatzenbuehler et al., 2014). Therefore, one avenue of future research should examine a link between experiences of stigma and/or discrimination and the metabolic syndrome. The allostatic load hypothesis suggests that repeated exposure to stressors disrupts the hypothalamus-pituitary-adrenal (HPA) axis, which is responsible for modulating cortisol levels in response to stress in order to maintain allostatis (McEwen & Stellar, 1993). Given the evidence in the extant literature of the relationship between discrimination and cortisol (Fuller-Rowell et al., 2012), and the relationship between cortisol, abdominal adiposity, and the metabolic syndrome (Anagnostis, Athyros, Tziomalos, Karagiannis, & Mikhailidis, 2009; Björntorp, 2001), we might hypothesize that excess prevalence of the metabolic syndrome and/or mortality in sexual minority populations is due to biological responses to social stressors. Data from the prospective Whitehall II study in England show an association between prevalence of the metabolic syndrome and both socioeconomic status and chronic work stress, providing further evidence for this hypothesis.

The concept of metabolic health is another avenue of research that would be useful to explore in the context of sexual orientation. Research suggests that metabolic health (e.g., the absence or presence of metabolic risk factors) is more predictive of CVD and all-cause mortality

than obesity (Hamer & Stamatakis, 2012). Thus, future studies should examine whether there is a disparity in prevalence of metabolic health among lesbians compared to heterosexual women.

This study was a convenience sample obtained from a limited geographic area, so generalizability is limited. The convenience sampling strategy likely missed subpopulations of lesbians who were unaware of the existence of the study because they were not connected to the community groups through which the study was advertised or who were unwilling to participate in this research. Thus, the fact that this study did not find higher rates of depression, binge eating, or hazardous drinking among lesbians compared to heterosexuals, which is inconsistent with the broader literature (S. B. Austin, Ziyadeh, Corliss, Rosario, et al., 2009; T. L. Hughes, 2003; Valanis et al., 2000), could be an artifact of the way the sample was obtained. Bisexual women were excluded from the sample, though recent studies have shown that bisexual or "mostly heterosexual" women report risk behaviors and health disparities that are as great or greater than lesbians (Conron et al., 2010). In addition, women with pre-existing diseases such as angina or heart disease were not included due to the focus of the original study.

However, this sample has many strengths compared to other convenience or population-based samples. The presence of an equivalent heterosexual comparison group among convenience samples is a weakness in the existing literature (Bowen et al., 2008) but significantly strengthens our ability to assess disparities. The quantity of the information collected by ESTHER is much greater than that could be obtained by population-based samples seeking to answer the same questions. Clinically measured data reduces self-report bias, and the breadth of psychosocial measures enhances our ability to test predictors associated with health outcomes.

Unfortunately, there has been little research funding directed at lesbian health disparities over the years (Coulter, Kenst, Bowen, & Scout, 2014). Given the growing evidence that lesbians are at significantly higher risk of having the metabolic syndrome and other CVD risk factors, additional funding and research is needed to determine possible mediators between sexual orientation and CVD risk, as well as determine if lesbian women are at higher risk of CVD or all-cause mortality compared to heterosexuals.

