

Sexual Orientation and Physical Activity for Men

by

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B.S., Kansas State University, 2011

M.P.H., Kansas State University, 2013

AN ABSTRACT OF A DISSERTATION

submitted in partial fulfillment of the requirements for the degree

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Department of Kinesiology

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Abstract

Engagement in regular physical activity is essential to prevent chronic diseases, yet few individuals are active enough to receive health benefits. Social factors such as relationship status, social support, and social capital are important for engagement in physical activity, although research investigating this area has not accounted for sexual orientation, including gay and bisexual men. The purpose of this dissertation was to examine the associations between relationship status, social support, and social capital by sexual orientation for men by using national-level epidemiologic data from the National Institutes of Health. Chapter one reviewed the literature examining the relationship among social variables, physical activity and sexual orientation to identify the gaps in sexual orientation/physical activity research. Chapter two used logistic regression to identify the prevalence of meeting physical activity recommendations for single and coupled gay and straight men by determining the association between relationship status and physical activity by sexual orientation. Coupled gay men were 1.61 (95% CI: 1.01-2.56) times more likely to meet physical activity recommendations compared to coupled straight men. Chapter three used linear and logistic regression to test the relationships between social support and physical activity by sexual orientation. Social support was not related to increases in physical activity for gay (AOR: 0.98, 95% CI: 0.49-1.97) or bisexual (AOR: 0.64, 95% CI: 0.28-1.51) men as it was for straight men (AOR: 1.63, 95% CI: 1.44-1.90). Chapter four used multiple group structural equation modeling to test the association between social capital and physical activity by sexual orientation. Social capital was related to more light/moderate-intensity physical activity for gay ($\beta = .14, p < .05$) and straight men ($\beta = .06, p < .001$), and social capital was related to more vigorous-intensity physical activity for straight men only ($\beta = .06, p < .001$). Lastly, chapter 5 introduces a conceptual model of how sexual orientation is related to social

variables, and ultimately, physical activity. These results provide insight into the complex associations among a social determinant of health and physical activity while highlighting the need for future descriptive and intervention studies.

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Chapter 1 - Introduction

Engagement in regular physical activity is essential to prevent poor health (United States Department of Health and Human Services (USDHHS), 2008). Physically active individuals are less likely to suffer from chronic diseases such as cardiovascular disease, hypertension, and diabetes (Warburton, Nicol, & Bredin, 2006). Individuals who are physically active are 30-50% less likely to be diagnosed with colorectal cancer (Giovannucci et al., 1995), or breast cancer (Lee, 2003; Thune, Brenn, Lund, & Gaard, 1997). Not only does physical activity prevent the onset of disease, physical activity can also reduce the severity of disease. When individuals are active, cancer treatments are more effective (Knols, Aaronson, Uebelhart, Fransen, & Aufdemkampe, 2005), diabetes medication is reduced (Kelley & Goodpaster, 2001), and hypertension decreases (Fagard, 1999).

Physical activity also prevents the onset, severity, and complications of obesity. Individuals who are physically active are less likely to be obese (Seo & Li, 2010). Conversely, if an individual is overweight or obese and active, the deleterious effects of obesity are attenuated (Ruderman, Carling, Prentki, & Cacicedo, 2013). Positive effects of exercise include reductions in insulin sensitivity, metabolic syndrome, dyslipidemia, diabetes, atherosclerotic cardiovascular disease, hypertension, and others (Ruderman et al., 2013).

The outcomes of physical inactivity are the most important problems of the current age. Two-thirds of all American adults are overweight or obese (Ogden, Carroll, Kit, & Flegal, 2014). Only 21% of American adults meet physical activity guidelines (CDC, 2013). Nearly 400,000 deaths a year are due to inactivity and poor eating behavior (Mokdad, Marks, Stroup, & Gerberding, 2004). The direct medical cost of obesity in the U.S. is \$147 billion (Finkelstein, Trogon, Cohen, & Dietz, 2009). Every year, more Americans die of obesity-related issues than

alcohol, motor vehicle crashes, firearms, sexual behaviors, and illicit drugs combined (Mokdad et al., 2004). Regular engagement in physical activity is the primary mechanism to prevent disease and death in the United States.

Physical activity research is lacking for some population groups. Racial minorities, rural populations, and sexual minorities are consistently under-represented in the literature (Gorzynski, 2016; Umstattd, 2015). While evidence is available on the correlates of physical activity for these populations (e.g. environment and other barriers), few interventions are culturally tailored and are mostly ineffective (Marcus et al., 2006). Simply stated, we do not know how to change physical activity for marginalized populations. Of the interventions available, active transportation interventions seem to be the most effective (Centers for Disease Control and Prevention (CDC), 2013). Only recently has the Institute of Minority Health and Health Disparities provided funding to increase physical activity among marginalized populations (USDHHS, 2016).

Physical Activity and Health

While some physical activity is good for an individual, the United States Department of Health and Human Services (USDHHS) recommends 150 minutes of moderate-intensity, or 75 minutes of vigorous-intensity physical activity per week to receive health benefits. For additional and more extensive health benefits, individuals should engage in at least 300 minutes of moderate-intensity, or 150 minutes of vigorous-intensity physical activity per week. Additionally, all individuals should engage in at least two days of muscle-strengthening activities per week (USDHHS, 2008).

Sexual Minority Men and Health

There are several ways to operationalize sexual orientation. Dimensions of sexual orientation often include attraction, behavior, and/or identity (Matthews, Blosnich, Farmer, & Adams, 2014). Mayne (1908, p. 6) was one of the first to define sexual minority men as, “a human being that is more or less perfectly, even distinctively, masculine in physique; often a virile type of fine intellectual, oral and aesthetic sensibilities: but who, through an inborn or later-developed preference feels sexual passion for the male human species. His sexual preference may quite exclude any desire for the female sex: or may exist concurrently with that instinct.” Mayne’s definition of sexual orientation was attraction-based. Later research suggested that sexual orientation should be operationalized as a spectrum of behavior ranging from exclusively heterosexual to exclusively homosexual (Kinsey, Pomeroy, Martin, & Sloan, 1948). Current literature operationalizes sexual orientation as identity, (i.e. an individual self-identifies as gay, bisexual or straight). Current estimates by suggest that 1.7% of the total U.S. male population are gay (Gates, 2011). That is, roughly 500,000 males identify as gay in the U.S.

Studying health behaviors among sexual minority men is, by nature, studying opposite extremes. Sexual minority men are more likely to engage in deleterious health behaviors such as drug and alcohol abuse, risky sex practices, and are more likely to suffer from depression, anxiety, and suicide (King et al., 2008; Mattison, Ross, Wolfson, Franklin, & Grp, 2001; Meyer, 1995). However, gay men are more likely to be of a healthy weight than straight men (Fredriksen-Goldsen, Emler, et al., 2013) more likely to access healthcare (Boehmer, Miao, Linkletter, & Clark, 2012b), undergo colonoscopies, and testing for HIV and other sexually transmitted infections (Conron, Mimiaga, & Landers, 2010). As a whole, gay men die earlier than straight men (Cochran, Bjorkenstam, & Mays, 2016). However, when adjusting for deaths

due to HIV/AIDS, gay men live similar life expectancies as straight populations, yet gay men engage in more negative health behaviors (Cochran & Mays, 2015). Due to the high prevalence of illness among gay men compared to the rest of the population, the National Institutes of Health (NIH) recently designated gay men as a health disparity population (Perez-Stable, 2016) and have put forth funding announcements to understand this disparity (NIH, 2016).

The need for research addressing sexual minority men and physical activity is urgent. As such, a recent call to action has been presented by the Journal of Preventive Medicine (Gorczyński, 2016). Most studies that have been conducted were qualitative, conducted on small sample sizes, or focused on HIV seropositive men who have sex with men (Duncan, 2008; Webel, 2016). The majority of studies address topics such as the culture of the exercise club (Duncan, 2008), attitudes in the locker room (Pronger, 1990), masculinity (Anderson, 2002) and homophobia in physical education classes (Morrow & Gill, 2003). To date, only a handful of studies have addressed the prevalence of physical activity among gay men (Boehmer, Miao, Linkletter, & Clark, 2012a; Fredriksen-Goldsen, Emler, et al., 2013). Of the studies available, most produce non-significant or mixed results. One study suggests that gay men engage in more muscle-strengthening activity, and as gay men age, they are more likely to continue regular engagement in physical activity (Fredriksen-Goldsen, Emler, et al., 2013). Calzo, et al., (2013) suggest that adolescent gay boys engage in less aerobic physical activity than straight adolescent boys. However, Boehmer, et al., (2012b) suggest that adult gay men engage in similar rates of aerobic physical activity compared to adult straight men. Therefore, more research is needed to understand the physical activity behavior of sexual minority men.

Social Relationships, Physical Activity, and Health

Social variables include the number and strength of relationships with friends, family, coworkers, and others; level of integration within the community; capacity to solve large social problems; among others (Berkman, Kawachi, & Glymour, 2014). These variables may be more important than other well studied constructs for health outcomes. For example, social integration is a better predictor of mortality than smoking, BMI, and physical inactivity (Holt-Lunstad, Smith, & Layton, 2010).

Cross-sectional and longitudinal studies have indicated that social variables are related to physical activity. For example, increasing contact with friends has been related to greater odds of meeting physical activity recommendations (Larsen, Strong, & Linke, 2013). Longitudinal associations indicate that higher levels of loneliness are related to lower levels of physical activity, indicating the needs of social networks and social integration for physical activity (Hawkley, Thisted, & Cacioppo, 2009). However, the field of social factors and physical activity lacks significant causal evidence, fails to understand the detailed mechanisms of change, and does little to influence interventions to change health outcomes (Holt-Lunstad, Smith, & Layton, 2010).

Not only are social variables and health as a whole understudied (Cohen & Janicki-Deverts, 2009), the influence of social variables on physical activity lacks significant research to produce effective evidence-based interventions. Of the interventions that have been implemented, targeting social variables has either not produced a change in the social variables or failed to change physical activity (Barrera, Glasgow, McKay, Boles, & Feil, 2002; Cavallo et al., 2012). There seems to be one exception to this failure of social interventions. Interventions that use existing social networks and social support to leverage behavior change show promising

increases in physical activity (Kahn et al., 2002). Authors have called for more research focused on changing social variables (Jalali, Sharafi-Avarzaman, Rahmandad, & Ammerman, 2016).

Eco-Social Theory

Krieger (2012) suggests that individuals embody societal and ecological factors that change health outcomes on a population level. This disparity in health is due to societal and ecological factors such as racism, sexism, and homophobia. The Eco-Social Theory (EST) is one of the few frameworks that incorporates societal and ecological factors to explain health. The EST suggests that differences in health are due to the embodiment of external exposures that literally change the biology of a group. Exposures include working and economic conditions, living situations, discrimination, marketing of harmful behaviors (tobacco, alcohol and illicit drugs), access and quality of healthcare, and others. As groups experience these exposures more often or at a higher severity, the exposure increasingly affects health (Badgett, 1995; Diaz, 2001). Additionally, not all individuals have the same level of susceptibility or agency to deal with effects of these exposures (Siegrist, 2015). The EST has been used to study multiple populations, including sexual minorities (Agénor, 2014).

