

THE RELATIONSHIP BETWEEN PHYSICAL ACTIVITY AND SEXUAL SATISFACTION
AMONG WHEELCHAIR USERS

By

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Abstract

Sexuality is an important part of life. Many people with disabilities report lower levels of sexual satisfaction (SS) than people without disabilities. SS has been correlated with many psychosocial, psychological, and physiological variables. Because physical activity (PA) improves many of the variables correlated with SS, promoting PA may be one strategy for promoting SS. Several studies have demonstrated a relationship between PA and SS in the general population; however this relationship has not been explored among people with physical disabilities.

This study explored the relationship between satisfaction with sex life and PA in a sample of participants with physical disabilities who used wheelchairs as their primary mode of mobility. In addition, psychosocial, psychological, and physiological correlates of both PA and SS were explored. Further, variables that were related to both PA and SS were examined to assess whether they mediated the relationship between PA and SS.

Results indicated that PA and SS were related. Several psychosocial and psychological variables were related to PA and to SS. Two variables—satisfaction with personal appearance and satisfaction with emotional support from people other than family —mediated the relationship between PA and SS. There is a need for future research to explore these relationships using qualitative methods, and objective measures of PA.

Keywords: sexual satisfaction, physical disability, physical activity, exercise, psychosocial support, biopsychosocial model, wheelchair users

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The Relationship Between Physical Activity and Sexual Satisfaction

Among Wheelchair Users

Sexual satisfaction (SS) is an important part of life. It correlates with many facets of well-being in the general population, including psychosocial, psychological, and physiological health variables. For the approximately 3.6 million people who use wheelchairs (Brault, 2012), SS may be affected not only by disability-related physical factors but also by psychosocial and psychological factors similar to those found in the general population.

Practitioners working with people with disabilities often focus on physical adjustment and rehabilitation rather than on sexuality. SS is important, however, and research indicates that people living with physical disabilities report being less sexually satisfied than do those without disabilities (McCabe & Taleporos, 2003). Thus, research exploring ways to improve SS in people with disabilities is important. Given that SS involves a complex interplay of psychosocial, psychological, and physiological factors, the most effective means for improving SS will likely be those that addresses multiple factors involved in SS (Althof et al., 2005; Perelman, 2005, 2007).

Physical activity (PA) may provide a novel approach for improving SS in people with disabilities. The association between PA and improved health is well documented, and some of the psychosocial, psychological, and physiological problems associated with disability are improved or even prevented through regular exercise. For example, PA is related to improvement in psychological variables, such as reductions in depression (Martin, 2003; Martinsen, 2008) and improved body image (Campbell & Hausenblas, 2009; Wetterhahn, Hanson, & Levy, 2002). In addition, studies suggest that PA is related to psychosocial variables that may be related to relationship quality, such as intimacy and interpersonal sensitivity, (e.g.,

Fiorilli et al., 2013; Guedes, Hatmann, Martini, Borges, & Bernadelli, 2012), and to greater social interaction and social support (e.g., Petajan, 1996; Steptoe et al., 1997). Moreover, PA plays a role in the reduction of symptoms associated with physical disabilities, such as pain and fatigue (e.g., Motl, McAuley, Snook, & Gliottoni, 2009).

Although there has been extensive research on the association between PA and physical and mental health, there has been far less research on the relationship between PA and *sexual* health in the general population, and no research on the relationship between PA and sexual health in wheelchair users. Although wheelchair users might be unable to return to pre-disability sexual functioning, PA might help increase their SS. Given the positive impact that PA has on many psychosocial, psychological, and disability-related physical factors that correlate with SS, an examination of a potential role for PA in improvement of satisfaction with sex life among people with disabilities is warranted. Research examining the relationship between PA and SS could help evaluate the usefulness of PA as a non-invasive method for improving satisfaction with sex life and could further our understanding of factors that underlie this relationship. This information may ultimately inform future sex and rehabilitation research.

The purpose of the present study is to explore the relationship between PA and SS, and possible mediators of this relationship, in wheelchair users with mobility impairments. In addition, possible relationships between both PA and SS and two psychological variables (i.e., depression and satisfaction with personal appearance), three psychosocial variables (i.e., satisfaction with spouse, lover, or partner; satisfaction with emotional support from family; and satisfaction with emotional support from people other than family), and two physiological variables (i.e., pain and fatigue) will be examined. The following sections present an overview of the literature in two areas: first, the correlates of SS in the general population and in people

with disabilities, and second, these correlates as they relate to PA in the general population and in people with disabilities. Finally, literature examining the relationship between PA and SS in the general population will be reviewed.

Sexual Satisfaction

Sexual health is an important aspect of life that comprises many facets of well-being. In fact, the current World Health Organization's (WHO) definition of sexual health takes into account three areas of well-being related to sexuality—physical, emotional, and social—and suggests that sexual health is a necessary component of a person's satisfaction with sex life (WHO, 2006). Correspondingly, much research has been devoted to exploring various correlates of sex life satisfaction.

Conceptualization of sexual satisfaction. A review of current research surrounding SS suggests that researchers vary in their definitions of SS, and there is no consensus about how to conceptualize SS. Several researchers have noted a dearth of literature exploring conceptual definitions and comprehensive theoretical models of SS (McClelland, 2014; Neto, 2012; Pascoal, Narciso, & Pereira, 2014).

Neto (2012) proposed a general principle to explain how people evaluate their SS. He suggested that people evaluate their satisfaction with their sex life through a cognitive, judgmental process whereby they compare their sex life with standards that they believe to be appropriate. He posited that the more closely an individual's sexual situation matches the individual's self-imposed standards, the higher the individual's rating of SS will be.

Research examining the meaning of SS to lay people has indicated that different people have different criteria for defining their own SS (McClelland, 2014; Pascoal et al., 2014). For example, Pascoal et al. surveyed an online sample of 449 women and 311 men, ages 20 to 69

years with a mean of 36 years. All identified as heterosexual, and all were either married or living with a partner. They were asked to give qualitative answers to the question, “How would you define sexual satisfaction?” (p. 24). Using thematic analysis, Pascoal et al. identified two main themes, one reflecting personal sexual well-being and one reflecting dyadic processes. Responses related to personal sexual well-being included themes such as “the positive aspects of individual sexual experience, such as pleasure, positive feelings, arousal, sexual openness, and orgasm” (p. 22). Responses related to dyadic processes included themes such as “mutuality, romance, expression of feelings, creativity, acting out desires, and frequency of sexual activity” (p. 22). However, not all individuals mentioned both of these themes; in fact, individuals’ responses varied widely.

In most research on SS, researchers have used quantitative measures to assess participants’ satisfaction. These measures varied considerably. Some have measured SS in terms of discrete physical aspects of sexual activity. For example, White, Cass, McWhirter, and Mattison (1990) assessed sexual dysfunction and dissatisfaction by having participants complete a 5-week diary to assess 34 sexual issues, including frequency and duration of sexual activities. Sexual dissatisfaction was calculated from diary data as incidence of short or dissatisfying orgasms. Others have used scales assessing SS as satisfaction with overall sexual relationship. Byers (2005), for example, measured SS using the Global Measure of Sexual Satisfaction (Lawrance & Byers, 1998). On this scale, participants are asked to generally rate their satisfaction with their sexual relationship on 5, bipolar seven-point scales, (e.g., good-bad, pleasant-unpleasant, etc). Still other investigators have assessed SS by measuring both physical and relational aspects of sexuality. For example, Penhollow and Young (2008) measured SS on an 11-item scale assessing topics, such as satisfaction with sexual communication with partner,

satisfying orgasm, frequency sexual activity, and sexual attraction to partner. Further, some researchers have assessed satisfaction with sex life with scales that take a more global items such as, “I am satisfied with my sex life,” (Neto & Pinto, 2014, material section, paragraph 1a).

There are important distinctions between Neto’s (2012) global approach to measuring SS and other approaches based on specific aspects of respondents’ sexuality. Measuring sexuality by asking about the respondents’ physical functioning (e.g., whether respondents orgasm, how satisfied they are with their orgasms) or asking about the respondents’ relationships (e.g., the quality of their sexual relationships with their partner) might actually be assessing the predictors or correlates of the respondents’ SS rather than their sex satisfaction per se. For example, what if some individuals report that they are satisfied with the number and quality of their orgasms, but they also report that they do not feel sexually satisfied? If satisfaction with one’s orgasms is considered to be the *definition* of SS, then the above situation would be conceptually impossible. However, if satisfaction with one’s orgasms is considered to be a *predictor* or a *correlate* of SS, then the above situation would be conceptually possible; it would suggest that whereas for many people, satisfaction with orgasm is an important predictor of SS, for some individuals, it is not.

From this conceptual perspective, it is possible to then assess various predictors or correlates of SS using a biopsychosocial as a framework (Engel, 1977; see Figure 1). This model posits that health, disease, and human functioning involve biological, psychological, and psychosocial aspects and that these issues can best be understood by taking these three sets of factors into account. Further, one implication of this model is that strategies that take all of these factors into account should be best suited to promote health. As the literature review in the next section shows, research has demonstrated that biological factors (e.g., pain, fatigue), psychological factors (e.g., depression, body image), and psychosocial factors (e.g., social

support, relationship quality) can all relate to SS and might influence SS. Thus, interventions to promote SS might be those that influence the biological, psychological, and psychosocial correlates of SS. PA has been shown to promote many aspects of psychosocial, psychological, and physiological health, and therefore may be well suited as a means to promote SS.

Figure1.

The Biopsychosocial Model of Sexual Satisfaction

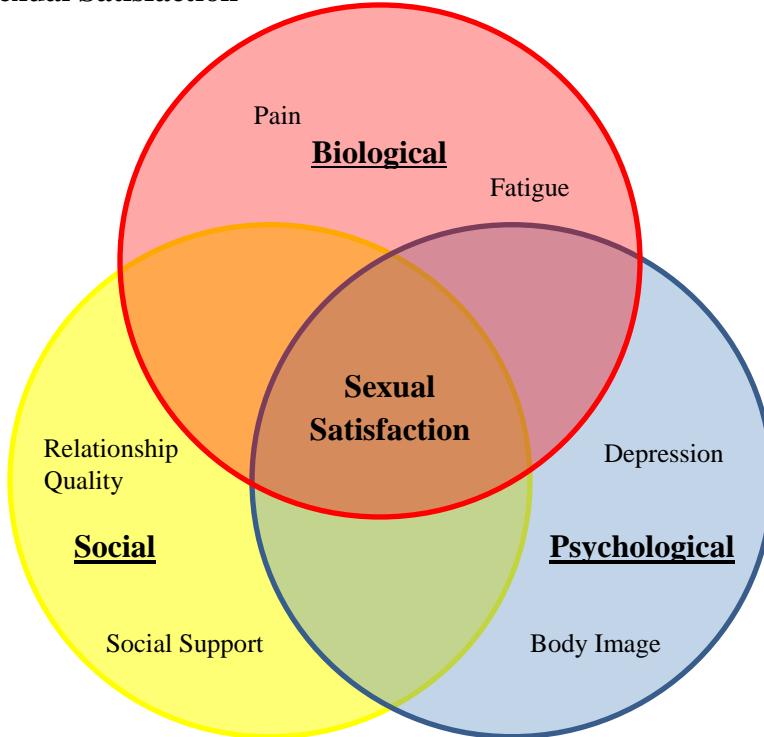


Figure 1. The biopsychosocial model of sexual satisfaction. The model suggests that biological, psychological, and social factors all play a role in sexual satisfaction. Adapted from Engle, G. L. (1977). The need for a new medical model: A challenge for biomedicine, *Science*, 196(4286), 129-136.

Correlates of sexual satisfaction. Although the conceptual definition of SS has varied across studies, research examining the correlates of SS has provided relatively consistent evidence of relationships between SS and several psychosocial, psychological, and physiological correlates. The following two sections provide an overview of these relationships. In the first

section, I provide an overview of research that examines the relationships between SS and psychosocial, psychological, and physiological variables among the general population. Next, I provide an overview of research examining these relationships among people with disabilities.