**Table 5-1: Sample Characteristics**

| Variable | Total (N=875) | Heterosexual (N=397) Mean (SD)/% | Lesbian (N=478) | p |
|---|---|---|---|---|
| Race (%) | | | | |
| White | 806 (92.1%) | 366 (92.2%) | 440 (92.1%) | 0.938 |
| African American | 69 (7.9%) | 31 (7.8%) | 38 (7.9%) | |
| Age (%) | | | | |
| 35-39 | 125 (14.4%) | 58 (14.6%) | 67 (14.0%) | 0.377 |
| 40-44 | 204 (23.3%) | 89 (22.4%) | 115 (24.1%) | |
| 45-49 | 216 (24.7%) | 95 (23.9%) | 121 (25.3%) | |
| 50-54 | 154 (17.6%) | 65 (16.1%) | 90 (18.8%) | |
| 55-65 | 176 (20.1%) | 91 (22.9%) | 85 (17.8%) | |
| Education (%) | | | | |
| <BS | 305 (34.9%) | 151 (38.0%) | 154 (32.2%) | 0.072 |
| >=BS | 570 (65.1%) | 246 (62.0%) | 324 (67.8%) | |
| In a Committed Relationship (%) | 619 (70.6%) | 264 (66.7%) | 353 (73.8%) | **0.02** |
| Menopausal (%) | 331 (37.9%) | 149 (37.5%) | 182 (38.2%) | 0.85 |
| Current Smoking (%) | 99 (11.4%) | 29 (7.4%) | 70 (14.7%) | **0.001** |
| Hazardous Drinking (%) | 219 (25.3%) | 90 (22.8%) | 129 (27.3%) | 0.13 |
| Currently Depressed (%) | 168 (19.4%) | 69 (17.4%) | 99 (21.0%) | 0.187 |
| BMI Status (%) | | | | |
| Normal | 307 (35.1%) | 150 (37.8%) | 157 (32.8%) | **0.002** |
| Overweight | 247 (28.2%) | 126 (31.7%) | 121 (25.3%) | |
| Obese | 321 (36.7%) | 121 (30.5%) | 200 (41.8%) | |
| Abdominal Obesity (%) (N=875) | 642 (73.4%) | 277 (69.8%) | 365 (76.4%) | **0.028** |
| WC (cm) | 99.49 (16.86) | 97.93 (15.88) | 100.79 (17.55) | **0.012** |
| Glucose (mg/dL) | 96.08 (20.52) | 94.35 (19.98) | 97.53 (20.87) | **0.023** |
| Systolic BP(mm Hg) | 112.11 (15.01) | 110.87 (14.66) | 113.14 (15.23) | **0.026** |
| Diastolic BP (mm Hg) | 73.02 (9.92) | 72.22 (9.86) | 73.68 (9.92) | **0.029** |
| Triglyceride (mg/dL) | 113.56 (68.53) | 110.02 (57.30) | 116.50 (76.56) | 0.164 |
| HDL-C (mg/dL) | 58.48 (14.44) | 59.06 (14.31) | 58.01 (14.54) | 0.285 |
| Receiving Treatment for (%): | | | | |
| Diabetes | 19 (2.17%) | 5 (1.26%) | 14 (2.93%) | 0.073 |
| High Blood Pressure | 112 (12.80%) | 50 (12.59%) | 62 (12.97%) | 0.554 |
| High Cholesterol | 87 (9.94%) | 32 (8.06%) | 55 (11.5%) | 0.104 |
| High Triglycerides | 27 (3.09%) | 10 (2.67%) | 17 (3.56%) | 0.076 |
| Metabolic Syndrome (%) | 178 (20.3%) | 62 (15.6%) | 116 (24.3%) | **0.002** |

**Table 5-2: Predictors of the Metabolic Syndrome Among ESTHER Participants**

| | RR (95% CI) | p | RR (95% CI) | p |
|---|---|---|---|---|
| Sexual Orientation | | | | |
| Heterosexual | Ref. | | Ref. | |
| Lesbian | **1.554 (1.142, 2.115)** | **0.005** | **1.436 (1.034, 1.993)** | **0.031** |
| Race | | | | |
| White | | | Ref. | |
| African American | | | 0.729 (0.429, 1.238) | 0.242 |
| Age | | | | |
| 35-39 | | | Ref. | |
| 40-44 | | | 1.141 (0.644, 2.021) | 0.65 |
| 45-49 | | | 1.250 (0.705, 2.214) | 0.445 |
| 50-54 | | | 1.319 (0.709, 2.455) | 0.382 |
| 55-65 | | | 1.696 (0.853, 3.371) | 0.132 |
| Education | | | | |
| <BS | | | Ref. | |
| >=BS | | | **0.686 (0.502, 0.938)** | **0.018** |
| In a Committed Relationship | | | | |
| Yes | | | 0.896 (0.642, 1.252) | 0.52 |
| No | | | Ref. | |
| Menopausal | | | | |
| Yes | | | 1.065 (0.687, 1.650) | 0.78 |
| No | | | Ref. | |
| Current Smoking | | | | |
| Yes | | | 0.973 (0.599, 1.581) | 0.913 |
| No | | | Ref. | |
| Hazardous Drinking (%) | | | | |
| Yes | | | 0.940 (0.649, 1.362) | 0.744 |
| No | | | Ref. | |
| Currently Depressed (%) | | | | |
| Yes | | | 1.171 (0.825, 1.662) | 0.377 |
| No | | | Ref. | |
| BMI Status | | | | |
| Normal | | | Ref. | |
| Overweight | | | **3.880 (2.028, 7.426)** | **<.001** |
| Obese | | | **8.845 (4.847, 16.141)** | **<.001** |