The mechanism of a particular disease is not enough to understand the distribution of disease in a population. When examining the susceptibility and severity of the common cold, individuals who have few social ties (1-3) are 4.2 times more likely to acquire it than individuals who have many social ties (6 or more) after controlling for virus-specific antibody, virus type, age, sex, season, BMI, education, and race (Cohen et al., 1997). Furthermore, there seems to be a dose-response relationship with social ties and susceptibility, such that those individuals who have slightly more social ties are less susceptible (Cohen et al, 1997).

Not only are social ties related to reduced susceptibility of infectious disease like the common cold, social ties are also related to increased physical activity. Individuals who have 5-8 close friends are 30% more likely to be active, compared to individuals with fewer close friends (Watt et al., 2014). In fact, contact with friends seems to be related to higher rates of physical activity compared to contact with family (Larsen, Strong, & Linke, 2014). Potential mechanisms that explain this association are relationship status, social support, social engagement, person-to-person contact, and access to resources (Berkman et al., 2014). Of these potential mechanisms, relationship status has the largest literature base.

Significant Same-Sex Relationships

Research shows that men who are in relationships are more likely to live longer, suffer from less chronic disease and engage in more physical activity (Ben-Shlomo, Smith, Shipley, & Marmot, 1993; Hakola et al., 2015). However, gay relationships are different than straight relationships in many dimensions. There are many benefits to gay relationships. Gay men in relationships report higher levels of relationship quality, are happier, better able to resolve conflict, and better at dividing household labor compared to straight men in relationships (Carrington, 1999; Gabb, Klett-Davies, Fink, & Thomae, 2013; Kurdek, 2004). Compared to single gay men, gay men in relationships report less stress, more reliance on their partner for social support that they do not receive elsewhere, and are better at coping with traumatic life events (Kurdek, 1988, 2004). Gay relationships may buffer the stress of everyday life better than straight relationships. In addition, gay relationships may buffer the harmful effect of sexual orientation discrimination on physical activity.

Health behaviors are an integral part of gay relationships. Couples in gay relationships may use behavior change strategies similar to straight couples, suggesting that similar constructs

that control health behaviors are present in gay and straight couples (Lewis, Butterfield, Darbes, & Johnston-Brooks, 2004). However, gay men are more reliant on their partner or husband to provide social support than straight men, indicating that gay men may engage in physical activity together or support each other more than straight couples (Kurdek, 1988). Lewis et al. (2004) suggest that gay men report discussing physical activity as the most common health enhancing behavior. Gay men also report trying to get their partner to engage in healthy behaviors, such as physical activity (Lewis et al., 2004). Social support may play an important role in explaining these differences.

Social Support

There is a large evidence base to suggest that social support is related to better health and more physical activity (Cohen et al., 1997; Esterling, Kiecolt, Glaser, & Glaser, 1996; Rothrock, Lutgendorf, Hoffman, & Kreder, 2002). Social support may provide individuals with a sense of security that benefits health and promotes engagement in physical activity. Specifically, social support in the form of instrumental social support aids in tangible resources and services, while emotional social support provides feeling of trust, empathy, caring, and love (Berkman et al., 2014). However, evidence suggests that the social support/physical activity relationship is not consistent across groups as it may not be present among marginalized populations such as women and African American men (Allen, Markovitz, Jacobs Jr, & Knox, 2001).

Social support may also impact health and health behaviors by buffering stress of everyday life (Power, 1988). When an individual experiences stress many changes occur. A large literature base has suggested that stress increases all-cause mortality and morbidity (Brown, 1993; Dohrenwend, 2000; Redmond et al., 2013). Not only does stress impact health outcomes, but health behaviors also change in response to stress. Individuals who experience stress are less

likely to engage in physical activity and more likely to smoke, abuse alcohol and other drugs, and eat poorly (Meyer, 1995; Steptoe, Wardle, Pollard, Canaan, & Davies, 1996). The relationship between exposure and stress may be mediated by social support derived from family and friends. The stress buffering hypothesis suggests that social support from close relationships buffers the deleterious effects of stress on a person's well-being (Krieger & Berkman, 2000). However, the stress buffering hypothesis has never been tested for physical activity of sexual minority men.

The social support/physical activity relationship has not been studied for sexual minority men. However, several studies suggest that social support plays an important role in several deleterious mental health concerns for gay men. Depression and poor self-acceptance have been related to low levels of social support (Vincke & Bolton, 1994). Adolescent gay boys who suffer from family-based rejection are more likely to be depressed, use illicit drugs, engage in risky sex behaviors, and commit suicide (Ryan, Huebner, Diaz, & Sanchez, 2009). High levels of social support are also positively associated the mental health of HIV seropositive individuals, a group consisting largely of gay men (Friedland, Renwick, & McColl, 1996; Wolf et al., 1991). Among HIV seropositive gay men, high levels of social support may be related to lower levels of physical activity (Clingerman, 2004).

Social Capital

Most literature examining social interactions has been conducted at the micro-level (e.g. social support, relationships). Recent research has examined the broader social conditions that impact health and physical activity. Social capital refers to the level of reciprocity, trust, connectedness, and sharing of resources (Berkman et al., 2014). Moreover, social capital is usually operationalized as being place based (e.g. neighborhoods). Leyden (2003) suggests that

living in a neighborhood that has mixed-use land, sidewalks, and local business establishments is associated with higher levels of social capital. Growing evidence suggests that targeting social and environmental structures, such as social capital, is an effective way to produce sustainable, population-based behavior change (Bender, Kawachi, Jorgensen, & Pisinger, 2015).

A growing body of evidence is establishing a positive association between social capital and physical activity; high social capital is related to higher levels of physical activity (Kawachi, Kennedy, & Glass, 1999; Lindström, Hanson, & Östergren, 2001; Marquez, Gonzalez, Gallo, & Ji, 2016; Novak, Doubova, & Kawachi, 2016). Although the mechanism underlying this relationship is unknown, it is hypothesized that the relationship between social capital and physical activity could be moderated by physical environment or individual level social variables (social support, isolation) (Kawachi et al., 1999). Clearly, the association between social capital and physical activity is not straightforward and is limited by methodological concerns including poor measures (Uphoff, Pickett, Cabieses, Small, & Wright, 2013) and lack of causality (Portes & Vickstrom, 2011).

Evidence for the relationship among social capital, physical activity, and sexual orientation is lacking. To date, no studies have assessed social capital and physical activity for gay men. However, several studies suggest that social capital may be related to the health of sexual minority men. For examples, gay men who feel as if they belong to the gay community are less likely to suffer from depressive symptoms (Morris, McLaren, McLachlan, & Jenkins, 2015). Reporting low social capital may be a significant determinant for poor mental health among sexual minorities (Axelsson, Moden, Rosvall, & Lindstrom, 2013). Social capital may also moderate the association between self-acceptance and self-rated health for lesbian, gay, and

bisexual (LGB) individuals (van der Star & Branstrom, 2015), thereby protecting a LGB individual from the deleterious impacts of discrimination and stigma of being a sexual minority.

Purpose of Dissertation

Based on the available literature, the conceptual model in Figure 1-1 was tested. Limited evidence suggests that sexual orientation is directly associated with relationship status and decreases in social support (Lewis et al., 2004; Kurdek, 1988; Vincke & Bolton, 1994). However, there is a large evidence based to suggest that relationship status, social support and social capital are related to physical activity (Sobal & Hanson, 2010; Cohen & Willis, 1985; Trost et al., 2002; Berkman et al., 2014; Kawachi et al., 1997). This dissertation fills a gap in the literature by testing the indirect effect of sexual orientation on the associations between relationship status, social support, and social capital with physical activity. Additionally, the direct association between sexual orientation and social capital was tested.

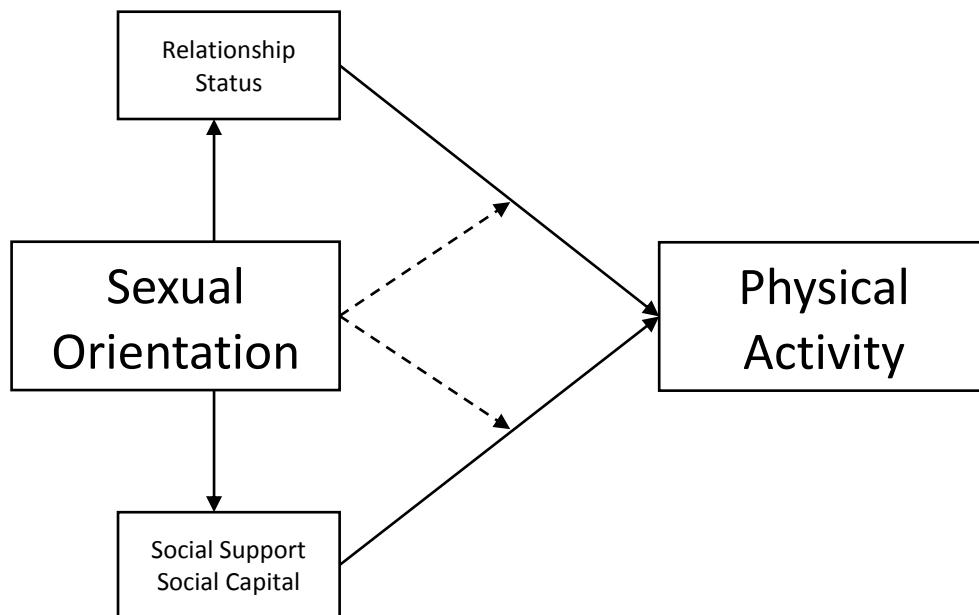


Figure 1-1. Conceptual Model of the Association among Sexual Orientation, Relationship Status, Social Support, Social Capital, and Physical Activity.

The overarching goal of this project was to understand how social variables impact physical activity for gay men. Chapter 2 examines differences in physical activity by coupling status and sexual orientation for men. Chapter 3 determines how social support is related to physical activity for male sexual minorities. Chapter 4 analyzes how social capital might be related to physical activity for gay men. Lastly, chapter 5 provides a summary of the studies presented and provides recommendations on future directions of research regarding physical activity for gay men.

Chapter 2 - A Population-Based Study of Physical Activity and Coupling by Sexual Orientation for Men

Introduction

Close relationships have been shown to be important for explaining physical activity behavior. However, close relationships for gay, bisexual, and straight men are likely different from each other. Research shows that men who are in relationships are more likely to live longer, suffer from less chronic disease and engage in more physical activity (Ben-Shlomo et al., 1993; Verbrugge, 1979). However, few studies have been conducted examining the role of close relationships and physical activity for men of different sexual orientations.

Sexual orientation has been shown to be related to many health behaviors. Compared to straight men, gay men are more likely to abuse drugs and alcohol, smoke, commit suicide and engage in risky sexual behaviors (Cochran & Mays, 2000; McKirnan & Peterson, 1989; Xu, Sternberg, & Markowitz, 2010). However, the research on sexual orientation and physical activity suggests little or no difference in physical activity behaviors among gay, bisexual, or straight men (Deputy & Boehmer, 2010; Fredriksen-Goldsen, Kim, Barkan, Muraco, & Hoy-Ellis, 2013). To date, no studies have analyzed the relationship among sexual orientation and physical activity for single individuals versus coupled individuals.