SS and psychosocial correlates in the general population. Psychosocial factors reported to be related to greater satisfaction with sex life include relationship or partner satisfaction and social support. For example, Byers (2005) examined the relationship between sexual and relationship satisfaction in an 18-month longitudinal study. Participants included 34 men and 53 women who were in a heterosexual relationship with the same partner throughout the study. At baseline and 18-months after baseline, participants completed a packet of questionnaires, including the Global Measure of Sexual Satisfaction (GMSEX, Lawrence & Byers, 1998) and the Global Measure of Relationship Satisfaction (GMREL; Lawrence & Byers, 1998). The GMSEX is designed to measure people's satisfaction with their sexual relationship with their partners. The GMREL measures people's satisfaction with their overall relationship with their partner. Hierarchical multiple regression analysis revealed that change in relationship satisfaction was related to change in SS. These analyses did not provide support for directional relationships between SS and relationship satisfaction. However, exploratory analyses revealed that direction of the relationship may be dependent on level of SS or level of relationship satisfaction. Other correlational studies have also reported a positive association between relationship or marital satisfaction and SS in men and women (Heiman et al, 2011; Sprecher, 2002; Rahmani, Merghati, Khoei, & Gholi, 2009).

In addition to relationship satisfaction, evidence suggests social support may also play a role in satisfaction with sex life in men and women. Social support can be conceptualized as the feelings that one is loved, esteemed, and is included in a network of people who can be relied

upon when needed (Cobb, 1976). Support can come from a variety of sources, including family, friends, and the larger community. A recent literature review examining correlates of SS found evidence for a relationship between social support and SS (Sánchez-Fuentes, Santos-Iglesias, & Sierra 2014). Although only two studies were identified that directly measured the relationship between these variables, these studies provided evidence for a relationship between SS and support from family and between SS and general social support. Research examining the potential differences between type of support and the relationship between SS is limited. A cross-sectional, population-based study in Finland found evidence of positive relationships between SS and social support in both married and unmarried men and women (Ojanlatva al., 2005). In this study, SS was measured with a single question “Are you satisfied with your sex life?” (Methods, Section 2.2 *Questionnaire*) with response choices ranging from 1 = *very satisfied* to 7 = *very unsatisfied*. Findings suggested social support in the form of support from a partner or spouse is positively related to SS in both married and unmarried women and men. Although findings varied across age groups, social support from friends was also generally related to SS in married and unmarried women and in unmarried men. Moreover, results indicated that in married men and women and in unmarried men, family support was negatively associated with SS. In contrast to this finding, Ji and Norling (2004) found that in a sample of Chinese adults living in urban settings, family support was positively associated with SS. Ji and Norling (2004) posited that although family life is changing in China due to rapid economic and social reform over the last several decades, extended family still plays a prominent role in the relationships between couples. Thus, although cultural differences may influence from whom a person seeks support, research generally supports a link between SS and support from family and friends.

SS and psychological correlates in the general population. Research also indicates that psychological factors, such as depression and body image, are related to SS in both men and women. Findings from descriptive research examining depressive symptoms and SS suggest a negative association between depression and SS in both men and women (Cyranowski et al., 2004; Nicolosi, Moreira, Villa, & Glasser, 2004; Peleg-Sagy & Shahar, 2013). Frohlich and Meston (2002) examined the relationship between sexual function and depressive symptoms in undergraduate women. Participants were asked to complete questionnaires, including a self-report inventory of depression symptoms. They were also asked to answer selected questions from a survey pertaining to sexual function, The Brief Index of Sexual Functioning for Women (BISF-W; Taylor, Rosen, & Leiblum, 1994). One question from the BISF-W was chosen to assess SS: “How satisfied have you been with your sexual relationship with your partner?” (p.322). Response choices ranged between 1 = *very dissatisfied* to 5 = *very satisfied*. Results suggested that women with high scores on the depression inventory reported significantly less SS compared to women with low scores on the inventory.

Research findings also support a relationship between SS and body image. Body image has been described as a multifaceted social construct comprised of many facets, such as satisfaction with specific body parts, body size concern, physical condition, and sexual attractiveness (Pujols, Meston, & Seal, 2010). In addition, body image has many correlates, such as self-esteem (Kostanski & Gullone, 1998). Pujols et al. (2010) examined the relationship between SS and body image in a descriptive study of 154 women aged 18-49 years. SS was measured with the Sexual Satisfaction Scale for Women (SSS-W; Meston & Trapnell, 2010), a 30-item questionnaire that measures 5 domains of SS including contentment, communication, compatibility, relational concern, and personal concern. The investigators reported a moderate,

positive relationship between SS and total scores on a measure of body image. In addition, SS had a positive, moderate association with three body image variables, including weight concern, physical condition, and appearance-based distracting thoughts; and a strong, positive association with one body image variable, sexual attractiveness. Further, results indicated that after controlling for sexual function, body image variables accounted for between 15% and 20% of the variance in SS. These results suggest that high scores on measures of body image and body image variables are related to high self-reported SS. Similar findings have been reported in research exploring the relationship between body image and SS in men and women (Holt & Lyness, 2007).

SS and physiological correlates in the general population. In addition to psychosocial and psychological factors, physiological factors such as fatigue and pain appear to be correlated with satisfaction with sex life in both men and women. Several studies have examined the relationship between SS and fatigue in individuals with and without other medical concerns. In both men and women, this research has generally found a negative relationship between SS and fatigue. For example, SS was negatively associated with fatigue in pregnant and post-partum women (De Judicibus & McCabe, 2002), in women who are homemakers and in women who work outside the home (Hyde, DeLamater, & Hewitt, 1998), and in aging men (Beutel, Schumacher, Weidner, & Brähler, 2002). In a cross-sectional study, Blazquez et al. (2008) examined the relationship between SS and fatigue intensity in 27 women with chronic fatigue syndrome and 15 healthy controls. The sample consisted of women ages 20-45 years with no reported history of sexual abuse or current psychopharmacological, hormonal or antihypertensive treatment. Fatigue was measured with the Fatigue Impact Scale (Frisk et al., 1994). This scale is designed to measure functional limitation due to fatigue (0 = no problem, 4 = extreme problem)

over the previous month. SS was assessed with a well-validated measure of SS, the Golombok Rust Inventory of Sexual Satisfaction (Rust & Golombok, 1985, 1986). Results indicated that the impact of fatigue was moderately, negatively correlated with scores on the SS subscale in women with chronic fatigue syndrome. No differences were found in SS scores in women with chronic fatigue syndrome compared to women in the control group; however, significantly more women with chronic fatigue syndrome compared to controls reported that they had a negative experience with sex or felt exhausted by sex.

Finally, although the relationship between SS and pain has been given little attention in the literature, a few correlational studies have addressed this association. Findings generally suggest that pain is negatively associated with SS women reporting chronic pain (Ambler, Williams, Hill, Gunary, & Cratchley, 2001), in women with migraine headaches (Ifergane, Ben-Zion, Plakht, Regev, & Wirguin, 2008), and in women with chronic pelvic pain (Kaya et al., 2006; Tripoli et al., 2011). Moreover, a review of the literature concluded that findings of controlled studies indicate that compared to controls, women with provoked vestibulodynia reported less SS (Smith & Pukall, 2011).

Taken together, these findings demonstrate the variety of psychosocial, psychological, and physical correlates of SS in the general population. These factors, along with factors specific to disability may also play a role in the satisfaction with sex lives of people living with disabilities.

Correlates of sexual satisfaction among people living with disabilities. In determining disability classification, the World Health Organization, International Classification of Disability, Functioning and Health, takes into account four areas in determining disability classification, impairments in bodily structure, impairments in body function, limitations in

activities, and limitations in social participation.(WHO, 2014) For the purpose of this literature overview, disability is defined loosely on these criteria. In this paper, physical disabilities are those resulting in loss of bodily physical function due to injury or disease process (e.g., due to spinal cord injury; multiple sclerosis, arthritis) or loss of a body part (e.g., because of amputation). Research indicates that those living with physical disabilities report having low SS (Akkuş, Nakas, & Kalyoncu, 2010; Kennedy et al., 2010; Schmidt, Hofmann, Niederwieser, Kapfhammer, & Bonelli, 2005). Although clinicians working with people with disabilities often overlook issues surrounding sexuality, many people with disabilities report that sexuality and intimacy are important aspects of life and that sexual recovery is a top priority in their overall recovery (Anderson, 2004; Cole, Chilgren, & Rosenberg, 1973; Elliot, 2006; McCabe, Cummins, & Deeks, 2000).

SS and psychosocial correlates among people living with disabilities. Psychosocial factors found to be related to SS among people with disabilities include both social support and satisfaction with partner. Although disability research suggests that social support plays an important role in many aspects of life, including adjustment to disability (Schultz & Decker, 1985), life satisfaction, and well-being (Rintala, Young, Hart Clearman, & Fuhrer, 1992), relatively few studies have examined the relationship between sexuality and social support. Cross-sectional results lend support for a positive relationship between social support and SS. Lankveld, Ruiterkamp, Näring, & Rooij (2004) examined this relationship among 59 RA patients and their spouses. Results demonstrated that social support was related to SS in both RA patients and their spouses. In addition, after disease status variables were controlled, both marital and sexual satisfaction continued to be significantly and positively associated with social support in RA patients and their spouses. This relationship has also been explored in people with

multiple sclerosis. For example, Blackmore, Hart, Albiani, & Mohr (2011) performed a 16-week longitudinal, secondary analysis of data. Data derived from a randomized controlled experiment examining two types of telephone psychotherapy interventions for depression among people with multiple sclerosis. Participants in the secondary study were 81 sexually active people involved in a romantic relationship. Data from SS, sexual dysfunction, and depression surveys were analyzed at baseline and posttreatment follow-up of the larger study. SS was measured with a scale from a quality of life inventory designed for people with multiple sclerosis (Ritvo et al., 1997). The scale is comprised of 4 items that measure satisfaction with areas such as “frequency and variety of sexual activity, expressed affection, and general SS” (p. 119). The authors found that after controlling for sexual dysfunction, depression severity, age, gender, and years diagnosed with multiple sclerosis, increased positive partner support (e.g., encouragement) and decreased negative partner support (e.g., criticism) were significantly related to improvements in SS. In terms of relationship quality and SS, Phelps, Albo, Dunn, and Joseph (2001) reported that among married men with spinal cord injury, partner satisfaction and relationship quality was positively and significantly related to SS. Taken together, these results demonstrate the important role social support and relationship quality plays in SS among persons with disabilities.

SS and psychological correlates among people living with disabilities. Associations between psychological variables, such as body image and depression, have also been reported in the disability literature. Bodily changes due to progression of disability or from traumatic injury may result in body image disturbances (Drench, 1994). Among people with disabilities, comparisons of one’s body against social norms may also lead to deleterious changes in perceptions of one’s self. For example, in a retrospective study of sexual problems in people

with amyotrophic lateral sclerosis, participants reported a 29% decrease in SS over the duration of the disease (Wasner, Bold, Vollmer, Borasio, 2004). Participants attributed decreases in SS and increases sexual problems, in part, to bodily changes leading to “inhibitions to show the body.” (p.447). Further, Taleporos and McCabe (2002) surveyed a sample of 748 people with disabilities and 448 people without disabilities. The sample consisted of predominantly heterosexual men and women between 18 and 69 years. Participants completed scales measuring self-esteem, body esteem, and sexual esteem, and one measure assessing depression, anxiety, and stress. SS was measured with a single question, “Looking back over the past 6 months, how sexually satisfied do you feel overall?” (p. 180). Responses were on a 7-point Likert scale and ranged from *extremely satisfied* to *extremely dissatisfied*. The authors found that high levels of SS, body esteem, and sexual esteem predicted high levels of self-esteem and low levels of depression symptoms in people living with disabilities. The findings are interpreted in light of the role sexuality plays in adjustment among people with disabilities. The authors call for future research to include longitudinal studies to determine the direction of the relationships.