RR = Risk Ratio

CI = Confidence Interval

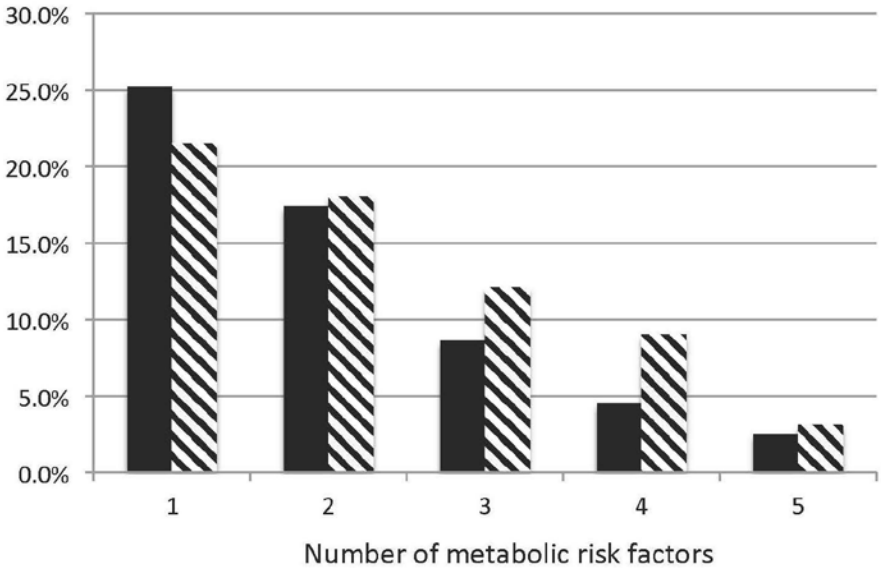


**Figure 5-1: Distribution of Metabolic Risk Factors Among Heterosexual Women (solid) and Lesbian Women (hatched)**

# 6.0 CONCLUSION

## 6.1 SUMMARY OF MAIN FINDINGS

The results from these studies advance the lesbian health literature in several important ways. Specifically, they provide evidence to support the overarching hypotheses of this dissertation, which is that the higher odds of obesity among lesbians are influenced by social forces and that lesbian health disparities extend to higher risk of the metabolic syndrome.

In Study 1, we found evidence that gender nonconformity influences body image and satisfaction as well as weight. Butch lesbians reported a smaller difference between their current and ideal figure compared to femme lesbians, lesbians who were "neither" butch nor femme, and heterosexual women, although we did not note any significant differences between the lesbian subgroups in terms of ideal figure. Butch lesbians had significantly higher odds of both overweight and obesity (AOR = 2.15 and 5.57, respectively), which is to our knowledge the first study to discover this phenomenon.

Our hypotheses for Study 2 were partially supported. We did not find any difference between lesbians and heterosexuals in term of waist-to-hip ratio (WHR), which is contrary to the one other study that has investigated WHR among lesbians. As with many other studies, lesbian women in ESTHER were more obese than heterosexual women. After controlling for several covariates, the odds of lesbians being obese compared to normal weight were 1.63 times higher than the odds of heterosexuals being obese compared to normal weight ($p$=0.013). We found that relationship status and gender discrimination moderated the relationship between sexual orientation and BMI status. Being in a committed relationship was associated with significantly

lower odds of overweight and obesity for heterosexual women but not for lesbians. Importantly, lesbians who reported gender discrimination had over three times higher odds of being obese (AOR = 3.122, $p < 0.001$). This finding is only the second study to demonstrate discrimination's impact on biological outcomes among lesbians.

Finally, Study 3 produced further evidence that health disparities among lesbians extend beyond just weight. On average, lesbians had more risk factors for the metabolic syndrome compared to heterosexuals (1.46 vs. 1.16, respectively, $p < 0.001$). The overall prevalence of the metabolic syndrome in the sample was 20.3%, although nearly one-quarter (24.3%) of lesbians had the metabolic syndrome compared to 15.6% of heterosexual women (Chi-square = 10.015, $p = 0.002$). Compared to heterosexuals, lesbians had a 44% higher risk of having the metabolic syndrome, even after controlling for behavioral and psychosocial risk factors ($p = 0.031$).

## 6.2 FUTURE RESEARCH AGENDA

This research makes promising steps toward addressing the issue of obesity among lesbians outline in the Institute of Medicine's 1999 consensus statement (Solarz, 1999) and it raises several intriguing avenues of future research.