There are several types of relationships that are associated with physical activity for men. The research on marriage suggests that married men engage in more physical activity than unmarried men (Sobal & Hanson, 2010). However, few studies have analyzed differences in physical activity by coupling status (married, cohabiting, or partnered) for gay and bisexual men.

Of those, most studies have been conducted with gay men, small sample sizes, and none have been conducted with a representative sample of men across the U.S (Gabb, et al., 2013; Lewis, et al., 2004; Umberson & Kroeger, 2016). To date, no known studies have been conducted on the relationship among sexual orientation, coupling, and physical activity for bisexual men.

Research on gay men suggests that health behaviors are an integral part of gay relationships. Couples in gay relationships may use behavior change strategies similar to straight couples (Lewis et al., 2004), suggesting that similar constructs that control health behaviors are present in gay and straight couples. However, gay men are more reliant on their partner or husband to provide social support than straight men (Kurdek, 1988), indicating that gay men may engage in physical activity together or support each other more than straight couples. Lewis et al. (2004) suggest that gay men report discussing physical activity as the most common health enhancing behavior. Gay men also report trying to get their partner to engage in healthy behaviors, such as physical activity (Lewis et al., 2004).

Physical activity is important for overall health of gay, bisexual, and straight men. Men who are physically active are less likely to suffer from chronic diseases such as cardiovascular disease, diabetes, hypertension, and overall mortality (USDHHS, 1996). The Centers for Disease Control and Prevention recommend that all Americans engage in enough physical activity to confer health benefits (USDHHS, 2008). Specifically, individuals should engage in at least 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity physical activity per week and at least two days of full-body muscle-strengthening activities. To confer additional health benefits, individuals should engage in at least 300 minutes of moderate-intensity or 150 minutes of vigorous-intensity physical activity per week and two or more days of muscle strengthening activity (USDHHS, 2008).

It is important to understand how physical activity might differ by coupling status for men of different sexual orientations. Disparities may exist in physical activity levels for single and coupled gay and bisexual men. The current literature suggests that relationships confer positive health benefits for men (Finkel et al., 2015; Robards, Evandrou, Falkingham, & Vlachantoni, 2012). Coupled gay and bisexual men may engage in different rates of physical activity than coupled straight men.

The first step is to identify whether the prevalence rates of meeting physical activity recommendations differ by coupling status and sexual orientation for men. Therefore, this study seeks to understand the prevalence of coupling and physical activity by sexual orientation in a nationally-representative sample of U.S. adult men. We hypothesize that coupled gay men will be more likely to meet physical activity recommendations than coupled straight men, but that no differences will be seen between coupled straight and coupled bisexual men.

Methods

The data source for this study was the National Health Interview Survey (NHIS) aggregated data from 2013-2014. Earlier years were not included because a sexual orientation variable was not collected. The NHIS is a yearly, cross-sectional, face-to-face, in-home interview of the civilian non-institutionalized population of the United States. The NHIS employs a multistage, stratified, random sampling procedure of U.S. households. The National Center for Health Statistics (NCHS) provides the data to researchers with weights to represent the total U.S. population.

Measures

Sexual Orientation

All men were asked to indicate their sexual orientation by asking, “Which of the following best represents how you think of yourself?” Individuals could answer gay, straight (that is, not gay), bisexual, something else, I don’t know the answer, or could refuse. Those who answered something else, I don’t know the answer, or who refused were excluded from this study. Our final sample included 29,926 straight men, 623 gay men, and 162 bisexual men.

Coupling Status

Several of the analyses were conducted by coupling status. Individuals were asked, “Are you now married, widowed, divorced, separated, never married, or living with a partner?” For this study, coupled individuals were those who reported that they were married with their spouse living in the household, spouse not living in the household, or living with a partner. Individuals were defined as not coupled (single) if they reported that they were widowed, divorced, separated, or never married.

Physical Activity

Individuals were asked how often and for how long they engaged in moderate- and vigorous-intensity physical activity, as well as how often they engaged in strength training. These variables were coded into four dichotomous groups: active, highly active, strength, and meeting recommendations. Following CDC recommendations for physical activity, (USDHHS, 2008) active individuals were defined as those who engaged in at least 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity physical activity per week. Highly active individuals were defined as those who engaged in at least 300 minutes of moderate-intensity or 150 minutes of vigorous-intensity physical activity per week. Strength was defined as those who engaged in at least two days of strength training per week. Meeting physical activity recommendations was defined as those individuals who engaged in at least 150 minutes of

moderate-intensity or 75 minutes of vigorous-intensity physical activity and at least two days of strength training per week.

Covariates

The adjusted models included four covariates: age, race, income, and education. Age was a continuous variable from age 18 and truncated at age 85. Races were grouped as white, black/African American, American Indian and Alaska Native, Asian, race group not released, and multiple races. Income was categorized as: \$0 - \$34,999; \$35,000 - \$74,999; \$75,000 - \$99,999; and \$100,000 and over. Education was categorized as 8th grade or less; 9-12 grade without graduating high school; GED recipient; high school graduate; some college; associates degree recipient; Bachelor's degree; and master's, professional, or doctoral degree.

Statistical Analysis

A series of logistic regression models were conducted to determine unadjusted and adjusted odds ratios predicting each physical activity category. Additionally, 95 percent confidence intervals were estimated to determine statistical differences between groups. Unadjusted models were conducted without covariates. Adjusted models were conducted with age, race, education and income included as covariates. All analyses used survey weights to generalize the results to the U.S. population, consistent with NCHS guidelines (CDC, 2010). For odds ratios comparing gay, bisexual, and straight men, straight men were used as the reference group. When gay men and bisexual men were compared, bisexual men were used as the reference group.

Results

The coupled gay men (n=174) in the sample were white (90.2%), approximately 45.8 years old (SD = 13.8), reported incomes \$100,000 or greater (41.3%), and reported having a

master's degree or higher (31.6%). The single gay men (n=16,381) in the sample were white (75.2%), approximately 43.3 years old (SD = 15.4), reported incomes less than \$35,000 (47.7%), and reported having a college degree (30.0%). Coupled straight men (n=449) in the sample were white (80.5%), approximately 50.7 years old (SD = 16.1), reported incomes between \$35,000 and \$74,999 (33.3%), and having some college education (30.85%). Lastly, single straight men (n=13,545) in the sample were white (73.6%), approximately 45.0 years old (SD = 19.3), reported incomes less than \$35,000 (55.4%), and having a high school education (39.4%). T-tests were conducted to assess difference in demographic variables between sexual orientation. No statistical difference were found. Demographic data for bisexual men are not presented because of small numbers due to data suppression guidelines from the NHIS (Control & Prevention, 2010).

The unadjusted models showed that gay and bisexual men were 0.35 (95% CI: 0.29-0.44) and 0.22 (95% CI: 0.14-0.35) times less likely to be coupled than straight men, respectively. After accounting for covariates, gay men and bisexual men were 0.32 (95% CI: 0.25-0.41) and 0.20 (0.12-0.36) times less likely to be coupled than straight men, respectively. Gay men were 1.61 (95% CI: 1.03-2.51) times more likely to be coupled than bisexual men, but in the adjusted models, this relationship was no longer statistically significant.

Analysis of differences in physical activity within groups (e.g. physical activity for gay men who are coupled verses gay men who are single) only showed statistical significance for straight men. Odds ratios of physical activity for coupled verses single by sexual orientation are shown in Table 2-1 (unadjusted) and Table 2-2 (adjusted). For every physical activity variable, straight men who were coupled were more likely to be active, highly active, engage in strength activities, and meet physical activity recommendations than single straight men. All of these

relationships were significant to the $p < .001$ level for straight men. However, there were no statistically significant differences between coupled versus single gay men.

Table 2-1. Unadjusted Odds of Meeting Recommendations by Relationship Status for Gay and Straight Men.

Variables	n	Gay Men Odds Ratio (CI)	n	Straight Men Odds Ratio (CI)
Meeting Aerobic Recommendations				
Coupled	171	1.35 (0.93-1.95)	16170	1.15 (1.07-1.24)***
Single	439	Ref	13341	Ref
Meeting Highly Active Recommendations				
Coupled	170	1.32 (0.91-1.90)	16135	1.28 (1.19-1.37)***
Single	438	Ref	13308	Ref
Meeting Muscle Strengthening Recommendations				
Coupled	173	1.33 (0.90-1.98)	16326	1.55 (1.45-1.66)***
Single	448	Ref	13472	Ref
Meeting both Aerobic and Muscle Strengthening Recommendations				
Coupled	164	1.36 (0.89-2.10)	15630	1.52 (1.42-1.64)***
Single	422	Ref	12723	Ref

Note: CI = 95% Confidence Interval; *** = p -value < .001, Ref = Reference Category; National Health Interview Survey 2013, 2014.

Table 2-2. Adjusted Odds of Meeting Recommendations by Relationship Status for Gay and Straight Men.

Variables	Gay Men		Straight Men	
	n	Odds Ratio (CI)	n	Odds Ratio (CI)
Meeting Aerobic Recommendations				
Coupled	164	1.01 (0.64-1.58)	14980	1.20 (1.11-1.29)***
Single	426	Ref	12613	Ref
Meeting Highly Active Recommendations				
Coupled	163	1.18 (0.76-1.82)	14948	1.28 (1.18-1.38)***
Single	425	Ref	12583	Ref
Meeting Muscle Strengthening Recommendations				
Coupled	166	1.18 (0.76-1.83)	15122	1.65 (1.52-1.79)***
Single	435	Ref	12738	Ref
Meeting both Aerobic and Muscle Strengthening Recommendations				
Coupled	157	1.18 (0.72-1.92)	14467	1.63 (1.50-1.78)***
Single	410	Ref	12028	Ref

Note: CI = 95% Confidence Interval; *** = *p*-value < .001, Ref = Reference Category; National Health Interview Survey 2013, 2014.

Differences in physical activity between coupled men by sexual orientation were statistically significant (see odds ratios presented in Table 2-3). Coupled gay men were more likely to meet physical activity recommendations than coupled straight men. Coupled gay men were 1.62 (95% CI: 1.05-2.50) times more likely to be active, 1.67 (95% CI: 1.10-2.51) times more likely to be highly active, 1.89 (95% CI: 1.24-2.89) times more likely to meet strength recommendations, and 2.00 (1.28-3.11) times more likely to meet physical activity recommendation than straight coupled men. Bisexual coupled men were more 2.61 (95% CI:

1.11-6.12) times more likely to be active compared to straight, coupled men. Adjusted odds ratios were also significant; gay coupled men were 1.57 (95% CI: 1.00-2.46) times more likely to meet strength recommendations and 1.61 (95% CI: 1.01-2.56) times more likely to meet physical activity recommendations than straight, coupled men. However, adjusted odds ratios showed no significant differences in physical activity between coupled bisexual and straight men.

No statically significant differences were found in physical activity for single men. Odds ratios for physical activity of single men by sexual orientation are presented in Table 2-4. The only significant relationship for single men was that gay men were 0.67 (95% CI: 0.45-0.99) times less likely to be active than bisexual men. However, adjusted odds ratios did not show statistical significance.

Table 2-3. Unadjusted and Adjusted Odds Ratios for Meeting Physical Activity Recommendations by Sexual Orientation for Coupled Men.