There is evidence that depression is also related to sexual outcomes, although research examining this relationship among people with disabilities is scant. In one of the few studies to explore this relationship, 52 sexually active women with rheumatoid arthritis completed pain, physical disability, anxiety, and depression surveys (Abdel-Nasser and Ali, 2006). In addition, participants underwent a rheumatological examination and a grip strength test to assess disease activity, including pain grade, grip strength, and morning stiffness. SS was assessed by a questionnaire measuring loss of SS over the previous month; however, the name of the questionnaire or examples of items on the questionnaire are not provided. Women with disorders that would impair communication, and those with gynecological diseases or abnormalities were

excluded from the study. This study found a positive relationship between depression scores and loss of SS over the previous month. Moreover, in hierarchical stepwise regression analyses, age, pain, and depression explained 36% of the variance of loss of SS.

SS and physiological correlates among people living with disabilities. Finally, SS is also related to physiological health variables among people with disabilities. Similar to evidence in the general population, both pain and fatigue have been reported to be inversely associated with SS. In one correlational study examining SS and quality of life in adults with amputations, Walters and Williamson (1988) found a relationship between increased pain and decreased SS. This finding was also reported for men with SCI (Valtonen et al., 2006).

Few studies have evaluated the relationship between SS and fatigue. In a review of the literature examining sexuality in MS, Schmidt, Hoffmann, Niederwieser, Kapfhammer, and Bonelli (2005) describe difficulties people with MS have with sexual function. Individuals with multiple sclerosis experience problems within all phases of the sexual response cycle. Problems in sexual response are caused by many disability related factors, including fatigue. Similarly, Areskoug-Josefsson and Öberg (2009) reviewed the literature concerning sexual health in women with rheumatoid arthritis. Several factors were found that impact sexual health, including body image disturbance, pain, and depression. Further, several studies reviewed cited fatigue as an important or as one of the most important factors affecting sexual health. Taken together, these descriptive findings demonstrate that disability-related physical factors, such as pain and fatigue, are negatively related to SS in people living with disabilities.

In sum, SS is related to psychosocial, psychological, and physiological factors in both the general population and in people living with disabilities. The studies discussed here that document these relationships are correlational and thus do not prove causality or the direction of

the relationship. Nevertheless, it is possible that addressing problems in these domains may improve SS in people with disabilities. One way to address these problems might be through regular PA.

Physical Activity

Improved physical fitness through PA is related to many mental and physical health benefits. Most health benefits associated with PA are dependent on aerobic activity (U.S. Department of Health and Human Services, 2008), defined as the rhythmic movement of the large muscles in the body for a continuous period of time (Caspersen, Powell, and Christenson, 1985). To achieve PA-induced health benefits, current guidelines recommend that adults engage in a minimum of 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity aerobic activity per week (U.S. Department of Health and Human Services, 2008). Moderate-intensity activity and vigorous-intensity activity are typically defined as PA expending 3-6 kilocalories (kcal)/min and over 6 kcal/min, respectively (U.S. Department of Health and Human Services, 2002). PA intensity can also be defined in terms of heart rate. In these terms, moderate-intensity PA is defined as performing PA at a rate that is between 50% and 70% of a person's maximum heart rate based on age, and vigorous activity is between 70% and 85% of maximum age-related heart rate (Center for Disease Control and Prevention, 2011). Improvements in health can occur within a few weeks of increased PA (U.S. Department of Health and Human Services, 2008).

Definitions of terms related to physical activity. The field of sports medicine has developed concise definitions of key terms used in PA research. In the field of sports medicine, most researchers use definitions of PA and exercise proposed by Caspersen et al. (1985). Caspersen et al. defined PA as “any bodily movement produced by skeletal muscles that results in energy expenditure” (p. 126). This definition permits delineation of various categories of PA,

including activities of daily living (e.g., bathing, dressing, housework), work related PA, and exercise. Exercise is a subcategory of PA; it is defined as PA that is “planned, structured, and repetitive and has as a final or an intermediate objective the improvement or maintenance of physical fitness” (p. 128). Exercise can include work and household -related activities if they are carried out in a way aimed at increasing physical fitness (Caspersen et al., 1985). Exercise may be subdivided into categories (Caspersen et al., 1985). These categories include work and household related activities that are carried out in a way that is specific to increasing physical fitness. Physical fitness, in turn, is defined as “a set of attributes that people have or achieve that relates to the ability to perform physical activity” (p. 128). Casperson et al. suggested that physical fitness be measured in terms of cardiovascular and muscular endurance.

The assessment of physical activity. PA can be measured both subjectively and objectively. Diaries, recall surveys, single-item questions, and questionnaires are low-cost, easy-to-use self-report assessments frequently used to measure PA (Bishop, 2008; LaPorte, Montoye, & Caspersen, 1985). The most accurate of these subjective measures, activity diaries (e.g., 1-week diaries, 2-week diaries) and recall surveys, (Ainslie, Reilly, & Westerterp, 2003; Bishop, 2008; Macera et al., 2001) take into account three dimensions of activity: intensity, duration, and frequency (Bishop, 2008; Shephard, 2003). Despite the advantages of subjective measures, they may be limited by participant over-reporting and inaccurate recall of PA (Sallis & Saelens, 2000). Most also demonstrate low reliability and validity (Shephard, 2003).

Because fitness increases with PA, measurements of fitness are often used as objective markers of PA. The gold standard criterion method of fitness assessment is VO₂ max (maximum oxygen uptake) testing (Bishop, 2008; Vanhees et al., 2005). This method assesses the maximum amount of oxygen used by the body during graded, continuous exercise (Bishop,

2008). The high cost of administering this procedure, however, prohibits its use in many studies (Bishop, 2008).

In sum, the field of sports medicine has developed clear definitions for key PA-related terms. PA includes many forms of exercise. Several self-report measures can be used for subjective assessment of PA, whereas objective measurement involves assessment of fitness, a marker of PA.

Correlates of physical activity. PA is correlated with many psychological, psychosocial, and physiological benefits. Many of these benefits overlap with correlates of SS. Research has examined the mental and physical health benefits of PA in the general population and among people with disabilities.

PA and psychosocial correlates in the general population. Correlational research has demonstrated that PA is associated with several psychosocial factors that may enhance the quality of interpersonal relationships and perceived social support. Hassmén, Koivula, and Uutela (2000) explored the relationship between self-reported PA (“How often do you exercise physically in your spare time for at least 20-30 minutes to the extent that you at least slightly lose your breath and perspire?,” (p. 18) and scores on self-report surveys measuring, among other variables, hostility, anger, and feelings of social integration (i.e., integration in one’s family, neighborhood, municipality, church, etc.). Participants could choose one of seven response options regarding PA, ranging from daily exercise to unable to exercise. Results indicated that individuals who engage in PA at least two times per week reported significantly less anger and hostility and higher levels of perceived social integration than participants who reported exercising less frequently or never. Other cross-sectional, population-based studies have reported similar findings, in which higher self-reported PA was associated with higher scores on

measures of intimacy (Guedes, Hatmann, Martini, Borges, & Bernardelli, 2012), social participation (Guedes et al., 2012) and social support (Steptoe et al., 1997). Further, a controlled exercise trial examining fatigue and psychologic status in patients undergoing treatment for cancer suggested a causal relationship between a regular program of exercise and factors that may be associated with better interpersonal relationships. Dimeo, Stieglitz, Novelli-Fischer, Fetscher, and Kuehl (1999) assigned 27 participants to an exercise intervention group and 32 participants to a no-exercise control group. Intervention group participants engaged in 30 minutes of daily ergometer bicycling in a supine position. The researchers found reduced feelings of interpersonal sensitivity in participants who participated in the exercise arm of the trial but not in those who were in the control group (Dimeo, Stieglitz, Novelli-Fischer, Fetscher, & Kuel, 1999). Although none of these studies aimed to measure relationship quality per se, Taken together, these results suggest that PA may play an important role in factors related to quality of interpersonal relationships.

PA and psychological correlates in the general population. In addition to the psychosocial benefits of PA, strong evidence exists for relationships between PA and psychological variables, including depression and variables related to body image. Several literature reviews indicate that PA leads to improvements in—and can be used as a successful treatment for—depression (Carek, Laibstain, & Carek, 2011; Fox, 1999; Martinsen, 2008; Strohle, 2009). In terms of body image, results from several randomized, controlled trials provide evidence that PA also plays a role in improved body image and self-esteem. For example, Mehnert et al., recruited 58 women with breast cancer for a 10-week exercise trial. Intervention group members ($n = 28$) participated in twice weekly PA, including walking and jogging. Study results showed significant decreases in anxiety, depression, and improved body

image compared to the women in the wait-list control group. Similar findings have been reported in women with breast cancer (Milne, Wallman, Gordon, & Courneya, 2008), obese/overweight women (Carraça et al., 2012), menopausal women (Elavsky & McAuley, 2007), and older adults (Li, Harmer, Chaumeton, Duncan, & Duncan, 2002). Moreover, in a review of the impact of PA on factors related to mental well-being, Fox (1999) reported findings from two meta-analyses suggesting that PA provides a means for improving self-esteem. Likewise, a more recent meta-analysis examining 57 experimental studies found that body image improved more in the exercise-intervention groups than in the control groups (Campbell & Hausenblas, 2009). Thus, there is evidence that PA can decrease depression and improves body image.

PA and physiological correlates in the general population. PA also affects physiological health variables, such as pain and fatigue. Experimental research has linked PA to reductions in pain among people with fibromyalgia. For example, Mannerdorpi, Nyberg, Ahlmen, and Ekdahl (2000) randomized 58 participants to a pool exercise plus six-session education program intervention group or a control group. At conclusion of the six-month intervention, intervention group participants had significantly less pain severity and psychological distress; and better physical function, grip strength, and social functioning compared to control group participants. Experimental research has also linked PA to reductions in pain in people experiencing low back pain (Moffett et al., 1999). Moreover, findings from a review and from a meta-analysis examining randomized, controlled trials concluded that exercise is effective in reducing non-specific low back pain (Hayden, van Tulder, Malmivaara, & Koes, 2005; van Middelkoop et al., 2010).

PA also appears to play a role in reduction of fatigue. A systematic review of randomized, controlled trials examining the effects of exercise on fatigue in participants with a clinical diagnosis of chronic fatigue syndrome supported the use of exercise for reduction of fatigue (Edmonds, McGuire, & Price, 2004). Similar effects have been reported for fatigue in cancer patients (Dimeo et al., 1999). Moreover, a recent review and meta-analysis of 60 controlled studies examining cancer survivors during and after treatment found that PA interventions are generally well-tolerated and have a beneficial effect on fatigue (Speck, Courneya, Mâsse, Duval, & Schmitz, 2010). Together, findings from these studies suggest that PA can often lead to improvements in physical health problems such as pain and fatigue.

PA and psychosocial correlates among people living with disabilities. There is evidence that PA is related to improvements in emotional and physical health in people living with physical disabilities, similar to the general population. Results from a controlled study examining mental health and social participation in wheelchair users revealed that scores on a measure of interpersonal sensitivity were significantly lower for individuals who regularly participated in wheelchair basketball (i.e., 3 hours twice per week over a 4 year period) than scores for wheelchair users who were not participating in an exercise program or competitive sport (Fiorilli et al., 2013). The authors hypothesize that involvement in wheelchair basketball may help players feel more socially involved and foster reciprocal relationships. Further, results from a randomized controlled trial examining the effect of exercise on fitness and quality of life in individuals with multiple sclerosis also found a relationship between PA and psychosocial variables (Petajan et al., 1996). Specifically, in an experimental study, Petajan et al. found that individuals in a 15-week exercise group who engaged in arm and leg ergometry for 40 minutes,

three times per week showed greater decreases in anger and greater increases social interaction compared with individuals in the no-exercise control group.