The novel finding that butch lesbians had higher odds of being overweight and obese compared to being normal weight than heterosexual women or other lesbian subgroups indicates that more research is needed to identify what aspects of identifying as butch contribute risk for obesity. The finding that the proportion of butch lesbians who smoked was double that of heterosexuals and other lesbian subgroups provides a hint that perhaps butch women experience a constellation of risk factors for obesity. Thus, syndemics theory, which examines multiple, co-

occurring risk factors and epidemics, might be a useful model with which to research this phenomenon in the future. Examining how prejudice and discrimination interacts with butch identify would also lend insight into this disparity. In addition, the theoretical and qualitative queer and gender studies literature could lend useful understanding of what it means to be butch in a heterosexist society and how that impacts health.

Additional exploration of obesity among lesbians requires a better understanding of how discrimination acts on the body. Exploring whether measures of inflammation, such as cortisol or C-reactive protein, are also elevated among lesbians, and if these measures mediate the relationship between sexual orientation and the metabolic syndrome is a necessary step. Further, studying whether discrimination mediates allostatic load measures, and if this is a potential pathway by which lesbians are more obese, would be a key line of research.

Given the metabolic syndrome's association with CVD or all-cause mortality, our finding that lesbians had higher risk of the metabolic syndrome raises questions about whether lesbians are also at higher risk of mortality compared to heterosexuals. While Study 3 found evidence of this health disparity, more research is needed to explore contributors to the higher risk of the metabolic syndrome among lesbians. For example, does experiencing discrimination moderate the relationship between sexual orientation and the metabolic syndrome as it does obesity? As noted above regarding obesity, research also needs to explore the concept of allostatic load as a risk factor for metabolic syndrome among lesbians. Finally, examining whether there is a difference in "metabolic health" between lesbians and heterosexual women might provide insight into this health disparity. Even though we know that lesbians are more obese than heterosexual women, perhaps lesbians are more likely to fall into the "metabolically healthy" category, which would mitigate mortality risk.

Finally, a discussion about a future research lesbian health agenda would be remiss without acknowledging that sexual orientation or identity is more than binary (heterosexual vs. lesbian). A growing body of literature is finding that bisexual or "mostly heterosexual" women actually experience some of the starkest health disparities (Conron et al., 2010). Thus, identifying the different health risks and needs of all sexual minority women is a priority.

## 6.3 NEEDED RESPONSE TO STUDYING LESBIAN HEALTH

Measuring lesbian health presents methodological challenges. Convenience samples such as ESTHER, with its breadth and depth of information, allow researchers to collect data relevant to the experience of being a sexual minority that can be used to move the field beyond merely describing health disparities to identifying predictors, mediators, and moderators. Conversely, the methodological rigor of sampling for population-based cohorts allows for more generalizable conclusions than convenience samples but can be limited in terms of small sample sizes and lack of depth. An advantage of ESTHER is that it was as rigorous as possible in collecting physical measures from participants, elevating the clinical data beyond merely self-report.

However, studies like this require significant resources. The U.S. research funding for lesbian health is miniscule in comparison to other populations – in a review of National Institutes of Health (NIH) grants from 1989 to 2011, only 13.5% of LGBT health studies targeted lesbian health issues and the vast majority of intervention studies related to HIV/AIDS or other sexual health issues (Coulter et al., 2014). Moreover, currently funded research that is examining critical health disparities between lesbians and heterosexuals has been scrutinized by opinion leaders (Hicks, September 2, 2014). Without funding for basic epidemiologic research to identify

and describe disparities, public health will have few tools with which to design and test effective interventions that adequately address the health impacts unique to or strongly associated with being a lesbian in U.S. society.

When assessing concepts such as discrimination and health risks such as mortality, longitudinal samples are extremely valuable, especially given the recent and rapid social changes related to sexual minority civil rights. There are a few existing longitudinal studies currently underway that can help us understand risk factor change over time and long-term risk of health outcomes. For example, the Chicago Health and Life Experiences of Women (CHLEW) study is a longitudinal study of lesbians, and general population samples such as the Nurses Health Study II and the Growing Up Today Study (GUTS), which consists of children of the Nurses Health Study, have significant numbers of sexual minority women and have been able to explore trajectories of weight and other outcomes. The Gay and Lesbian Medical Association's (GLMA) Lesbian Health Fund has funded a small, ten-year follow-up survey of ESTHER participants to allow us to measure change in BMI and waist circumference and identify potential mediators of change. Given limited resources to conduct lesbian health research, gleaning what information we can from samples already in existence is an efficient method to expand our knowledge of the field.

This dissertation provides intriguing insight into future research needs. The novel information about contributors to the lesbian weight disparity and higher risk of metabolic syndrome provides potential direction for other research to ascertain the origins of lesbian health disparities, and ultimately improve health for lesbians.

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