Variables	n	Unadjusted Odds Ratio (CI)		n	Adjusted Odds Ratio (CI)	
Meeting Aerobic Recommendations						
Gay	171	1.62 (1.05-2.50)*	1.61 (0.76-3.41)	164	1.25 (0.80-1.95)	1.98 (0.80-4.89)
Bisexual	40	2.61 (1.11-6.12)*	Ref	37	2.28 (0.85-6.10)	Ref
Straight	16170	Ref	-	14980	Ref	-
Meeting Highly Active Recommendations						
Gay	170	1.67 (1.10-2.51)*	0.65 (0.32-1.30)	163	1.38 (0.91-2.11)	0.66 (0.32-1.38)
Bisexual	39	1.08 (0.49-2.35)	Ref	36	0.83 (0.33-2.11)	Ref
Straight	16135	Ref	-	14948	Ref	-
Meeting Muscle Strengthening Recommendations						
Gay	173	1.89 (1.24-2.89)**	0.63 (0.32-1.27)	166	1.57 (1.00-2.46)*	0.65 (0.30-1.39)
Bisexual	42	1.20 (0.54-2.67)	Ref	39	0.98 (0.41-2.34)	Ref
Straight	16326	Ref	-	15122	Ref	-
Meeting both Aerobic and Muscle Strengthening Recommendations						
Gay	164	2.00 (1.28-3.11)**	0.54 (0.26-1.12)	157	1.61 (1.01-2.56)*	0.49 (0.22-1.13)
Bisexual	38	1.08 (0.44-2.63)	Ref	35	0.83 (0.32-2.15)	Ref
Straight	15630	Ref	-	14467	Ref	-

Note: CI = 95% Confidence Interval; *** = p -value < .001, - = values not computed; Ref = Reference Category; National Health Interview Survey 2013, 2014.

Table 2-4. Unadjusted and Adjusted Odds Ratios for Meeting Physical Activity Recommendations by Sexual Orientation for Single Men.

Variables	n	Unadjusted Odds Ratio (CI)		n	Adjusted Odds Ratio (CI)	
Meeting Aerobic Recommendations						
Gay	439	1.05 (0.78-1.41)	0.67 (0.45-0.99)*	426	0.90 (0.66-1.24)	0.67 (0.42-1.07)
Bisexual	118	0.70 (0.42-1.16)	Ref	115	0.60 (0.35-1.04)	Ref
Straight	13341	Ref	-	12613	Ref	-
Meeting Highly Active Recommendations						
Gay	438	0.99 (0.74-1.34)	0.76 (0.53-1.08)	425	0.90 (0.65-1.24)	0.78 (0.52-1.16)
Bisexual	118	0.75 (0.46-1.23)	Ref	115	0.69 (0.41-1.17)	Ref
Straight	13308	Ref	-	12583	Ref	-
Meeting Muscle Strengthening Recommendations						
Gay	448	0.92 (0.69-1.22)	1.06 (0.75-1.51)	435	0.78 (0.57-1.06)	1.19 (0.80-1.78)
Bisexual	120	0.97 (0.57-1.65)	Ref	117	0.91 (0.50-1.69)	Ref
Straight	13472	Ref	-	12738	Ref	-
Meeting both Aerobic and Muscle Strengthening Recommendations						
Gay	422	0.96 (0.71-1.31)	0.92 (0.61-1.37)	410	0.80 (0.57-1.13)	0.98 (0.62-1.55)
Bisexual	116	0.88 (0.55-1.42)	Ref	113	0.79 (0.45-1.36)	Ref
Straight	12723	Ref	-	12028	Ref	-
Note: CI = 95% Confidence Interval; *** = p-value < .001, - = values not computed; Ref = Reference Category; National Health Interview Survey 2013, 2014.						

Discussion

The results of this study support the hypothesis that participation in physical activity changes by coupling status for men of different sexual orientations. There is a significant difference between single and coupled straight men's engagement in physical activity. Additionally, coupled men who are gay report more physical activity than straight coupled men in all categories of physical activity. However, only muscle-strengthening activity and total physical activity categories are significant in the adjusted models. For single men, gay men engage in more physical activity than bisexual men, but the relationship is explained mostly by covariates. These data also suggest that there is little or no difference for bisexual men in physical activity by coupling status.

The primary finding is that coupled gay men were roughly 60% more likely to meet physical activity recommendations than coupled straight men. While the mechanisms by which this occurs cannot be determined from this study, we unequivocally show that the prevalence of meeting physical activity recommendations is higher for coupled gay men than it is for coupled straight men.

These findings contradict past research that suggests that there is very little, if any, difference in physical activity for gay and straight men (Deputy & Boehmer, 2010; Fredriksen-Goldsen, Kim, et al., 2013). For example, one study suggested that gay adolescents and young adults may have engaged in less aerobic physical activity than their straight counterparts (Calzo et al., 2014). Another study suggested that older gay men engaged in more muscle strengthening activity than older straight men (Boehmer et al., 2012a). In this sample, coupled gay men reported engaging in more physical activity compared to coupled straight men. Our sample of gay men was slightly older than our sample of straight men but this difference was not

statistically significant. This study provides evidence to suggest that coupling is another important variable to consider when researching physical activity by sexual orientation.

This study lends support for conducting further research on coupling status, sexual orientation, and health behaviors. There seems to be a difference in physical activity among coupled men by sexual orientation. This difference may be supported by important theoretical concepts of gay men's relationships. For example, since gay men rely more on their partner for social support than straight men, it might also be that gay men encourage each other more to engage in physical activity (Lewis et al., 2004). Additional mechanisms that may influence physical activity for gay men are yet to be discovered. Possible mechanisms include social support or other theoretical concepts (e.g., social capital, social networks, and built environment). Additional research should be conducted to explore the theoretical mechanisms that influence physical activity of coupled gay men.

There are several strengths of this study. First, we used data from a nationally representative sample of the U.S. population. Second, the results from this study are generalizable to the U.S. population of gay, bisexual, and straight men. Third, we controlled for age, race, education, and income. Lastly, our measure of sexual orientation measured identity, not behavior. Measuring sexual identity instead of behavior is a major improvement in the NHIS dataset for 2013 and 2014. However, as with other national samples, the NHIS risks self-report bias. Individuals are likely to over-report physical activity levels. While this may skew results, it is likely that this limitation occurs at the same rate for gay, straight, and bisexual men. Due to the wording of the physical activity questions, we were only able to determine those meeting physical activity recommendations for both moderate or vigorous aerobic activity and muscle-strengthening activity. Additionally, due to the small sample of bisexual men, we risk making a

type 2 error. It may be that the nationally representative weights decrease the power to the point where the results were not significant. More research should be conducted on bisexual men's physical activity behavior with larger sample sizes.

Public Health Implications

Studying the health of all minority populations is important, including the health of gay and bisexual men. Research often focuses on negative aspects of gay men's health behaviors. This study provides a unique perspective of a single health behavior for gay men, suggesting that within coupled men, gay men engage in more physical activity than straight men.

Simply stated, little is known about the social determinants of physical activity for gay men. Therefore, the health impacts of coupling for gay men have several potential theoretical and policy implications. Current public health interventions focus very little on increasing physical activity for gay men. This research is a first step in understanding the differences in health behaviors by sexual orientation. Future studies should be conducted on the mechanism of this relationship and public health interventions should incorporate the results of this study to improve physical activity interventions for gay men. Public health practitioners should encourage gay men to engage in supportive relationships for greater likelihood of physical activity behaviors and better overall health.

Future studies should also be conducted on the policy factors that influence the coupling behaviors of gay men. With the recent nation-wide availability of gay marriage, gay men may develop closer relationships that improve health (Umberson & Kroeger, 2016). Additionally, as non-discrimination laws and policies are adopted, gay men may engage in more physical activity. However, these are all assumptions. To truly understand how policy impacts the health of gay men, additional research needs to be conducted.

Chapter 3 - Social Support and Physical Activity by Sexual Orientation for Men

Preface

The previous chapter showed that a disparity exists in the prevalence of physical activity by coupling. To explain this association, social support was identified as a potential mediating variable. Evidence suggests that gay men receive lower social support from their social networks compared to straight men (Vincke & Bolton, 1994). However, epidemiological studies have yet to report on social support levels by sexual orientation and no study has assessed if an association exists between social support and physical activity for gay or bisexual men. Perhaps gay and bisexual men are receiving lower levels of social support that can help explain the difference in physical activity levels by sexual orientation. This study tests such a hypothesis.

Introduction

Regular engagement in physical activity is important for overall health and wellbeing. The positive effects of physical activity have been well-studied (Warburton, Nicol, & Bredin, 2006). However, limited research has examined differences in physical activity behaviors by sexual orientation for men. Of the available evidence, most studies suggest that gay and bisexual men engage in similar rates of physical activity as straight men (Deputy & Boehmer, 2010; Ward, Dahlhamer, Galinsky, & Joestl, 2014) with few exceptions. Boehmer and associates (2012a) suggest that as gay men age, they are likely to maintain higher levels of physical activity into older age compared to straight men. Additionally, gay men report engaging in more muscle-strengthening activities than straight men (Fredriksen-Goldsen, Emler, et al., 2013). However, levels of moderate- and vigorous-intensity physical activity have been shown to be similar across

large nationally-representative samples of men regardless of sexual orientation (Deputy & Boehmer, 2010).

There is a large literature base to suggest that social support is positively linked to physical activity; as social support increases, physical activity increases (USDHHS, 2005). Social support is the perception of support from an individual's social network (Cohen & Willis, 1985). Social support buffers the stress of everyday life so that individuals can be active (Cohen & Willis, 1985). For men, many studies show a positive association between social support and physical activity (Trost, Owen, Bauman, Sallis, & Brown, 2002). However, the social support/physical activity relationship is not consistent across all groups. For example, social support may not be related to physical activity for certain group of women (Allen et al., 2001; Eyler et al., 1999) or Black men who are in poor hostile environments (Eyler et al., 1999). To date, no known studies have assessed how social support is related to physical activity by sexual orientation for men.

Social support is associated with the health of sexual minority men. Low levels of social support have been related to several deleterious mental health concerns of gay men such as depression and poor self-acceptance (Vincke & Bolton, 1994). Furthermore, adolescent gay men who are rejected by their family members are more likely to commit suicide, experience depression, use illegal drugs, and engage in risky sex (Ryan et al., 2009).

Past literature suggests that gay men receive more social support from friends than family (Domínguez-Fuentes, Hombrados-Mendieta, & García-Leiva, 2012; Kurdek, 1988). Support received from gay friends and the gay community may buffer the deleterious effects of discrimination and stigma on health for gay men (Meyer, 2003). However, few studies have tested the effects of social support on physical activity for gay men and none have been

conducted with bisexual men. Limited research for the effects of social support on physical activity has only studied HIV positive gay men (Friedland et al., 1996; Wolf et al., 1991). Findings showed an inverse relationship between social support and physical activity (Clingerman, 2004), which contrasts with research on men in general (Hoerster et al., 2015). Due to the lack of evidence on the social support/physical activity relationship for gay and bisexual men and differences in social support by sexual orientation, the purpose of this study is to understand how social support is related to physical activity for straight, gay, and bisexual men, independently. We hypothesize that higher levels of social support will be related to greater physical activity for each group, regardless of sexual orientation.