PA and psychological correlates among people living with disabilities. PA also appears to be related to psychological factors in individuals living with disabilities. Studies across several disability types have found a negative relationship between PA and depression. For example, cross-sectional findings support a negative relationship between PA and depression in people with multiple sclerosis (Jensen, Molton, Gertz, Bombardier, & Rosenberg, 2012; Motl et al., 2009; Stroud & Minahan, 2009) and spinal cord injury (Murake, Tsunawake, Hiramatsu, & Yamasaki, 2000; Tawashy, Eng, Lin, Tang, & Hung, 2009). Likewise, results of randomized, controlled trials suggest that PA plays a role in lowering depression in people living with spinal cord injury. For example, Hicks et al. (2003) reported significantly less depression in men and women with spinal cord injury who were randomized to a 9-month exercise training condition compared with men and women randomized to a non-exercise condition. Similar findings were reported in a randomized, controlled trial examining the effect of sport activity (e.g., wheelchair basketball, wheelchair racing, wheelchair tennis) on depression and anxiety in individuals with tetra- or paraplegia (Muraki, Tsunawake, Hiramatsu, & Yamasaki, 2000). Similarly, Martin et al. (2003) found that people with SCI randomized to a 3-month exercise intervention group reported less depression compared with those in a no-exercise control group.

Research also indicates that PA is related to variables associated with body image in people with disabilities. For example, in a quasi-experimental study, Wetterhahn et al. (2002) reported that lower limb amputees who were active (participation in at least 2 hours of aerobic exercise twice per week) reported less body image concern than amputees who were minimally active. Further, experimental studies provide evidence that PA may play a causal role in

improved body image. For example, in a one-group pretest-posttest design, participant ratings of body satisfaction increased after a 10-week exercise program for participants with spinal cord injuries (Semerjian, Montague, Dominguez, Davidian, & de Leon, 2005). In a randomized controlled study, Ginis et al. (2003) reported that 21 participants with spinal cord injury who were randomized to a 3-month exercise intervention group reported lower scores on a measure of depression and pain; and better scores on a measure of physical self-concept than the 13 participants who were randomized to the wait-list control group. Together, these studies demonstrate that PA plays a role in decreasing depression and in increasing body image.

PA and physiological correlates among people living with disabilities. In addition to the emotional benefits conferred by PA, people with disabilities who participate in PA also achieve physical health benefits. Research indicates that PA is associated with less reported pain across several disability types. For example, descriptive research examining this relationship supports a negative association between PA and pain for people living with multiple sclerosis (Motl, et al., 2009) and spinal cord injury (Tawashy et al., 2009). In addition, randomized, controlled studies provide evidence that PA may play a causal role in pain reduction. For example, in a study of participants with spinal cord injury, those who completed a 9-month, bi-weekly exercise program reported significant reductions in pain over the duration of the study; furthermore, the exercise group experienced more pain reduction than did the control group (Hicks et al., 2003). A follow-up study found a negative correlation between pain at the end of the trial and PA participation for participants who voluntarily maintained exercise adherence during the three months after study completion (Ditor et al., 2003). Results for this phase of the study are more difficult to interpret, however, because participants' pain severity may have influenced their exercise participation. Similar findings from randomized controlled trials examining the association between PA and

pain have also been reported in people with osteoarthritis (O'Reilly, Muir, & Doherty, 1999; Thomas et al., 2002). Moreover, in a review of research examining PA and pain, May (2010) concluded that PA is negatively related to pain for people living with osteoarthritis and recommended exercise in the management of pain from osteoarthritis. Although these studies suggest that PA helps to ameliorate pain, caution is warranted in interpretation of results as it is possible that pain severity influences people's choices about engaging in PA.

PA is also related to fatigue among people living with disabilities. Findings from correlational studies suggest that engagement in PA is inversely related to fatigue in people living with MS (Motl et al., 2009; Stroud & Minahan, 2009) and those with spinal cord injury (Tawashy et al., 2009). Data from randomized, controlled trials suggest that PA can have a causal influence on fatigue. For example, Cakt et al. (2010) examined the effect of 8-weeks of PA on disability-related factors, fatigue, and depression in people with multiple sclerosis. Forty-five participants were randomized into a control group or one of two intervention groups. Participants in one intervention group participated in bicycle ergometer progressive resistance training and balance exercise. Participants in the other intervention group participated in home-based strengthening and balance exercise. Results showed improvement in several disability-related factors. In addition findings demonstrated improved scores on a measure of fatigue and on a measure of depression for participants in the progressive resistance training and balance exercise group compared to participants in the other groups. Similar findings regarding fatigue were reported by Hayes, Gappmaier, & LaStayo (2011). Taken together, results from these studies suggest that PA leads to reductions in fatigue in people living with disabilities.

In sum, numerous randomized, controlled studies have demonstrated that PA promotes physical and mental health in both the general population and in people living with disabilities.

In both the general population and in people with disabilities, PA is related to improvement in variables associated with both relationship quality and social support. In addition, PA leads to reductions in depression and improvement in body image. PA also helps to decrease pain and fatigue. In addition to positively influencing physical and mental health, PA may also be related to increases in SS. Many psychosocial, psychological, and physiological problems related to SS may be improved through engagement in PA. Thus, PA may provide an indirect means for improving SS.

The Relationship Between Physical Activity and Sexual Satisfaction

A review of the literature suggests that PA may be positively related to SS in the general population. Although no published articles were found that explore the relationship between SS and PA among people with disabilities, there is a small but growing body of evidence for this relationship in the general population.

Some of the studies reviewed below did not indicate how exercise or PA was defined or measured. The wording used here (i.e., “physical activity” or “exercise”) is consistent with the authors’ wording.

Correlational research has explored the relationship between PA and SS among men and women across a variety of ages. Several cross-sectional studies have found evidence of a positive relationship between PA and satisfaction with one’s sex life.

For example, Penhollow and Young (2008) conducted a cross-sectional study aimed at identifying body image and exercise factors accounting for the variance in SS in 408 college-aged men and women. Based on research demonstrating relationships between body image variables (e.g., body satisfaction, body image self-consciousness) and sexuality variables, and between fitness variables and sexuality variables, these researchers hypothesized that body image

and fitness would account for a significant amount of the variance in SS. SS was measured using a scale including items pertaining to satisfaction with sexual partner, frequency of sexual activity, and satisfaction with orgasm. No description of the measurement of “exercise frequency” was provided by the authors. Results of multiple regression analyses conducted separately for men and women found that for both men and women, self-reported exercise frequency significantly predicted SS. For females, a model containing exercise frequency, concerns about being nude, and fitness explained 46% of the variation in SS. For men, a model containing exercise frequency, concerns about being nude, and strength and build explained 29% of the variance in SS.

Huang, Lee, and Chang (2007) found similar results from survey data collected by mail from male and female participants. Participants were members of fitness centers in Taiwan, Europe, and the United States and were between 26 and 45 years old. These authors proposed a model whereby personality directly influences exercise motivation, participation in exercise behavior, and quality of life (including SS). In addition, an indirect path was proposed such that personality affects exercise motivation, which then affects exercise participation, which, in turn, affects quality of life. Exercise participation was measured using 2 self-report items assessing frequency (days and hours per week) of “primary exercise activities” (p.1196). Participants rated their SS over the previous week on a 3-item scale. Two of these items referred to satisfaction with sexual relationship after exercise, and one referred to satisfaction with sex life after exercise. Results of regression analyses confirmed all of the relationships proposed in the model. In regard to the relationship between exercise and SS, specifically, exercise significantly influenced SS.

Additional evidence for the relationship between PA and SS comes from a cross-sectional study examining the lifestyle and psychosocial factors related to sexual problems in sexually-active heterosexual Hong Kong Chinese men and women between the ages of 18 and 59 (Lau, Kim, & Tsui, 2005). SS was assessed with one question inquiring whether the participant was sexually satisfied. Results indicated that both men and women who reported engaging in less than 3 hours of exercise per week were more likely to report sexual dissatisfaction compared with those who reported exercising more than 3 hours per week. Moreover, in multivariate analyses, men who exercised less than 3 hours per week, reported high stress from work, and reported poor spousal relationships were less likely to report SS than their counterparts.

Further, after noting research suggesting that changes in sexual function occurring throughout menopause are multifaceted (i.e., biological, psychosocial, and social), Hess et al. (2009) conducted a cross-sectional study to explore the relationship between lifestyle (i.e., PA and sleep) and psychosocial (i.e., social support) factors and three sexual functioning scales (i.e., engagement in sexually intimate activities, enjoyment of sexually intimate activities, and pain and lubrication use with sexual intercourse) in 677 sexually active women in mid-life. Items on the enjoyment scale included satisfaction with partner, frequency of sexual arousal, and frequency of feeling sexually satisfied. PA was measured with a yes/no question asking if the participant gets “at least 30 minutes of PA 5 days a week (This can be in 10-minute increments and can include walking, gardening, cycling, arm cycling, etc.)” (p.1360). In terms of relationships between SS and PA, results demonstrated that participants who engaged in PA and participants who reported moderate or high social support were more likely to have higher sexual enjoyment scores than participants who did not engage in PA. In a multivariate analysis, after controlling for menopause status, engagement in PA continued to be related to higher sexual

enjoyment scores. However, in a model combining PA, sleep difficulty, and social support while controlling for menopausal stage, only moderate and high perceived levels of social support continued to be related to higher levels of sexual enjoyment. This demonstrates that in the more complex model, PA was no longer significantly related sexual enjoyment. However, because the variables examined can be interrelated in many ways, these findings are difficult to interpret. Further, direction of relationships is not able to be determined from this study design.

Gerber, Johnson, Bunn, and O'Brien (2005) explored the longitudinal relationship between sexual function and testosterone, psychosocial, and lifestyle factors during menopause in a prospective clinical study. Twenty-three perimenopausal women ages 45 to 55 completed questionnaires and blood draws during the first and fifth year of a larger study. Exclusion criteria included use of hormone therapy, oral contraceptives, or other drugs that could influence outcome variables, oophorectomy, obesity, history of drug or alcohol abuse, pregnancy, and medical problems that might impact menopause transition or outcome variables. Several potential correlates of sexual function during menopause were assessed, including testosterone level, items related to menopausal symptoms and ability to control symptoms, and psychological stressors, such as satisfaction with job and financial resources, and confidence in managing symptoms of menopause, and stressful life events. SS was measured on an 18-item scale created by the investigator assessing topics such as desire, sexual experience, communication, body image, and satisfaction in context of a relationship, fling, or masturbation. Results indicated that weekly exercise frequency was the only factor related to SS. The authors suggested several mechanisms by which PA may improve SS, including through improved body image, prevention of depression, and promotion of positive cognition. The investigators posit that changes in

biological neurochemicals induced by exercise may promote healthy sexual function and thereby result in increased sexual activity.

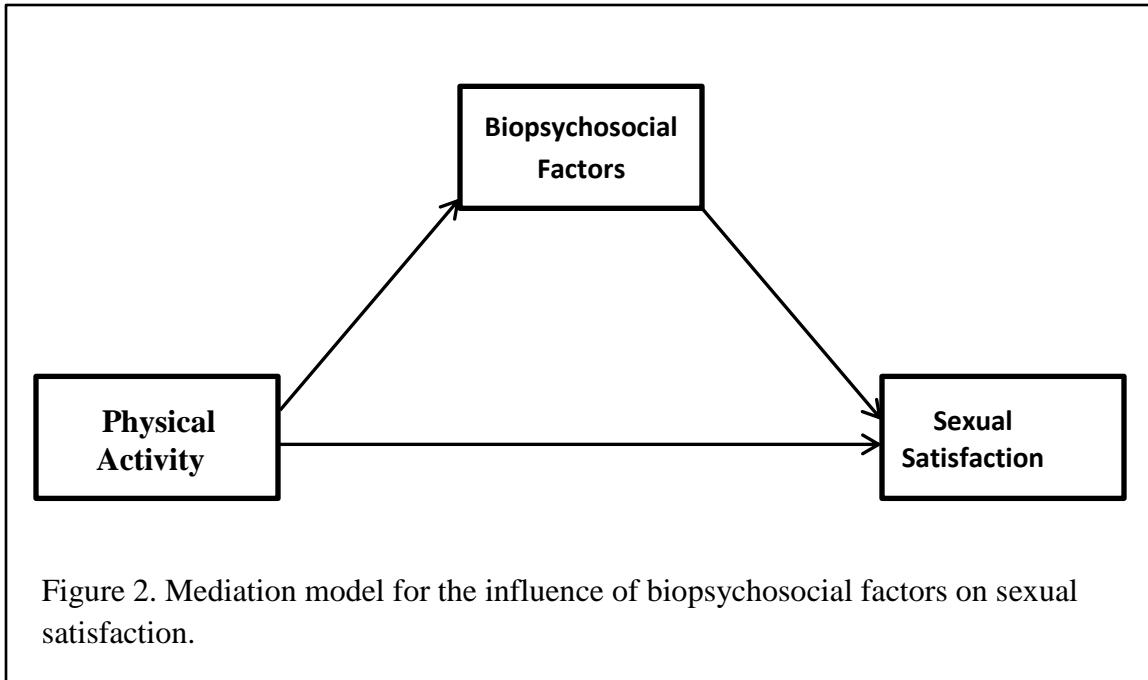
The relationship between SS and PA also appears to exist among younger women who engage in extremely high amounts of exercise. Based on research documenting the importance of clitoral blood flow in the arousal and orgasm phases of sexual function, Karatas et al. (2010) proposed that better overall blood flow in athletes would confer enhanced sexual function to athletic women. Twenty-five elite female athletes (≥ 4 hours of strenuous exercise per day) ages 25 through 45 and an age-matched group of healthy, sedentary females underwent clitoral Doppler ultrasonography to examine clitoral blood flow as an objective indicator of sexual function. Exclusion criteria for the study included genitourinary disease, vascular and endocrine disorders, recent childbirth, BMI equal to or over 25 kg/m², and medications that affect sexual function. Participants also completed a self-report measure of female sexual function that includes a domain score for SS. Differences were found between groups in both physiological and subjective measures of sexual function; athletic women had better clitoral blood flow and higher scores for both self-reported overall sexual function and domain scores for SS, arousal, and orgasm. Based on these results, the authors proposed that increased genital blood flow facilitated through exercise results in better sexual functioning and satisfaction in female athletes compared with sedentary controls.