Methods

Dataset

The National Epidemiologic Survey of Alcohol and Related Causes Wave 3 (NESARC III) was used in this study. The NESARC is a nationally-representative, face-to-face survey of non-institutionalized U.S. adults sponsored by the National Institute of Alcohol Abuse and Alcoholism. Inclusion criteria include civilian, noninstitutionalized adults (18 or over), residing in the United States. Data were collected by trained Census Bureau Data Collectors. Blacks, Hispanics, and young adults were over-sampled, although the data were weighted to the general U.S. population.

Measures

Sexual Orientation

Sexual orientation was measured with one item. Participants were asked, “Which of the categories on the card best describes you?” Categories included heterosexual (straight), gay or

lesbian, bisexual, or not sure. Only data from men (gay, bisexual, and straight men) were included in this study.

Social Support

The 12-item Interpersonal Support Evaluation List (ISEL-12) was used to measure perceived interpersonal social support (Cohen, Mermelstein, Kamarck, & Hoberman, 1985). Participants were presented items such as “There is someone I can turn to for advice about handling problems with my family” and “If I were stranded 10 miles from home, someone I know would come and get me” Responses were collected on a scale of 1 (*definitely false*) to 4 (*definitely true*). Six items were reverse coded so that higher scores indicated greater levels of social support. High social support was operationalized as individuals who, on average, reported 3 or more (somewhat true or definitely true). Low social support was operationalized as individuals who, on average, reported less than 3 (somewhat false or definitely false). The ISEL-12 has appropriate inter-item reliability with $\alpha=.81$ (calculated from this sample).

Physical Activity

Participants were asked to report daily activities in leisure-time or as part of employment. Vigorous activity was assessed by asking, “How often in the last 12 months did you usually do vigorous activities that caused you to sweat heavily or caused large increases in your breathing or heart rate?” Moderate activity was assessed by asking, “About how often in the last 12 months did you usually do light or moderate activities that caused only light sweating or slight to moderate increase in your breathing or heart rate?” For both questions, participants chose categories ranging from *nearly every day* to *never in the last year*. To assess time spent engaging in activity, participants were asked, “About how long did you usually do these vigorous (light or moderate) activities each time?” Participants reported in hours and minutes. Total minutes of

moderate and vigorous activity were calculated separately by multiplying the frequency of activity by the duration of activity per session. Individuals who engaged in at least 150 minutes of light/moderate activity or at least 75 minutes of vigorous activity per week were categorized as meeting physical activity recommendations. Individual who reported engaging in less than 150 minutes of light/moderate activity and less than 75 minutes of vigorous activity per week were categorized as not meeting physical activity recommendations. It is important to note that muscle-strengthening activity was not assessed.

Statistical Analysis

Linear regression models were conducted by sexual orientation in SAS 9.4 (SAS Institute Inc, Cary, NC) using proc surveyreg to examine the relationship between social support and physical activity by sexual orientation. All significance tests were conducted at $p < .05$. All models were conducted separately with four covariates: age (years), race (White, Black or African American, Asian, Native Hawaiian or Pacific Islander, and American Indian or Alaska Native), annual household income, and education. Logistic regression models were also conducted to analyze the association between social support and meeting physical activity recommendations by sexual orientation. Proc surveylogistic was used to calculate odds ratios and 95% confidence intervals. All regression models used individuals not meeting physical activity recommendations as the reference group. Therefore, odds ratios as presented show the odds of meeting physical activity recommendations. Due to the complex study design, sampling weights provided were used in all multivariate analyses.

Results

Demographics

Table 3-1 presents all descriptive statistics by sexual orientation. On average, straight men were 45.3 years (SD 17.2), White, college educated, married, and reported a social support score of 3.5 (SD 0.5). Most straight men report median incomes between \$20,000-\$39,999 and most met physical activity recommendations (60.8%). Gay men were 42.4 years (SD 15.3), White, college educated, never married, and reported similar incomes (median \$20,000-\$39,999) and social support to straight men (3.4, SD 0.6). Most gay men reported meeting physical activity recommendations (58.3%). Bisexual men were 42.2 years (SD 17.6), White, college educated, never married, and reported similar incomes (median \$20,000-\$39,999) and similar social support to straight and gay men (3.2, SD 0.6). Between-group differences were not statistically significant.

Table 3-1. Demographic Variables by Sexual Orientation for Men.

	Straight Men (N = 14,981)	Gay Men (N = 316)	Bisexual Men (N = 142)
Age in years (SD)	45.3 (17.2)	42.4 (15.3)	42.2 (17.6)
Annual Household Income			
0-\$19,999	19.8%	25.6%	34.2%
\$20,000-\$39,999	23.2%	24.2%	35.0%
\$40,000-\$59,999	16.2%	16.2%	12.8%
\$60,000-\$79,999	12.4%	11.0%	3.7%
>\$79,999	28.4%	23.0%	14.4%
Race			
White	66.7%	74.0%	66.9%
Black or African American	11.0%	10.1%	11.6%
Asian	1.3%	0.6%	0.8%
Native Hawaiian or Pacific Islander	5.8%	2.3%	5.9%
American Indian or Alaska Native	15.2%	12.06%	14.9%
Education			
High School or less	40.5%	26.05%	36.7%
Some College or College Graduate	44.9%	51.1%	48.6%
Post Graduate	14.6%	22.9%	14.7%
Marital Status			
Married	54.6%	3.91%	22.4%
Living with Someone as if Married	6.9%	21.7%	7.0%
Widowed, Divorced, Separated	14.6%	7.4%	19.7%
Never Married	23.9%	67.1%	50.9%
Social Support (Likert Scale 1-4, SD)	3.5 (.5)	3.4 (.5)	3.2 (.6)
Moderate-Intensity PA (minutes/week, SD)	546.1 (913.3)	453.98 (759.3)	501.5 (865.1)
Vigorous-Intensity PA (minutes/week, SD)	435.5 (795.3)	305.1 (585.7)	285.2 (486.9)
Meeting Recommendations (%)	60.8%	58.3%	45.4%

Note: SD = standard deviation

Social Support and Physical Activity

Table 3-2 presents results for the linear regression models. Social support was not related to gay or bisexual men's reported moderate- or vigorous-intensity physical activity. However,

social support was related to straight men’s reported moderate- ($\beta = 53.78, p = .036$) and vigorous-intensity physical activity ($\beta = 70.61, p < .001$). Straight men who reported higher levels of social support also reported higher participation in moderate-intensity physical activity. Each one unit increase in social support (reporting definitely false to somewhat false, somewhat false to somewhat true, or somewhat true to definitely true, on average) was associated with a 53.8 minute per week increase in moderate-intensity physical activity and a 70.6 minute per week increase in vigorous-intensity physical activity.

Table 3-2. Association of Social Support and Aerobic Physical Activity by Sexual Orientation for Men.

Physical Activity	Sexual Orientation	Unstandardized Beta	SE	t	p
Moderate-Intensity					
	Straight	70.6	15.1	4.7	< 0.001
	Gay	-123.0	151.2	-0.8	0.42
	Bisexual	62.3	78.3	0.8	0.43
Vigorous-Intensity					
	Straight	53.8	25.4	2.1	0.04
	Gay	62.5	94.7	0.7	0.51
	Bisexual	49.9	98.9	0.5	0.62

Note: SE = standard error

Results from the logistic regression models indicated that straight men who reported high social support were 1.63 (95% CI: 1.44-1.90) times more likely to meet physical activity recommendations than straight men who reported low social support. No relationships were seen between social support and meeting physical activity recommendations for gay (AOR: 0.98, 95% CI: 0.49-1.97) or bisexual (AOR: 0.64, 95% CI: 0.28-1.51) men.

Discussion

The purpose of this study was to examine whether higher levels of social support were related to greater physical activity for men by sexual orientation. This study is consistent with the majority of the literature (Hoerster et al., 2015; Trost et al., 2002) by testing and providing

additional evidence for the positive relationship between social support and physical activity. However, we found no evidence of a social support/physical activity relationship among gay and bisexual men. Thus, our hypothesis was supported for straight men and not supported for gay or bisexual men. Similar to other marginalized populations (Allen et al., 2001; Eyster et al., 1999), the social support/physical activity relationship was not present for these sexual minority men. This may reflect that while gay and bisexual men's perceived levels of social support are not significantly different than straight men's, the interactions between social constructs (like social support) and physical activity are different.

One possible explanation for these results might be that gay culture dictates physical activity more than social psychology. Gay culture highly values physical appearance, masculinity, and muscularity (Morrison, Morrison, & Sager, 2004). Gay men report greater peer pressure to be attractive (Hospers & Jansen, 2005). Engagement in physical activity may be part of the self-schema of gay and bisexual men, thus eliminating the need for social support in order to be active.

Future research should examine potential theoretical mechanisms to help explain physical activity behaviors for gay and bisexual men. The minority stress theory (Meyer, 1995) suggests that social support may buffer the deleterious effects of health outcomes associated with being gay or bisexual. While this seems to be the case for mental health among HIV positive gay men (Andrews, 1995), this study provides evidence against any buffering effect for physical activity. Thus, studies exploring physical activity among gay and bisexual men should be aware of this limitation.

There are several strengths and limitations of this study. First, we provide a novel analysis of the social support/physical activity relationship by sexual orientation. Second, we use

a nationally-representative sample of men with high generalizability. Third, we use a validated 12-item measure of social support that has been used in other studies (Gattis, Sacco, & Cunningham-Williams, 2012; Lyons, 2016). However, the measure of physical activity is self-reported and may not account for occupational, household, or transportation physical activity. Additionally, our sample of gay and bisexual men is relatively small compared to the sample of straight men and some might wonder if the null results are potentially due to this difference in sample size. To account for this, linear regression models were conducted separately for gay, bisexual, and straight men.

There are several implications of this study. First, future studies should control for sexual orientation in all analysis of social relationships when examining physical activity. Second, a novel theory of understanding physical activity among gay and bisexual men should be developed to explain physical activity behavior without the well-established social support/physical activity relationship (Hoerster et al., 2015; Trost et al., 2002). Third, more research is needed to identify the factors that may influence physical activity for gay and bisexual men, such as social integration, social capital, or other well-established social constructs. Without this knowledge, public health practitioners are limited in their ability to deliver culturally-relevant physical activity interventions to gay and bisexual men.

Conclusion

Social support is important for health behaviors like physical activity for some men but not all. Sexual orientation is one variable that plays a role in how men's health and health behaviors are influenced by the social environment. Future research should investigate other potential social environmental correlates of physical activity among sexual minority men.

Chapter 4 - The Relationship among Social Capital, Physical Activity, and Sexual Orientation for Men

Preface

The previous study suggests that no relationship exists between social support and physical activity for gay or bisexual men. Other social variables may explain the differences reported in Chapter 2 of this dissertation. To provide an additional mechanism that can explain the difference, I test the association between social capital and physical activity by sexual orientation. Since social capital is a place-based measure of social interaction, it may be that gay men live in areas that provide factors that positively impact their level of physical activity. These “gayborhoods,” or inner city areas with high populations of gay individuals, may provide positive social environments where gay men can be active. This self-selection hypothesis is the central theme of the following study.