Taken together, results from these descriptive studies demonstrate that for men, women in mid-life and younger, highly active women, PA is positively related to SS. The relationship between PA and SS appears consistent across studies examining several age groups in the general population.

Sexuality is important to overall well-being, life satisfaction, and quality of life among people living with disabilities (Moin, Duvdevany, & Mazor, 2009; Nortvedt, 2001; Walters & Williamson, 1998). Given the positive relationship between PA and many disability-related psychosocial, psychological, and physiological factors that overlap with SS, an examination of the potential relationship between PA and SS among people with disabilities is warranted. In addition, exploration of potential mediators of this relationship may further facilitate an understanding of the factors involved in this potential relationship.

In both the general population and in people with disabilities, several factors related to SS overlap with physical and mental health benefits conferred by PA. Correspondingly, PA may be indirectly related to greater SS (see Figure 2). For example, a potential relationship between PA and SS may be mediated by mental health and physical health variables that are related to both PA and SS (e.g., depression, body image, relationship satisfaction, social support, pain and fatigue. Thus, PA-facilitated alterations in variables associated with SS may provide one means by which SS can be improved in the general population and among people with disabilities. Given the lower reported SS among people with disabilities, this finding would be especially important as a means of improving SS in this population.

Figure 2



The Present Study

The purposes of this exploratory study are (a) to examine the relationship between PA and SS and (b) to explore how PA and SS relate to numerous psychosocial, psychological, and physiological variables in a sample of wheelchair users, and (c) to explore whether any of these variables mediate the relationship between PA and SS. Participants were part of a larger randomized, controlled trial designed to promote a year-long, home-based exercise program for wheelchair users in the Kansas City area, Project Workout on Wheels (Froehlich-Grobe et al., 2014).

In the larger study, participants were randomly assigned to one of two exercise conditions: either the high-staff involvement condition or the low-staff involvement condition (Froehlich-Grobe et al., 2014). In the present study, data from these two conditions were combined, and participants' levels of PA were treated as a predictor variable rather than as a

dependent variable.

Participants completed pen-and-paper surveys four times throughout the trial (baseline, 3 months, 6 months, and 12 months). In the present study, data from the surveys from two time points will be examined, Time 1 and Time 2. These two times were chosen because they had the most complete datasets.

At both of these time points, the data collected included the following variables:

1. *Physical activity*: specifically, the number of minutes “in a usual week” that participants engaged in moderate- and vigorous-intensity PA.
2. *Sexual satisfaction*: how satisfied participants reported being with their sex life (SS).
3. Other variables, including, *psychosocial variables* (satisfaction with one’s spouse, lover, or partner; satisfaction with emotional support from one’s family; and satisfaction with emotional support from others), *psychological variables* (depression and satisfaction with one’s personal appearance), and, *physiological variables* (pain and fatigue). These are variables that other studies have found to be correlated with PA and SS.

Research Questions

Based on the findings from the literature review, several research questions were formulated. In total, four research questions were explored.

Research Question 1. Is there a relationship between self-reported minutes of PA and self-reported satisfaction with sex life? This question was addressed at two time points: at Time 1 (baseline) and at Time 2 (3 months into the program).

Research Question 2. Do any of the psychosocial, psychological, or physiological variables correlate with PA?

Research Question 3. Do any of the psychosocial, psychological, or physiological

variables correlate with SS?

Research Question 4. If PA and SS are related, do physiological, psychological, or psychosocial variables that may be correlated with both PA and SS mediate this relationship?

Method

This study was part of a larger study. Therefore, this section will describe (a) the intervention used in the larger study, (b) the measures used in the larger study that were also used in the present study, (c) the participants in the larger study, (d) the procedures used for determining which participants' data could be used in the present study, (e) the participants in the present study, and (f) the data analysis plan for the present study.

The Intervention Used in the Larger Study

Data for the present study derive from a 12-month, randomized-controlled exercise trial, Project Workout on Wheels (PWOW), which examined the effectiveness of two home-based exercise approaches for wheelchair users in the Kansas City metro area. A complete description of the larger study can be found elsewhere (see Froehlich-Grobe et al., 2012). The following summary of the study procedures is intended as an orientation to the research methods related to the present study.

Participants were recruited for the study from fliers, posters, and advertisements placed within the community. There were a total of 10 cohorts of participants over the three-year study period. Between enrollment in the study and baseline data collection, there was a lag time of varying lengths depending on the start date of the next cohort. During this time, some participants started engaging in PA before the start of the program.

Participants meeting criteria for enrollment in PWOW were randomized to either a supportive intervention group (the high-staff involvement condition) or self-guided control group

(the low-staff involvement condition). Participants in both groups received a binder containing information about local exercise facilities; a booklet designed for people with disabilities containing information about both the importance of PA and instruction on starting a program of exercise; and four worksheets for use in formulating individual exercise goals, predicting and preventing relapse, identifying participants' motivators for and expected positive outcomes from exercise, and listing people who might provide support for their exercise efforts. Participants were asked at enrollment if they could identify a support partner who would "support you in your exercise program and perhaps even exercise with you." All participants were given exercise bands and instructions for using them. Participants were instructed to increase the amount of exercise in which they engaged over the year-long program and to monitor their weekly participation in exercise. Participants in both groups received regular phone calls during the intervention phase (i.e., the first six months of the study). Weekly phone calls were made during the first three months of the program followed by bi-weekly phone calls, which tapered during the following three months. Participants did not receive scheduled calls during the maintenance phase (i.e., the last six months of the study). In addition, as part of the study protocol, all participants completed pen-and-paper surveys at baseline, 3 months, 6 months, and again at study completion (12-months after study initiation).

Differences in interventions between groups were related primarily to the amount of support given for engaging in the exercise program and in the behavioral skills taught to the intervention group. Unlike the control group, individuals in the intervention group were invited to attend a day-long workshop at the beginning of the program. This workshop consisted of a presentation designed to be both motivational and educational and targeted topics such as benefits of exercise and overcoming barriers to exercise. The workshop allowed participants a

chance to meet project staff and other wheelchair users beginning the program. Participants in both groups were shown how to use bands during initial fitness testing, but, in addition, workshop participants were individually shown how to use their exercise bands and given an opportunity to use them with staff present. The intervention group also participated in an aerobic exercise video for wheelchair users during the workshop. Intervention group participants also brainstormed in small groups (1-3 participants and a project staff member), discussing ways to elicit support for exercise, to overcome barriers, and to set goals.

In addition to the support provided at the workshop, during the regular phone calls made to the intervention group, various behavioral themes relating to exercise adoption were presented. These phone conversations were intended to be supportive and included loosely scripted topics such as “making exercise a priority” and “having fun with exercise.” The intervention group also received monthly newsletters reiterating the behavioral information discussed during the phone calls. In addition, each newsletter highlighted an activity in which wheelchair users can participate (e.g., snow skiing, kayaking, wheelchair basketball) or piece of exercise equipment (e.g., pedal exerciser) that can be used by wheelchair users.

In contrast to the support received by the intervention group, control group participants received minimal support. These participants were mailed binders containing written information similar to that received at the workshop. Phone calls for this group were not intended to be supportive; participants were asked two brief questions, one pertaining to participant adherence to study protocol and the other probing whether the participant had had any exercise related injuries since the last phone call. No newsletters were mailed to this group.

Measures

Sexual satisfaction and satisfaction with other life domains. Five questions were used

from the 66 items on the Quality of Life Index (QLI; Ferrans & Powers, 1985). The question used to measure SS was, “How satisfied are you with your sex life?” The other four questions measured participant satisfaction with personal appearance (“How satisfied are you with your personal appearance?”), with their significant other (“How satisfied are you with your spouse, lover, or partner?”), and with emotional support (“How satisfied are you with the emotional support you get from your family?” and “How satisfied are you with the emotional support you get from people other than your family?”). Items on the QLI are scored on a Likert scale ranging from 1 (*very dissatisfied*) to 6 (*very satisfied*). Participants could also indicate that a question does not apply. This scale, in its entirety, has been used in a variety of disabled populations, such as with persons living with multiple sclerosis (Stuifbergen, 2006) and persons living with chronic fatigue syndrome (Anderson & Ferrans, 1997), and it has demonstrated sound psychometric properties. Internal consistency in ill populations has been reported as .90, and in healthy populations, internal consistency in healthy populations has been reported as .93 (Ferrans & Powers, 1985; 1992).

Physical activity. PA was measured using selected questions pertaining to PA on the Behavioral Risk Factor Surveillance System (BRFSS; CDC, 2003; Yore et al., 2007). This measure, developed by the Centers for Disease Control, is used to gather monthly health-related information by telephone in all 50 states. For the present study, six questions pertaining to moderate and vigorous activity were used, but they were slightly modified for use with our mobility-impaired population (e.g., running” was changed to “wheeling”). In addition, the questions were worded to make them appropriate for use as a pen-and-paper measure. The instructions on this measure define vigorous activity as those activities that elicit “large increases in breathing or heart rate.” Moderate activities are described as those which “cause small

increases in breathing or heart rate.” Three questions pertaining to moderate activity and three questions pertaining to vigorous activity assessed non-work activities performed in bouts of at least 10 minutes (examples of exercise given include “brisk wheeling, bicycling, vacuuming, gardening, or anything else that causes small increases in breathing or heart rate”), frequency per week (number of days) that at least 10 minutes of activity is performed, and the total time per day spent engaged in PA lasting at least 10 minutes. Yore, et al. (2007) reported test-retest reliability for moderate-intensity activity between (κ) .35-.53, and .80-.86 for vigorous-intensity activity. Compared to accelerometer data, validity (κ) of the survey was $\leq .31$ for both intensities.

Fatigue. The Lee Fatigue Scale (LFS) is a self-report scale that contains 18 items scored on a 10-point Likert scale. Lowest and highest scores represent the extremes of each item, such as 1 (*not at all tired*) to 10 (*extremely tired*), and 1 (*not at all energetic*) to 10 (*extremely energetic*). The LFS has demonstrated strong psychometric properties; scores on this scale are highly correlated with scores on similar measures (Lee et al., 1991; Meek et al., 2000). Internal consistency reliability has been established in chronically ill and in sleep disordered populations, and ranges between .91 and .96 (Lee et al., 1991; Meek et al., 2000). In addition, the LFS is sensitive to changes in fatigue over time within subjects (Lee et al., 1991), making it a useful instrument in repeated measures research designs.

Pain. Pain was measured using the Pain Subscale of the SF-36 (Ware & Sherbourne, 1992). This subscale is comprised of two questions probing the amount of bodily pain experienced during the previous four weeks and the degree to which the pain interferes with work inside and outside the home. Responses for both questions are on a 1 (*none or not at all*) to 6 (*very severe or extremely*) Likert scale. Lower scores indicate more pain and pain interference.

Depression. The Center for Epidemiology Scale for Depression (CES-D; Radloff, 1977)

was used to measure depression symptomatology. This instrument has been validated for use in a wide variety of populations, including both general and various chronically-ill populations (Devins et al., 1988; Radloff, 1977). This scale measures frequency of 20 depression symptoms (e.g., "I felt depressed" and "I had crying spells") over the previous week. Scores are calculated from responses on a 4-point Likert scale ranging from 0 (*less than one day*) to 3 (*5-7 days*). Reliability and validity have been established for use of this measure among people with physical disabilities (Coyle & Roberge, 1992). This scale has also been found to have good internal consistency in ill populations (.63-.93; Devins et al., 1988).

Participants in the Larger Study

Eligibility criteria for the larger study included the following: (a) physical disability necessitating wheelchair use for at least the previous six months; (b) arm mobility sufficient to allow engagement in aerobic exercise; (c) classification at intake as physically inactive, defined as self-reported participation in fewer than 150 minutes of exercise per week; and (d) not having any mental or physical health conditions precluding full and safe participation in the study (e.g., not having a body mass index of 50 or higher, liver or kidney disease, significant cognitive impairment). Participants who had a BMI greater than or equal to 50, were pregnant or planning to become pregnant, had medical conditions that were contraindicated for exercise, or had cognitive impairments such that the person was unable to self-direct daily activities were excluded from the study.

Participants enrolled in the larger study were wheelchair users between the ages of 18 and 65 ($M = 44.5$) interested in increasing exercise. In the larger study ($N = 128$), 77% of the participants identified as White; 15%, as Black; 7%, as Asian; and 2%, as other ethnicities.

There were equal numbers of men and women. The most frequent primary disability reported by participants was spinal cord injury (46%). Just over one-third (36%) reported being married at study initiation; nearly one-third (30%) reported never having been married, and 30% reported being widowed, separated, or divorced. The average age of disability onset was 22.4 years old, and the average number of years participants had been living with their disability was 22.3. No significant differences were found between the intervention and comparison groups on any demographic factor.

Procedures for Identifying Participants for the Present Study

Not all participants from the larger study could be used in the present study. Participants from the larger study were excluded from the present study (a) if they had missing data for PA and for SS for the time point under consideration or (b) if their PA data were outliers for the time point under consideration.

Missing data. There were two reasons for missing data. For some participants, there were no data for some variables at some time points. In addition, recall that the “satisfaction with sex life” question had included an option for participants to indicate that the question did not apply to them. Among participants from the larger study, 28 chose the “does not apply” response at Time 1, and 24 chose this response at Time 2. For the present study, these individuals are excluded from the analyses for these time points.

In addition, in response to the item regarding satisfaction with sex life, four people chose “does not apply” at Time 1, but subsequently chose to answer the question with one of the six answer choices at Time 2. Similarly, eight people chose to answer the question regarding satisfaction with sex life with one of the six answer choices at Time 1, but chose “does not apply” as the response at Time 2.

Outliers. The self-reported PA data were positively skewed and included some data points that were several standard deviations (SDs) above the mean. For example, one individual reported a level of PA that was more than 7 SDs above the mean. After considering several methods for dealing with outliers (e.g., Leys, Ley, Klein, Bernard, & Licata, 2013), I decided to delete outliers, defined as data points that were three standard deviations or more above the mean. Three data points (3%) were removed at Time 1, and one data point (2%) was deleted at Time 2.

Participants in the Present Study

There were 89 participants in the Time 1 analyses and 61 participants in the Time 2 analyses. Table 1 provides demographic data for the Time 1 and Time 2 samples. The average age of participants at the beginning of the study was 46 years, with a range from 23 to 65. For both samples, almost half of the participants were married. Demographic data were collected at Time 1 only.

Table 1

Characteristics of the Participants Included in the Time 1 and Time 2 Analyses

Characteristic	Time 1, n = 89		Time 2, n = 61	
	M	SD	M	SD
Age	46.3	11.5	46.6	11.8
Years with disability	21.4	16.3	23.8	17.1
Age of disability onset	25.2	18.2	22.9	18.3
	n	%	n	%
Gender				
Male	45	50.6	32	52.5
Female	44	49.4	29	47.5
Race/Ethnicity				
African American/Black	12	13.5	8	13.1
European American/White	77	86.5	53	86.9
Marital Status				
Married	41	46.1	30	49.2
Divorced	14	15.7	12	19.7
Separated	6	6.7	3	4.9
Widowed	3	3.4	1	1.6
Never been married	22	24.7	13	21.3
Other	2	2.2	2	3.3
Primary Disability				
Spinal Cord Injury	44	49.4	28	45.9
Cerebral Palsy/Spina Bifida	15	16.9	12	19.7
Multiple Sclerosis	8	9	5	8.2
Other	7	7.9	5	8.2
Amputation	4	4.5	3	4.9
Orthopedic	5	5.6	4	6.6
Post Polio	2	2.2	2	3.3
Fibromyalgia/Lupus	2	2.2	1	1.6
Stroke/Traumatic Brain Injury	2	2.2	1	1.6
Group Assignment				
Intervention	47	52.8	33	54.1
Control	42	47.2	28	45.9

The Data Analysis Plan

Plan for combining moderate- and vigorous-intensity PA. At each time period, participants had reported the number of minutes per week that they had engaged in *moderate-intensity* PA and the number of minutes per week that they had engaged in *vigorous-intensity* PA. It was necessary to decide how to combine these variables to best reflect the participants' level of overall PA. Conducting separate analyses on these two variables would have been problematic. For example, examining the relationship between SS and moderate-intensity PA would have obscured the possible effects of vigorous-intensity PA. Likewise, examining the relationship between SS and vigorous-intensity PA would have obscured the possible effects of moderate-intensity PA.

After considering various ways of handling these variables, I developed a strategy for combining moderate- and vigorous- intensity PA into one weighted variable. PA data were weighted in order to reflect the weighting given to moderate and vigorous PA based on Center Disease Control (CDC) recommendations to improve health. The CDC recommends that for PA related benefits to occur, a person needs to engage in either 150 minutes of moderate-intensity PA, 75 minutes of vigorous-intensity PA, or an equivalent amount of combined moderate- and vigorous-intensity PA per week (U.S. Department of Health and Human Services, 2008). Based on these guidelines, for the present study, PA was calculated by doubling the minutes of vigorous-intensity PA and adding the product to the minutes of moderate-intensity PA (i.e., $2 \times$ minutes of vigorous-intensity PA + minutes of moderate-intensity PA).

Plan for the statistical analyses. First, I calculated descriptive statistics for the participants' PA and SS data from Time 1 and Time 2. Next, I did the inferential statistical data analysis. I began by testing the underlying assumptions of the planned analyses. I then

performed a regression analysis to determine if there was a relationship between PA and SS at Time 1, and then repeated this step with Time 2 data. Next, I examined whether PA was related to any of the correlates of interest in this study; I repeated these analyses to explore the relationship between SS and these correlates. Finally, I assessed possible mediators of the relationship between PA and SS.

Results

Descriptive Statistics

Table 2 summarizes the participants' PA and SS data for Time 1 and Time 2. Average PA reported by participants at Time 1 was 168.84 minutes/week, which averages to 24.12 minutes/day or 0.40 hours/day. At Time 2, average PA reported by participants was 410.66/week, which averages to 58.67 minutes/day or 0.98 hours/day.

Table 2

*Descriptive Statistics for the Participants' Physical Activity (PA) and Sexual Satisfaction (SS)
Data for Time 1 and Time 2*

Characteristic	Time 1, n = 89			Time 2, n = 61		
	M	SD	Range	M	SD	Range
Minutes/week of PA ^a	168.84	302.90	0–1440	410.66	548.93	0 – 2100
Sexual satisfaction ^b	3.33	1.91	1 – 6	3.87	1.75	1 – 6

^a These data reflect the weighted total of participants' number of minutes/week of PA, with minutes of vigorous PA given twice the weight of moderate PA. That is, the weighted total = $2 \times$ minutes/week of vigorous-intensity PA + minutes/week of moderate-intensity PA.

^b Sexual satisfaction (SS) was assessed with the question, "How satisfied are you with your sex life?" Responses could range from 1 (*very dissatisfied*) to 6 (*very satisfied*).

Tests of Underlying Assumptions

Before proceeding with the analyses related to the primary research questions, preliminary analyses were performed to determine whether assumptions underlying regression analyses and Spearman's rank-order analyses were met. This section describes these preliminary analyses.

Data were analyzed to test the underlying assumptions of linear regression, including absence of outliers, linearity of the criterion (SS) and predictor (PA) variables, homoscedasticity of residuals (equal error variances), and normal distribution of errors (residuals). The assumption of absence of outliers was met because, as discussed, data points that were 3 or more standard deviations above the mean had been deleted. Visual inspection of scatterplots for PA against SS at the corresponding time period revealed that the assumption of linearity was reasonably met. In order to determine whether the assumption of homoscedasticity of errors was met, I generated scatterplots of standardized predicted values (x-axis) against standardized residuals (y-axis) for each time and category of PA. Visual examination of these scatterplots revealed that standardized residuals were generally equally spread across standardized predicted values, suggesting that this assumption was met. Finally, evidence that the assumption of normal distribution of errors was met was found in visual inspections of histogram and normal P-P plots. Histograms at both time periods revealed normal distributions of residuals. Likewise, visual inspections of P-P plots confirmed a pattern of points generally aligned along the diagonal line of the P-P plot, which provides further evidence of normality of residuals.

In order to address Research Questions 2 and 3, which pertained to whether PA and SS related to the psychosocial, psychological, and physiological variables under consideration, Spearman's rank-order analyses were conducted. To assess the assumptions underlying these

analyses, I created scatterplots displaying the relationships between these variables (e.g., between PA and depression). Visual inspection of these scatterplots revealed monotonic relationships between all these variables.

The Relationship Between Sexual Satisfaction and Physical Activity

In order to examine the relationship between PA and SS, I conducted bivariate linear regression analyses in SPSS. At Time 1, in this sample, PA was not significantly correlated with SS ($R^2 = .03$, $F(1, 87) = 2.65$, $p = .12$). At Time 2, in this sample, higher minutes of weekly PA were significantly related to higher ratings of SS ($R^2 = .09$, $F(1, 59) = 5.68$, $p = .02$). As minutes of self-reported PA increased, SS increased. PA explained 9% of the variance in SS. Table 3 displays this information.

In order to control for the influence of demographic variables, such as gender, marital status, primary disability, current age, time with disability, and control/experimental group assignment, a multiple regression analysis was conducted. Results indicated that PA continued to be significantly associated with SS when demographic variables were controlled ($\beta = .29$, $p = .03$)

Table 3

Regression Analysis of the Relationship Between Physical Activity and Sexual Satisfaction

Time period	B	SE	β	p
Time 1	.001	.001	.172	.107
Time 2	.001	.000	.300	.020*

* $p < .05$

Relationships Between Psychosocial, Psychological, and Physiological Variables and PA

Because there was a significant relationship between PA and SS only at Time 2, the relationships between PA and the other variables under consideration were examined only at Time 2. Spearman's rank-order correlation demonstrated a moderate, positive, significant relationship between PA and satisfaction with personal appearance, $rs(59) = .35$, $p = .006$, and between PA and satisfaction with emotional support from others, $rs(59) = .30$, $p = .023$. This means that as minutes of self-reported PA increased, ratings of satisfaction with personal appearance and satisfaction with emotional support from others increased. No significant relationships were found between PA and pain score, depression scores, fatigue scores, ratings of satisfaction with lover, spouse, or partner, or ratings of satisfaction with emotional support of family. Table 4 displays the correlations matrix for these analyses.