Introduction

Growing evidence suggests that sexual orientation is an important variable to consider when analyzing health and health behaviors, such as physical activity (Boehmer et al., 2012b; Deputy & Boehmer, 2010). The social environment is important for overall health and may influence health behaviors such as participation in regular physical activity (McNeill, Kreuter, & Subramanian, 2006). The social environment is often defined as all aspects of social interaction that includes social relationships, social inequality, built environment, labor markets, wealth, etc. (Casper, 2001). However, not all populations experience the social environment similarly (Berkman et al., 2014). Gay men in the United States (U.S.) suffer from discrimination, stigma,

homonegativity, and other aspects of a hostile and homophobic culture (Diaz & Ayala, 2001; Meyer, 1995, 2003; Tilcsik, 2011). Hiding, concealing, and withdrawing from some aspects of social interaction have been seen with groups who experience stigma (Pinel, 1999).

Social capital, or the association, reciprocity, and trust of social ties, is one aspect of the social environment that may play an important role in population-level physical activity (Berkman et al., 2014; Kawachi, Kennedy, Lochner, & Prothrow-Stith, 1997; Putnam, 1996). Higher levels of social capital are thought to be associated with more physical activity (Kim, Subramanian, Gortmaker, & Kawachi, 2006; McNeill et al., 2006), possibly by reducing the negative effect of income (Doty, Willoughby, Lindahl, & Malik, 2010), increasing resource availability (Lin, 2002), and improving neighborhoods (Leyden, 2003). To date, no studies have been conducted to understand if sexual orientation moderates the association between social capital and physical activity.

Engagement in physical activity is important for overall health, yet much of the population does far too little (Haskell et al., 2007). Physical activity has been associated with decreased risks for cancer, heart disease, diabetes, hypertension, and many other diseases (Warburton et al., 2006). Of the limited studies published regarding physical activity and gay men, none account for social capital.

This study focused on the intersection of three important variables: sexual orientation, social capital, and physical activity. The purpose of this study was to understand the relationship between social capital and physical activity by sexual orientation. We hypothesized that 1) gay men will report lower social capital than straight men and yet 2) the relationship between social capital and physical activity will be similar for gay men as for straight men.

Method

Aggregated data from the 2013 and 2014 National Health Interview Surveys (NHIS) were used for this study. The NHIS is an in-home, cross-sectional survey of non-institutionalized U.S. adults. The NHIS employs a randomized cluster design of U.S. households and oversamples ethnic minorities. Approximately 35,000 households are surveyed annually. The NHIS is one of the best datasets to use for studying social capital and physical activity due to the large sample size, study design, and representation of U.S. adults. Only men who reported sexual orientation were used for this study. Our final sample included 603 gay men and 27,958 straight men. Bisexual men were excluded, as the sample of bisexual men was too small to allow for structural equation modeling. All participants in the original surveys completed written informed consent and this study was approved by the Kansas State University Institutional Review Board.

Measures

Social Capital

Social capital was measured by asking three questions. Participants were asked if there were people in their neighborhood that could be counted on, if neighbors could be trusted, and if neighbors helped each other. Responses were collected on a 4-point Likert scale from definitely agree to definitely disagree. Responses could also include “don’t know” and participants could refuse to answer. It is important to note that these questions measured perceptions of neighborhood social capital only.

Physical Activity

Physical activity was measured by asking participants the frequency and duration of their light/moderate- and vigorous-intensity aerobic and muscle-strengthening activities. Three variables were calculated. First, we standardized light/moderate-intensity physical activity by

calculating the weekly average time spent engaging in light/moderate leisure-time activity lasting at least 10 minutes. Next, we standardized vigorous-intensity physical activity by calculating the weekly average of time spent engaging in vigorous leisure-time activity lasting at least 10 minutes. Last, we calculated the average weekly frequency of individuals engaging in muscle-strengthening activity. This method of analyzing physical activity is based on current physical activity guidelines and is consistent with existing literature (USDHHS 2008).

Sexual Orientation

Sexual orientation was measured by asking participants, “Which of the following best represents how you think of yourself?” Participants could answer gay, straight (that is, not gay), bisexual, something else, I don’t know the answer, or could refuse to answer. For this study, gay men were those who identified as gay and straight men were those who identified as straight.

Demographics

Demographic data included age, education, income, race, region, and relationship status. Research generally suggests that these demographic factors serve as covariates for physical activity (Caspersen, Pereira, & Curran, 2000; Trost et al., 2002).

Analytic Plan

The analysis was conducted on a two-step approach used by most studies that use structural equation modeling (Kline, 2006). First, measurement models were conducted to map variables onto theoretical constructs. This is often called a confirmatory factor analysis model. The measurement model was conducted to test the model fit of the three social capital variables and a latent variable. Second, structural models were conducted to test the correlational links between variables. In this study, multiple group structural equation modeling (Kline, 2006) in Mplus (Muthén & Muthén, 2008) was used to understand how the relationship between social

capital and physical activity changed by sexual orientation. There were two groups, gay men and straight men. The measurement and structural models were conducted separately for each group. Physical activity variables were transformed using square root to correct for high skewness and kurtosis. Because of this transformation, unstandardized betas are not presented as they are not interpretable. Due to Poisson distribution of physical activity variables, maximum likelihood with robust standard error (MLR) was used. This did not allow for a chi-square difference test to be conducted (Kline, 2006). Full information maximum likelihood was used to handle missing data. All analyses used survey weights provided by the NHIS to make the results generalizable to the non-institutionalized U.S. adult population and controlled for age, race, education, region, income, and relationship status. Independent samples t-tests were also conducted to understand if variables differed by groups.

Results

Descriptive Statistics

Univariate statistics by sexual orientation are presented in Table 4-1. The sample of gay men were 44.0 years old (SD = 15.0 years), were mostly single (61.1%), white (81.5%), had incomes less than \$75,000 annually (64.1%), had some college education or higher (82.8%), and were from the south (35.3%). The sample of straight men were 48.1 years old (SD = 17.9 years), were mostly in a relationship (64.2%), white (80.6%), had incomes less than \$75,000 annually (61.4%), had some college education or higher (73.2%), and were from the south (35.3%). There were no statistical differences between gay and straight men for physical activity or social capital.

Table 4-1. Demographic and Variables of Interest for Gay and Straight Men.

		Gay Men		Straight Men	
		n or Mean	Percentage or SD	n or Mean	Percentage or SD
<u>Demographics</u>					
Age (years)		44.0	15.0	48.1	17.9
Race					
	White	495	81.5%	23,134	80.6%
	Black/African American	79	12.2%	4,015	11.3%
	American Indian/Alaskan Native	-	-	320	0.8%
	Asian	25	3.6%	1,848	5.5%
	Multiple Race	20	2.1%	580	1.5%
Income					
	\$0 - \$34,999	228	31.2%	10,753	29.3%
	\$35,000 - \$74,999	190	32.9%	8,863	32.1%
	\$75,000 - \$99,999	55	9.9%	3,124	13.06%
	\$100,000 and over	131	26.0%	5,278	25.6%
Education					
	High School or less	121	17.1%	9,499	26.8%
	Some College	199	31.3%	9,544	32.3%
	College Graduate	166	25.6%	6,467	24.0%
	Master's or Higher	138	25.9%	4,415	16.8%
Region					
	Northeast	114	18.8%	4,797	17.5%
	Midwest	92	17.4%	6,392	23.6%
	South	221	35.3%	10,528	36.3%
	West	197	28.6%	8,250	22.9%
Relationship Status					
	In a relationship	174	38.9%	16,381	64.2%
	Single	449	61.1%	13,545	35.8%
<u>Variables of Interest</u>					
	Neighborhood Trust	3.0	0.9	3.2	0.8
	(4-point Likert Scale)				
	Neighborhood Connectedness	3.0	1.0	3.2	0.9
	(4-point Likert Scale)				
	Neighborhood Assistance	2.9	0.9	3.1	0.8
	(4-point Likert Scale)				
	Light/moderate-Intensity Physical Activity	156.3	268.6	146.1	356.5
	(minutes/week)				
	Vigorous-Intensity Physical Activity	134.3	294.0	134.7	334.3
	(minutes/week)				

Muscle-Strengthening Physical Activity (days/week)	3.4	3.1	4.0	3.9
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Note: - = field not presented due to data suppression guidelines from the National Center for Health Statistics.

Measurement Model

Parameter estimates for the measurement model are presented in Table 4-1. The model fit was acceptable (Kline, 2006): Chi-square = 2.88, with 4 degrees of freedom, RMSEA = .00 (90% CI: .00 to .01), CFI = 1.0, TLI = 1.0, SRMR = .01. All paths were significant. Social capital accounted for similar variance in the observed variables for both gay and straight men. Unlike common methods of transforming variable, structural equation modeling allows for the development of latent variables. Social capital is a latent variable in this model that was developed from three observed variables: trust, connectedness, and assistance. Social capital accounted for a large amount of variance in the observed variables. For gay men, social capital accounted for 62.6% of trust, 72.9% of connectedness, and 74.5% of assistance. For straight men, social capital accounted for 63.2% of trust, 74.7% of connectedness, and 71.3% of assistance. Inter-item reliability for the three items was excellent at alpha = .98.

Structural Model

The structural models for testing the relationship between social capital and physical activity are shown for gay men in Figure 4-1 and shown for straight men in Figure 4-2. Parameter estimates are presented in Table 4-2 for the measurement model and structural model. The model fit for the structural model was also acceptable (Kline, 2006): Chi-square = 1,543.6, with 52 degrees of freedom, RMSEA = .05 (90% CI: .04 to .05), CFI = .94, TLI = .88, SRMR = .06.

For gay men, only the path from social capital to light/moderate-intensity physical activity was significant ($\beta = .14, p < .05$). A one standard deviation increase in social capital was

associated with a .14 standard deviation increase in light/moderate-intensity physical activity for gay men. The path from social capital to vigorous-intensity physical activity and the path from social capital to muscle-strengthening physical activity were not significant for gay men. The model accounted for a significant amount of variance in physical activity. For gay men, social capital and covariates accounted for 5.6% ($p < .05$) of the variance in light/moderate-intensity physical activity and 11.1% ($p < .01$) of the variance in vigorous-intensity physical activity. For gay men, income accounted for a significant amount of variance in light/moderate-intensity physical activity; age and education explained a significant amount of variance in vigorous-intensity physical activity; and region explained a significant amount of variance in muscle-strengthening activity.

For straight men, the path from social capital to light/moderate-intensity physical activity was significant ($\beta = .06, p < .001$), as was the path from social capital to vigorous-intensity physical activity ($\beta = .06, p < .001$). A one standard deviation increase in social capital was associated with a .06 standard deviation increase in both light/moderate-intensity and vigorous-intensity physical activity for straight men. Similarly to gay men, the path from social capital to muscle-strengthening physical activity was not significant. Social capital and covariates accounted for 2.4% ($p < .001$) of the variance in light/moderate-intensity physical activity, 9.2% ($p < .001$) of the variance in vigorous-intensity physical activity, and 0.8% ($p < .01$) of the variance in muscle-strengthening physical activity. For straight men, age, education, income and region explained a significant amount of variance in light/moderate-intensity physical activity; age, education, income, region, and relationship status explained a significant amount of variance in vigorous-intensity physical activity; and age, region, and relationship status explained a significant amount of variance in muscle-strengthening activity.