*Table 4**Time 2 Spearman's Rank Order Correlation Matrix for Key Measures and Physical Activity*

Measure	1	2	3	4	5	6	7	8
1. PA		.10	-.12	-.12	.35**	.22	.09	.30*
2. Pain	.10		.03	-.30*	-.07	-.12	.02	-.08
3. Fatigue	.12	.03		.28*	-.12	-.03	-.11	-.01
4. Depression	-.12	-.30*	.28*		-.47**	-.37**	-.44**	-.41**
5. Sat Per App	.35**	-.07	-.12	-.47**		.45**	.39**	.51**
6. Sat Spouse	.22	-.12	-.03	-.37**	.45**.		.61**	.49**
7. Support Family	.09	.02	-.11	-.44**	.39**	.61**		.44**
8. Support Other	.30*	-.08	-.01	-.41**	.51**	.49**	.44**	

Note. PA = Physical Activity; Pain = SF-36; Fatigue = LFS; Depression = CESD; Sat Per App = Satisfaction with Personal Appearance; Sat Spouse = Satisfaction with Spouse, Lover, Partner; Satisfaction with Emotional Support from Family; Support Other = Satisfaction with Emotional Support from People Other than Family.

* $p < .05$. ** $p < .01$. *** $p < .001$.

Relationships Between Psychosocial, Psychological, and Physiological Variables and SS

Because there was a significant relationship between PA and SS only at Time 2, the relationship between SS and the other variables under consideration were examined only at Time 2. Several significant relationships were found between SS and physiological, psychological, and psychosocial factors at Time 2.

Analyses demonstrated three significant, positive relationships between SS and psychosocial variables. SS was found to have a positive relationship with both satisfaction with emotional support from family, $r_s(60) = .44, p < .001$, and satisfaction with emotional support from others, $r_s(59) = .44, p < .001$. In addition, results revealed a significant relationship between SS and satisfaction with spouse, lover, or partner, $r_s(50) = .66, p < .001$. This indicates that as ratings of satisfaction with spouse, lover, or partner increased, ratings of SS increased.

Both psychological factors examined were related to SS. There was a significant negative relationship between depression scores and ratings of SS, $r_s(60) = -.38, p = .003$; as scores on the measure of depression (e.g., CESD) decreased, SS ratings increased. In addition, there was a significant moderate, positive correlation between satisfaction with personal appearance and SS, $r_s(59) = .49, p < .001$. As ratings of personal appearance increased, ratings of SS also increased. No relationships were found between SS and either of the physiological variables. Results from these analyses are displayed in Table 5.

Table 5

Time 2 Spearman's Rank Order Correlation Matrix for Key Measures and Satisfaction with Sex Life

Measure	1	2	3	4	5	6	7	8
1. SS		.08	-.08	-.38**	.49**	.66**	.44*	.44**
2. Pain	.08		.03	-.30*	-.07	-.11	.02	-.08
3. Fatigue	-.08	.03		.28*	-.12	-.03	-.11	-.01
4. Depression	-.38**	-.30*	.28*		-.47*	-.37**	-.44**	-.41**
5. Sat Per App	.49**	-.07	-.12	-.47**		.45**	.39**	.51**
6. Sat Spouse	.66**	-.12	-.03	-.37**	.45**		.61**	.50**
7. Support Family	.44**	.02	-.11	-.44**	.39**	.61**		.44**
8. Support Other	.44**	-.08	-.01	-.41**	.51**	.50**	.44**	

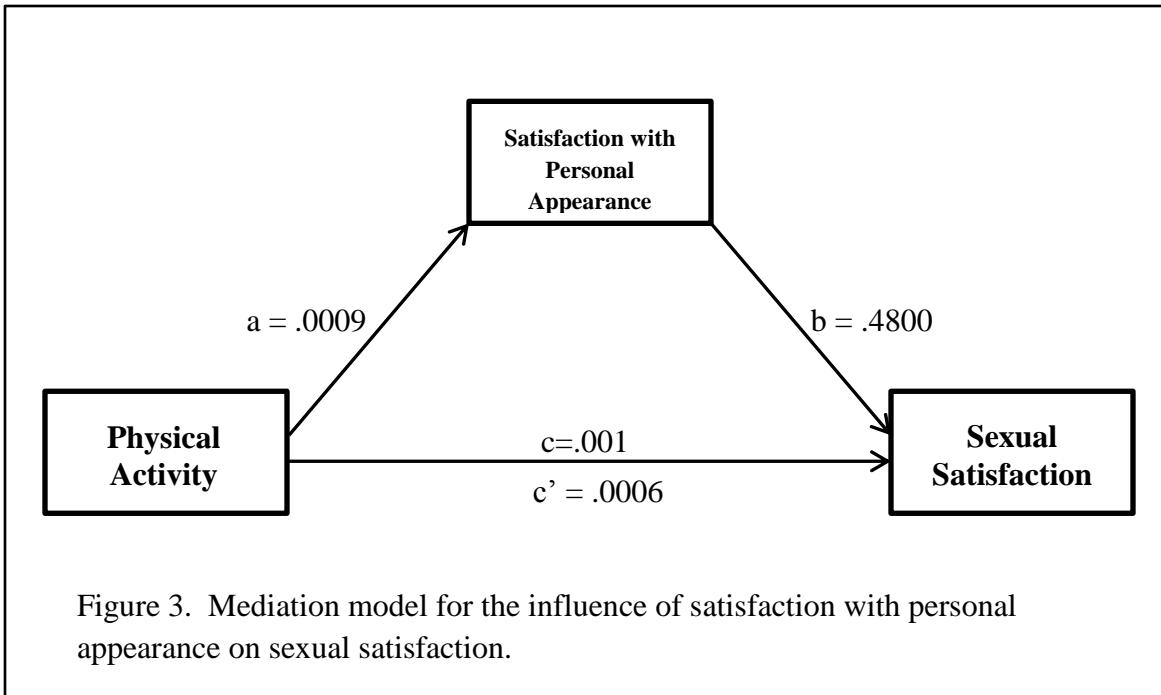
Note. SS = Satisfaction with Sex Life; Pain = SF-36; Fatigue = LFS; Depression = CESD; Sat Per App = Satisfaction with Personal Appearance; Sat Spouse = Satisfaction with Spouse, Lover, Partner; Satisfaction with Emotional Support from Family; Support Other = Satisfaction with Emotional Support from People Other than Family.

* $p < .05$. ** $p < .01$. *** $p < .001$.

Mediation Models

Regression analyses with bootstrapping were conducted to determine each relationship in the hypothesized mediation model at Time 2. In the first step, the c path (i.e., the total effect from PA to SS), was examined. Self-reported minutes of PA was found to be positively related to SS ratings, $B = .001$, $t(57) = 2.44$, $p = .02$. In the second step, the a path (i.e., the path from PA to satisfaction with personal appearance) was examined. Self-reported minutes of PA was also positively related to ratings of satisfaction with personal appearance, $B = .0009$, $t(57) = 2.49$, $p = .02$. Finally, in the third step, the b path (i.e., the direct effect of satisfaction with personal appearance to SS) was examined. Ratings of satisfaction with personal appearance was found to be positively related to ratings of SS, $B = .48$, $t(57) = 3.43$, $p = .001$. Following the procedures recommended by Preacher and Hayes (2008), the bootstrapping method with bias-corrected confidence estimates was employed for the mediation analyses after it was determined that both the a and the b path were significant. The 95% confidence intervals of the indirect effect that were used in this study were determined using 5000 bootstrap samples (Preacher & Hayes, 2008). Mediation analysis results indicated that ratings of satisfaction with personal appearance mediated the relationship between self-reported minutes of PA and ratings of SS, $B = .0004$; CI = .0001-.0009. Further, results of the mediation analysis confirmed that when controlling for the mediator, satisfaction with personal appearance, the c' path (i.e., the direct effect of PA on SS) was no longer significant, thus, indicating complete mediation $B = .0006$, $t(57) = 1.46$, $p = .15$ (see Figure 3).

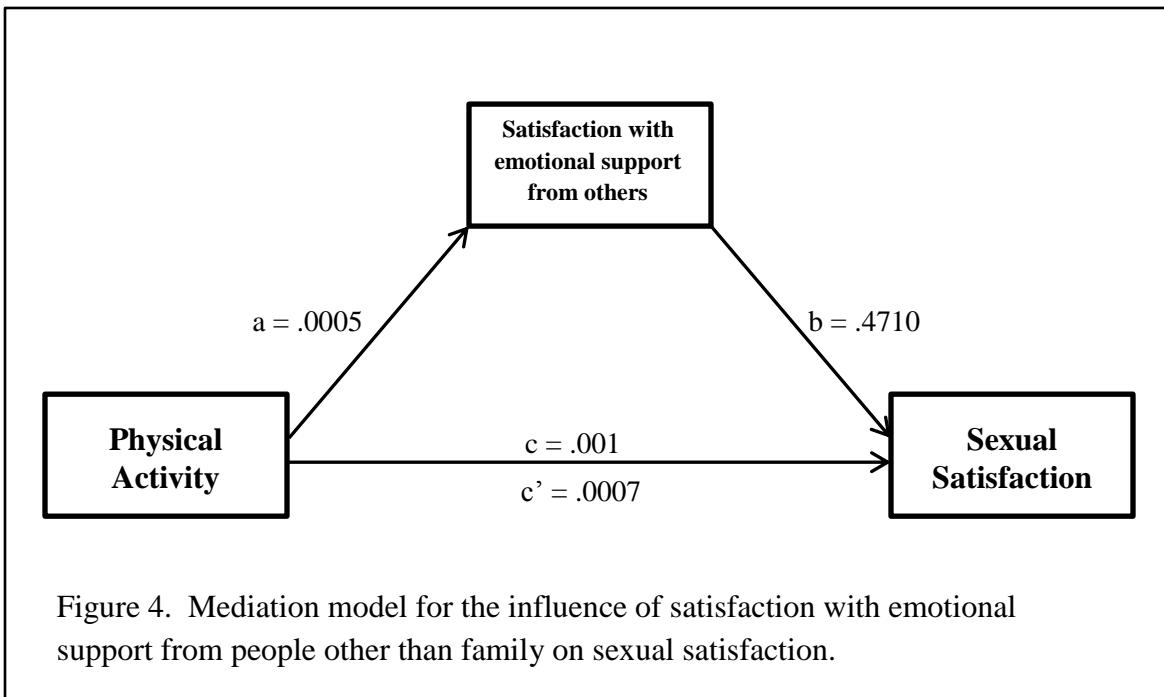
Figure 3



The same procedure was repeated to determine whether Time 2 satisfaction with emotional support from others mediated the relationship between Time 2 PA and Time 2 SS. Results of these analyses were similar to the previous mediation analyses reported above. First, the c path (i.e., total effect of PA on SS) was determined to be significant, $B = .001$, $t(2.42)$, $p = .02$. Next, the a path (i.e., PA to satisfaction with emotional support from others) was determined to be significant, $B = .0005$, $t(57) = 2.17$, $p = .03$. Then, the b path (i.e., direct effect of satisfaction with emotional support from others on SS) was found to be significant, $B = .47$, $t(57) = 2.25$, $p = .03$. Specifically, higher levels of PA were related to higher ratings of satisfaction with emotional support from others. Further, PA was positively related to satisfaction with emotional support from others, and this variable, in turn, was positively associated with SS. Results indicated that satisfaction with emotional support from others mediates the relationship between PA and SS, $B = .0003$; CI = .0001-.0006. Finally, results of the mediation analysis

confirmed that when controlling for the mediator, satisfaction with emotional support from others, the direct effect of PA on SS, the c' path, was no longer significant, thus, indicating complete mediation $B = .0007$, $t(57) = 1.79$, $p = .08$ (see Figure 4).

Figure 4



Discussion

Satisfaction with sex life plays an important role in overall quality of life and well-being. Unfortunately, many factors may impede SS, such as psychosocial factors (e.g., social support, relationship quality), psychological factors (e.g., depression, body image), and physiological factors (e.g., pain, fatigue). Given that self-reported SS is lower among people with disabilities than in the general population, research aimed at understanding and improving the sex lives of people with disabilities is important. PA may be one way to facilitate improvement in SS. Prior research has demonstrated that PA leads to improvements in mental and physical health factors that are correlated with SS.