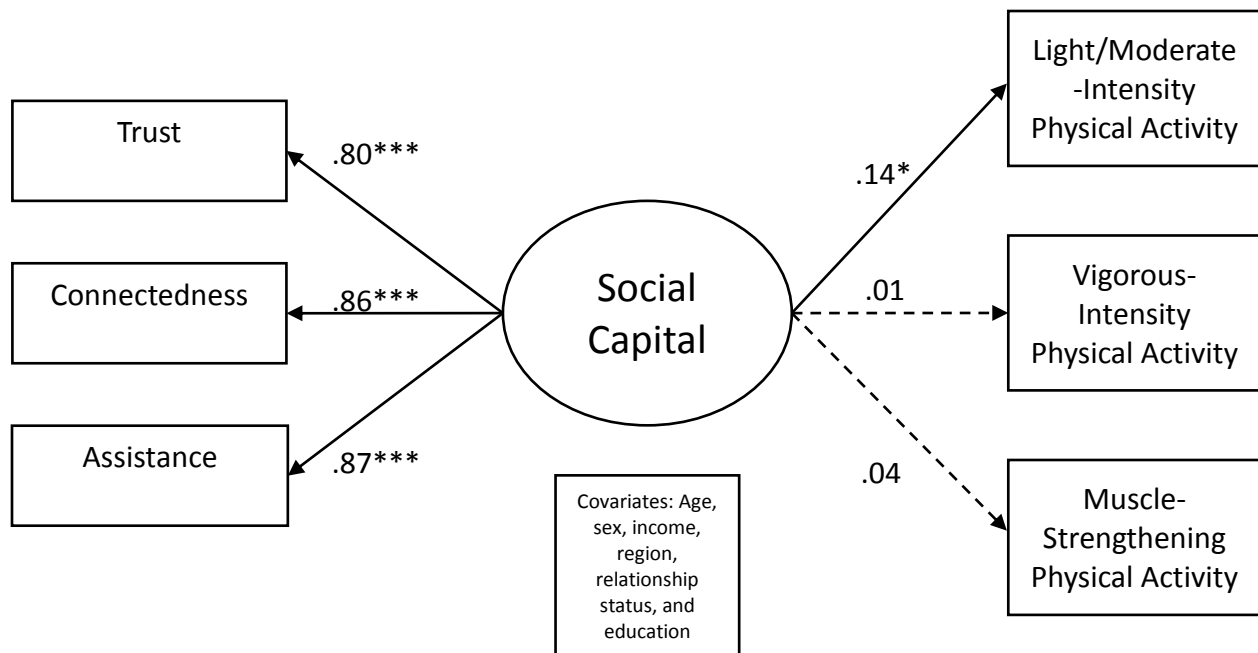


Figure 4-1. Structural Model for the Association of Social Capital and Physical Activity for Gay Men.

Note: Model Fit: $\chi^2(52) = 1543.6, p < .001$; CFI = .94; TLI = .89; RMSEA = .05; (two-sided).

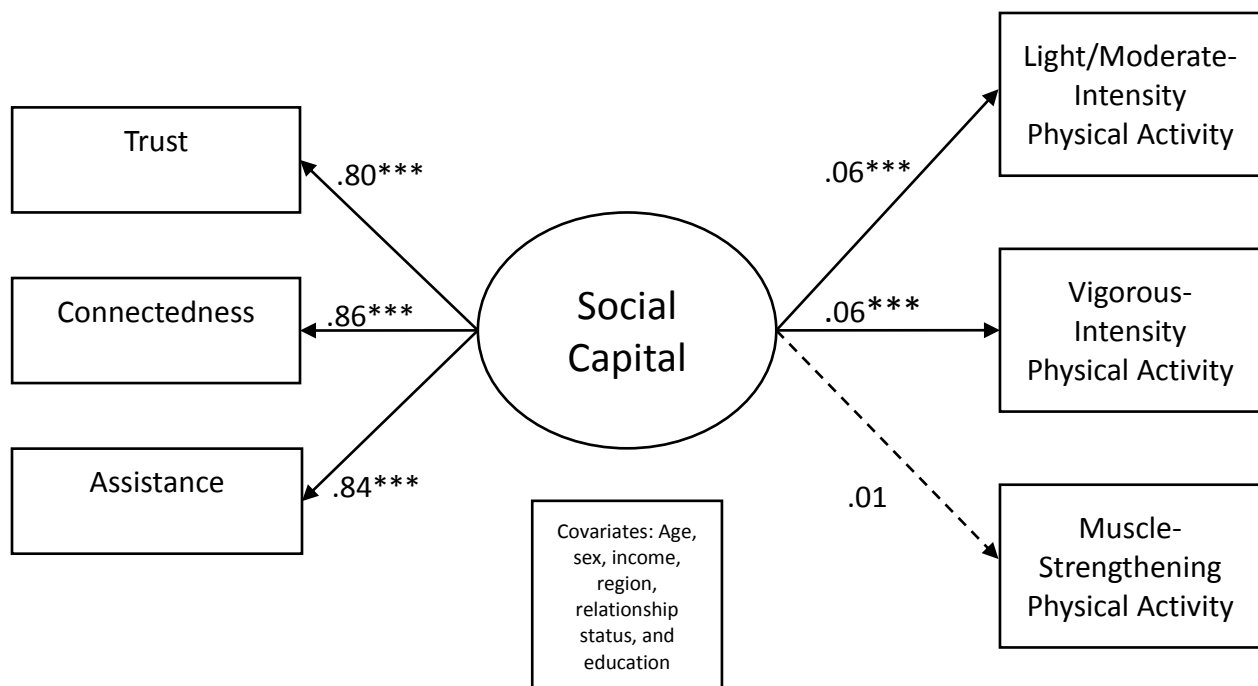


Figure 4-2. Structural Model for the Association of Social Capital and Physical Activity for Straight Men.

Note: Model Fit: $\chi^2(52) = 1543.6, p < .001$; CFI = .94; TLI = .89; RMSEA = .05; (two-sided).

Table 4-2. Standardized Parameter Estimates and Significance Levels for Models in Figure 1 and Figure 2.

Parameter	Gay Men		Straight Men	
	Standardized (SE)	<i>p</i>	Standardized (SE)	<i>p</i>
Measurement Model				
Trust → Social Capital	.79 (.02)	.00	.80 (.01)	.00
Connectedness → Social Capital	.86 (.02)	.00	.86 (.01)	.00
Assistance → Social Capital	.87 (.02)	.00	.84 (.01)	.00
Structural Model				
Social Capital → Light/moderate-Intensity PA	.14 (.06)	.03	.05 (.01)	.00
Age → Light/moderate-Intensity PA	-.01 (.06)	.88	-.04 (.01)	.00
Education → Light/moderate-Intensity PA	.06 (.07)	.42	.10 (.01)	.00
Income → Light/moderate-Intensity PA	.15 (.08)	.05	.05 (.01)	.00
Race → Light/moderate-Intensity PA	.02 (.04)	.58	-.01 (.01)	.34
Region → Light/moderate-Intensity PA	.01 (.06)	.91	.04 (.01)	.00
Relationship Status → Light/moderate-Intensity PA	-.02 (.07)	.78	.04 (.01)	.00
Social Capital → Vigorous-Intensity PA	.01 (.06)	.92	.06 (.01)	.00
Age → Vigorous-Intensity PA	-.22 (.06)	.00	-.24 (.01)	.00
Education → Vigorous-Intensity PA	.13 (.06)	.03	.10 (.01)	.00
Income → Vigorous-Intensity PA	.12 (.08)	.12	.09 (.01)	.00
Race → Vigorous-Intensity PA	.01 (.04)	.79	-.01 (.01)	.34
Region → Vigorous-Intensity PA	.07 (.05)	.13	.03 (.01)	.00
Relationship Status → Vigorous-Intensity PA	-.09 (.07)	.18	.05 (.01)	.00
Social Capital → Muscle-Strengthening PA	.04 (.07)	.63	.01 (.01)	.47

Age → Muscle-Strengthening PA	-.01 (.08)	.90	.06 (.02)	.00
Education → Muscle-Strengthening PA	.03 (.10)	.80	.02 (.02)	.23
Income → Muscle-Strengthening PA	-.01 (.08)	.95	-.01 (.02)	.49
Race → Muscle-Strengthening PA	-.04 (.05)	.34	.00 (.01)	.97
Region → Muscle-Strengthening PA	.13 (.06)	.03	-.04 (.01)	.01
Relationship Status → Muscle-Strengthening PA	-.10 (.08)	.23	.07 (.02)	.00
Residual of Light/moderate-Intensity PA	.94 (.03)	.00	.98 (.00)	.00
Residual of Vigorous-Intensity PA	.89 (.03)	.00	.91 (.01)	.00
Residual of Muscle-Strengthening PA	.97 (.03)	.00	.99 (.01)	.00

Note: Measurement Model Fit: $\chi^2(4) = 2.88, p = .58$; CFI = 1.0; TLI = 1.0; RMSEA = .01; Structural Model Fit: $\chi^2(52) = 1543.6, p < .001$; CFI = .94; TLI = .89; RMSEA = .05; PA= Physical Activity, (two-sided).

Discussion

The purpose of this study was to understand the relationship between social capital and physical activity by sexual orientation. Gay men report similar rates of social capital as straight men. However, our results suggest that the social capital/physical activity relationship varies by sexual orientation for men. Our results agree with the majority of the literature that social capital is related to aerobic physical activity (McNeill et al., 2006). This was true for light/moderate intensity physical activity for both gay and straight men and for vigorous-intensity activity for straight men. Social capital was not related to muscle-strengthening activity for either group.

One possible explanation of differential findings by group might be the neighborhood where individuals live. The effect size for light/moderate activity was larger for gay men than straight men. Light/moderate activities usually include walking and bicycle riding which are influenced by the neighborhood more than vigorous-intensity activity (Saelens, Sallis, Black, &

Chen, 2003). Gay men may live in dense urban neighborhoods, coined “gayborhoods,” that facilitate walking for transportation (Walter, 2011), where straight men may live in more suburban or rural neighborhoods where the environment does not support walking. The physical environment may explain why the effect size of light/moderate activity was larger for gay men than for straight men. Therefore, gay and straight men may self-select into physical environments that then change their physical activity behavior.

Social capital was significantly associated with vigorous-intensity activity for straight men but not for gay men. One interpretation of this result may be that social capital is more important for straight men’s participation in overall physical activity than for gay men. A second interpretation may be that sexual minorities experience the association between social capital and vigorous-intensity activity differently due to social networks. The social networks of gay men may be more varied, thereby not allowing the statistical model to reach significance. Lastly, straight men may be more likely to live in less dense, suburban-type neighborhoods with sports facilities that facilitate vigorous-intensity activity, such as running and playing sports.

Although social integration and social support have been related to increases in reported muscle-strengthening activity (Gorman & Sivaganesan, 2007), this was the first study to examine the association between social capital and muscle-strengthening activity. McNeill, Kreuter, & Subramanian (2006) suggest that social capital impacts health by enforcing social norms. Norms are followed if the individual is connected to the group and has shared resources. Connectedness and assistance are two observed variables of our latent social capital variable. Engaging in muscle-strengthening activity is likely to be highly resource intensive and impacted by social norms. Individuals who are highly connected and share resources (e.g. who have high social capital) should be more likely to engage in a behavior such as muscle-strengthening activity.

However, no studies have investigated this relationship. The results from this study seem to provide evidence that shared resources, connectedness, and trust are not related to muscle-strengthening activities for men, gay or straight.

The minority stress theory suggests that discrimination may be the underlying mechanism for health inequality of sexual minorities (Meyer, 1995). Although this study did not measure discrimination, our results suggest that gay men who have higher levels of social capital, thus higher levels of connectedness with their neighborhood, are also more likely to engage in higher levels of light/moderate physical activity. Future studies should attempt to understand if discrimination is one mechanism that may explain these differences in the social capital/physical activity relationship.

Strengths and Limitations

There are several strengths of this study. First, we analyze a nationally-representative sample of U.S. adult men. Second, we use sophisticated statistical methodology that accounts for several complex issues associated with social research (Kline, 2006). Third, we control for many demographic covariates which have been known to impact physical activity. However, as with most survey research, our measures are cross-sectional and are susceptible to self-report bias. Although data are collected by a trained staff member from the Census Bureau, it is likely that people may feel uncomfortable being asked questions about sexual orientation and may feel reluctant identifying themselves as sexual minorities to a stranger. Additionally, our sample of gay men is much smaller than our sample of straight men, although sufficient statistical power existed for our analyses. Our measure of social capital is a three-item measure that may not fully capture all of the complex aspects of social capital.

Future Research

Future research should attempt to understand the mechanisms underlying the relationship between social capital and physical activity for gay and straight men. While this study takes a first step at integrating ideas from several fields, future studies need to expand upon the intersectionality of society, individual, social, and place influences on health and health behaviors. Additionally, studying the differences between participation in aerobic and muscle-strengthening activities should be conducted in the frame of social variables. These data can be used to develop interventions to change social variables to positively impact physical activity behaviors.

Chapter 5 - Conclusion

Summary of Findings

The studies presented in this dissertation aimed to 1) understand how social variables impact physical activity for sexual minority men, 2) determine if social support is related to physical activity for male sexual minorities, 3) examine differences in physical activity for men by coupling status and sexual orientation, 4) analyze how social capital might be related to physical activity for gay men, and 5) provide recommendations on future directions of research regarding physical activity for gay men.

Overall, the social variables for sexual minority men are similar to straight men. Reported levels of social support and social capital are statistically similar. However, social variables are associated with the physical activity behaviors of sexual minority men differently than straight men. Multivariate statistics show that the strength of relationships are different for sexual minority men and straight men.

Explanation of results

Figure 5-1 visually depicts the overall outcomes of this dissertation. Sexual orientation is associated with a large difference in relationship status, with gay men being three times more likely to be single than straight men. The association between relationship status and physical activity also differs by sexual orientation; although straight coupled men report greater physical activity than straight single men, gay coupled men report significantly more moderate, vigorous, muscle-strengthening, and overall physical activity than straight coupled men. Sexual orientation does not seem to be associated with differences in social support or social capital. However, the relationships between social support/social capital and physical activity seem to change by

sexual orientation. Social support was only related to physical activity for straight men. Social capital for both gay and straight men was positively related to light/moderate physical activity, but only to vigorous intensity physical activity for straight men. The results of this dissertation failed to find a direct association between sexual orientation and physical activity. Past studies have also failed to present a clear direct association between sexual orientation and physical activity, as the current state of the field has produce mixed results (Fredriksen-Goldsen, 2013; Deputy, 2010).

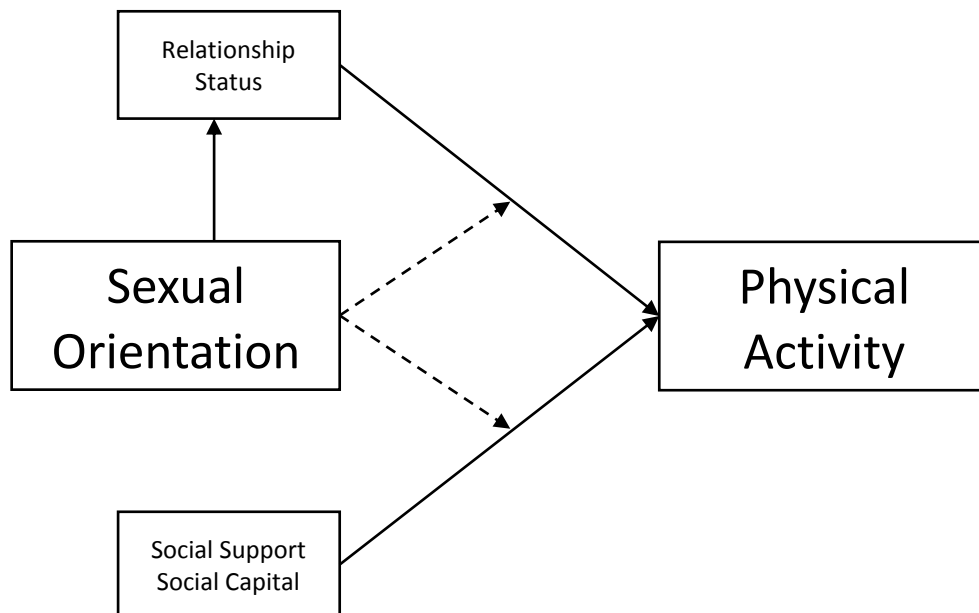


Figure 5-1. Conceptual Model of the Indirect Association between Sexual Orientation and Physical Activity

Relationship status, social support and social capital have different strengths of associations with physical activity by sexual orientation. The micro-level variables (social support and relationship status) seem to present conflicting results. Close interpersonal relationships for gay men seem to be beneficial for physical activity. However, it does not seem to be due to social support, as a social support/physical activity relationship was not found for gay men.

The social capital/physical activity relationship is important for light/moderate-intensity physical activity for both gay and straight men. However, the association between social capital and light/moderate-intensity physical activity might be stronger for gay men and stronger for vigorous-intensity physical activity for straight men. Gay coupled men report higher incomes and this may lead to greater access to more resources because they are coupled. Thus, they may live in better neighborhoods (e.g. dense neighborhoods with sidewalk or bike lanes) that facilitate light/moderate intensity physical activity. This could explain why coupled gay men meet physical activity recommendations 60% more often than straight coupled men. Overall, these studies suggest that, while the social environment is similar for men of different sexual orientations, the relationships between social variables and physical activity are different for gay and straight men.

Theoretical Significance

The Eco-Social Theory (EST) does not directly incorporate sexual orientation (Krieger, 2012). However, the theory was developed to understand the social and environmental factors that create health disparities by race. Therefore, the EST is a great model to study sexual orientation, as racial minorities and sexual minorities share similar factors in the promotion and engagement of physical activity (Krieger, 2012). To date, no known studies have used the EST to understand the factors associated with being a sexual minority and physical activity.

The results of this dissertation suggest that sexual orientation seems to play a role in the complex associations between social variables and physical activity. The theoretical construct of embodiment is operationalized as the factors associated with being a sexual minority. The three studies in the dissertation are focused on the pathways to embodiment, or how gay and bisexual men internalize the positive and negative aspects of being gay on physical activity behavior.

Social support does not seem to be a pathway to embodiment of physical activity behavior, as no significantly relationship was found for gay or bisexual men. However, relationship status and social capital may be important pathways that both improve physical activity behaviors of gay men.

This dissertation focuses on a small portion of the EST. For example, I focused on pathways to embodiment and micro-level factors (Krieger, 2012). This is due to the current state of the field of physical activity research. Past literature has been focused at the individual level (Ball, 2015). Only recently has significant research been conducted on social, environment, and societal levels. I examined individual (social support), household (relationship status), and area (social capital) levels of the EST. Future research should examine the regional, national, and global ecosystem factors of physical activity behavior for sexual minorities. Additionally, I did not examine the cumulative interplay of exposure, susceptibility and resistance, accountability and agency, nor did I attempt to examine physical activity over the life course for sexual minority men (Krieger, 2012).

Strengths and limitations

There are several strengths of this dissertation research. National-level, weighted data from two independent institutes within the National Institutes of Health were used that had variation in race, ethnicity, place, income, education and other factors that make the results of this dissertation generalizable to the U.S. adult, non-institutionalized population. The Census Bureau directly collected data for both the NESARC and NHIS, making data collection more consistent. A mix of statistical methodology was used that accounted for the majority of demographic characteristics of physical activity behavior, as presented by other studies (Troost, et

al., 2002). The social support survey used was more comprehensive than other population-based studies (Gattis, et al., 2012).

However, there are also several limitations of this research. While large national samples were used, the samples of gay and bisexual men were still relatively small compared to the samples of straight men and all were cross-sectional. The social capital variables were neighborhood based. It might be that gay men have high social capital in other areas that are more institutional, not neighborhood-based (e.g. gay community centers, gay bars, et cetera). Inherent issues with self-report physical activity data is a limitation of this dissertation, as well as the majority of physical activity research (Sallis & Saelens, 2000). All three studies in this dissertation rely on recalling physical activity in a face-to-face format. Social desirability bias and over reporting are common in self-report physical activity data (Sallis & Saelens, 2000).

Future Directions

There are many areas of future research that should be explored. Currently, little is known about the correlates of physical activity for gay men, nor are many interventions developed to increase physical activity for sexual minority men. Large-scale longitudinal trials have only been conducted on the link between physical activity and HIV treatment for gay men. To date, only one intervention has examined how to increase physical activity among HIV seronegative gay men (Zhang, et al., 2016) and it has produced lackluster results. The need for sexual minority-specific studies has been suggested elsewhere (Gorczynski & Brittain, 2016). This dissertation adds evidence to suggest that this population is worthy of being studied, as commonly studied relationships, such as the social support/physical activity relationship, were not found.

Research on the social environment and physical activity is still a new area of interest that warrants additional investigation. Specifically, social capital, social integration, and the link between the social environment and physical activity is not understood for sexual minorities. Qualitative studies need to be conducted on the association between sexual orientation and social variables to inform interventions. Interventions aimed at increasing social integration or social capital as a way to improve health and increase physical activity have not produced meaningful results (Hill, et al., 2016). More longitudinal trials need to be conducted to understand the ways social variables can be manipulated to change health behaviors and outcomes.

Public health interventionists should use this research to tailor interventions specifically for gay and bisexual men. In cities where there is a large gay population, physical activity interventions focused on increasing physical activity should use resources appropriately. Perhaps it would be better to implement interventions based on social capital than it would be to use interventions based on social support. Additionally, stealth interventions may be appropriate (King, et al., 2015). For example, policy interventions facilitating same-sex relationships may increase physical activity for gay men.

Conclusions

There have been many advances in the field of population-level physical activity, yet empirical evidence has done little to increase physical activity. This dissertation highlights two important concepts that have the potential to positively impact physical activity. First, sexual minority men are a specific group who deserve cultural-specific attention in the literature. Second, social capital and coupling are key variables to increase physical activity of this population. By focusing on traditionally underserved populations, like sexual minority men, we are better able to understand the similarities and differences within populations. Understanding

the key determinants of health for all people requires studying the marginalized groups as well as the majority groups.

Social relationships and sexual orientation are important predictors of an individual's physical activity level. For gay men, social predictors of physical activity include relationship status and social capital. Social support, however, is not as predictive for gay men's physical activity as for straight men's. Physical activity research on representative groups of straight, gay, and bisexual men can provide insight into the differences and similarities in group behavior. Identifying the social factors that increase physical activity for each group will lead to tailored interventions that would dramatically and positively impact, not only the individual, but also the community.

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