The aim of this study was to examine the relationship between PA and SS in people with disabilities. There is limited published research exploring this relationship in the general population, and this study was one of the first to explore this relationship among people with disabilities. Further, this study may also be novel because it proposed and explored a mechanism through which the relationship between PA and SS may be facilitated.

Research Questions

Research Question 1: Is there a relationship between self-reported minutes of PA and self-reported satisfaction with sex life? PA and SS were not significantly related at Time 1. This means that at Time 1, no support was found for a relationship between PA and SS. This finding is in contrast to the current, albeit small, literature examining this relationship. PA and SS were positively related at Time 2. At Time 2, participants who reported higher levels of PA also reported higher levels of SS. This finding is similar to results of several descriptive studies examining the relationship between PA and SS.

Because the study from which the data for the present study derived was designed to increase PA, individuals who reported engaging in over 150 minutes of weekly PA at enrollment were excluded from participation. At baseline, over half of the participants reported engaging in no PA. Thus, the lack of variability in PA scores may explain why no relationship was found at Time 1. Further, in order to detect a moderate relationship, a sample size of over 130 participants would have been needed. Given that the sample size for this analysis was 89, not finding a significant relationship may have resulted, in part, from the small sample size.

At Time 2, a significant relationship was found between PA and SS. As scores on the measure of satisfaction with sex life increased, reported minutes of weekly PA also increased. This finding supports similar research examining the relationship between PA and SS in the

general population. Although previous research has not generally provided possible explanations for this relationship, authors of some studies have speculated that factors such as PA-driven improvements in body image may account for the relationship, as SS is positively correlated with body image and negatively correlated with SS (Gerber et al., 2005; Huang et al., 2007).

Research Question 2: Do any of the psychosocial, psychological, or physiological variables correlate with PA? At Time 2, only two of the seven variables—satisfaction with personal appearance and satisfaction with emotional support from people other than family—were related to PA. Although a significant body of research suggests that PA leads to declines in depression, no significant relationship was found between scores on a measure of PA and depression in the present study. A review of the scores on the measure of depression used in this study revealed that approximately half (50.1%) of the participants' scores fell between 0 and 9 on a scale that can range from 0 - 60. This is in the range suggesting no or little depression severity (Weissman, Sholomskas, Pottenger, Prusoff, & Locke, 1977). In fact, 75% of the sample had scores in the subclinical range (i.e., none, minimal or mild). One explanation for why PA may not have been related to scores on the CESD is because this sample consisted primarily of individuals with few or no symptoms of depression. This might be expected as participants in the study were individuals who self-selected to engage in an exercise program. Individuals who were experiencing high levels of depression may have been less likely to enroll in the study. This indicates that the lack of support for a relationship between PA and CESD scores may be partly attributable to the restricted range in scores.

Results revealed a significant, positive relationship between PA and satisfaction with personal appearance. This finding is in line with current research that has suggested a positive relationship between PA and body image and body image correlates. Evidence for the

relationship is found among studies examining the general population and studies examining people with disabilities. Authors of a meta-analysis of literature examining the relationship between PA and body image among the general population suggested this relationship may occur because those who engage in PA perceive that their bodies more closely resemble the ideal of a fit body (Hausenblas & Fallon, 2006). Similar reasons have been suggested for this relationship among individuals with disabilities. For example, PA may help individuals with disabilities, such as amputees, improve comfort with their bodies (Wetterhahn et al., 2002).

Only one of the two questions regarding emotional support was significantly related to PA. Satisfaction with emotional support from family was not significantly related to PA, but a significant positive relationship was found between satisfaction with emotional support from people other than family and PA. Although emotional support from family would likely not have changed over the course of the study, participants were getting support from research staff throughout the first half of the study. Although participants varied in the level of staff support, all received some level of support. Perhaps those who felt satisfied with the support from staff might have engaged in more PA.

Further, PA is related to social integration and social participation (Guedes et al., 2012; Hassmén et al., 2000). People who exercise more may be more likely to participate with friends and others in the community in the form of exercise classes, recreational sports, fitness center attendance, or other exercise-related activities. Participation in the community through exercise may increase the likelihood of perceived social inclusion and support. This may, in turn, elicit perceptions of support, such as emotional support, from others in the community or friends. This might explain why PA was correlated with satisfaction with support from others but not satisfaction with support from family.

No significant relationship was found between PA and satisfaction with partner, lover, or spouse. PA is positively related to factors that may contribute to relationship quality, such as anger, hostility, and interpersonal sensitivity (Dimeo et al., 1999; Hassmén et al., 2000); however, these factors may not translate to satisfaction with a significant other. Although research suggests that people who are more physically active experience less anger, hostility, and interpersonal sensitivity, PA would not be expected to change attributes about a person's significant other. Therefore, it may not be related to a person's satisfaction with spouse, lover, or partner.

No relationships were found between PA and scores on measures of pain or fatigue. There is strong experimental and correlational evidence to support both these relationships. Examination of pain and fatigue scores suggests that the sample, on average, reported only modest levels of self-reported pain and fatigue. The participants in this study all voluntarily chose to begin an exercise program. Perhaps individuals with high levels of pain or fatigue chose not to enroll in the study. The limited variability in scores may explain why no relationships were found between PA and these variables.

Research Question 3: Do any of the psychosocial, psychological, or physiological variables correlate with SS? The majority of variables examined were related to SS, including scores on a measure of depression, satisfaction with personal appearance, satisfaction with spouse, lover, or partner, satisfaction with emotional support from family, and satisfaction with emotional support from others. These findings are not surprising as prior research has supported a relationship between each of these factors and SS. Mechanisms have been proposed to explain some of these relationships.

Although the literature suggests that both pain and fatigue are negatively related to SS,

the findings in this study did not support a relationship between those variables. As mentioned previously, self-reported pain and fatigue in this sample was moderate and may not have played a role in participant's satisfaction with sex life.

Research Question 4: Do any of the psychosocial, psychological, or physiological factors mediate the relationship between SS and PA? Results of the two mediation analyses support an indirect path for the relationship between PA and SS. This finding provides evidence that the relationship between SS and PA is explained by satisfaction with personal appearance. This finding also provides evidence that PA predicted satisfaction with personal appearance, and that satisfaction with personal appearance predicted SS. This mediation pathway between PA and SS provides a mechanism through which this relationship can be explained. This finding is not unsurprising because evidence from disability research suggests that PA promotes adjustment to disability, to disability-related changes in physical appearance, and to changes in physical function. Further, one reason that has been proposed for the relationship between SS and body image is that disturbing, negative thoughts and concerns about one's body during sexual activity may lead to sexual dissatisfaction (Pujols et al., 2010; Woertman & van den Brink, 2012. In addition, this study found that the relationship between PA and SS is also mediated by satisfaction with emotional support from people other than family. These analyses may be some of the first to examine a mechanism through which PA is related to SS.

Limitations

Findings in this study shed light on factors that may play a role in SS and PA in a population of people who use wheelchairs. However, several limitations should be discussed.

The sample limits the generalizability of the findings. The data for the present study derived from a larger randomized controlled exercise trial for wheelchair users. As such,

participants who enrolled in the study may not have been representative of the larger population of wheelchair users. It is conceivable that individuals who enrolled in this study may have had less depression, less, pain, and less fatigue than individuals in the larger population. Future studies enrolling a broader sample may provide more information about potential mediators of the relationship between PA and SS. This is especially true given research presented elsewhere in this paper suggesting that PA leads to reductions in pain, fatigue, and depression. In order to accomplish this, researchers may need to expand recruitment to include areas such as pain management clinics and community mental health centers. Principal investigators may also need to provide education regarding the benefits of PA for people with pain, depression, or fatigue to treatment providers so that they may share this information with their clients.

Further, the larger study upon which data for the current study derives was not specifically designed to address the research questions evaluated in the present study. Thus, definitions and measurement of the concepts explored here were limited by the goals of the larger study. Some of the measures (e.g., such as satisfaction with spouse, lover, or partner) did not thoroughly assess all aspects of the concept of interest (e.g., relationship quality), or measured only one dimension of the construct. For example, although satisfaction with personal appearance may be one part of body image, it does not fully represent this construct. Future research could more thoroughly measure these constructs with validated measures.

Another concern relates to the definition and measurement of PA. It appears that participants in the present study had varying definitions of PA. For example, some participants reported engaging in over 35 hours of PA per week whereas others reported engaging in none. Presumably, participants who reported engaging in 35 hours of PA per week had a much broader definition of PA than those who reported none. In order to improve validity of results, this term

should be more clearly defined for participants. Providing examples of both what does and what does not qualify as PA may also increase understanding of the term, and thereby improve validity of the data collected.

A similar concern relates to the definition and measurement of SS. Given that definitions of SS vary widely in the general population (McClelland, 2014; Pascoal et al., 2014), it is likely that they also vary among people with disabilities. Qualitative studies designed to ask participants what they meant when they reported that they were or were not sexually satisfied could help researchers understand what influences SS. For example, this type of research may help in determining if people perceive differences between satisfaction with sex life and satisfaction with orgasm. This type of research may also be helpful in understanding whether people have different meanings for satisfaction with sex life and SS. This type of study is warranted in both the general population and among people with disabilities in order to discern potential differences in definitions between populations. Further, a qualitative component of experimental studies may help answer questions related to the relationship between SS and PA. For example, if study findings suggest a change in SS over time, questions regarding the nature of the change could be useful. This line of research could provide insight on whether change in SS is related to change in psychosocial, psychological, and physical aspects of sexual functioning, appraisals of sexual function, relationship quality with a partner, etc. Qualitative research would also be helpful for broadening the understanding of the relationship between PA and the variables analyzed in this study. Information gleaned from this type of research may shed light on the reasons underlying quantitative statistical relationships being examined.

Another issue with measurements is that no secondary methods were used to confirm self-report PA data in the present study. Interpretation of results may have been skewed by

participant under- or over-reporting, thus possibly decreasing the reliability and validity of the results. The reliability and validity of future research in this area will be improved by the use of a secondary, objective measurement of fitness designed or validated for use with people with disabilities.

Further, research is needed to examine the most appropriate way to account for reports of exercise of varying intensity. For this study, we weighted vigorous activity twice as much as moderate. Future research could examine the best way to accurately account for varying levels of exercise intensity.

The correlational design of the current research limits conclusion that may be drawn from the study. This design allows for general conclusions to be drawn about the existence of relationships and nature of relationships (i.e., strength and direction--positive or negative) between factors; however, it is limited in terms of causal interpretations and direction of relationships. Moreover, the studies discussed in this paper regarding correlates of SS and those examining the relationship between PA and SS rely heavily on correlational evidence.

Conclusions and Implications

This study makes an important contribution to the literature pertaining to PA and SS as it is the first to explore the relationship between these variables among people with disabilities. Support was found for a positive relationship between these variables. In addition, satisfaction with personal appearance and satisfaction with emotional support from others were found to independently mediate this relationship. Further, PA and SS were also related to psychosocial and psychological variables.

An important component about the present study is that it provides evidence to explain the relationship between SS and PA. Previous studies have identified a relationship between

these two variables, but have not scientifically examined the reason this relationship might exist. Findings from this study provide a preliminary foundation on which future research examining the relationship between SS and PA can be based.

The biopsychosocial model provides a sound framework to conceptualize SS in future research. McClelland (2010) describes research examining SS as in its infancy. Few conceptual models and definitions have been proposed that fully account for the multifaceted factors associated with SS. Research to date, has often focused narrowly on one aspect of SS, such as satisfaction within a sexual relationship or physical satisfaction. Given the broad array of psychosocial, psychological, and physiological factors that have been correlated with SS, it seems most appropriate to conceptualize SS in terms of a model that can fully account for these factors. Viewing SS through such a framework may provide the most thorough understanding of SS, which, in turn, may lead to innovative multifaceted strategies to increase SS. This may be especially important among people with disabilities as this population reports lower SS than the general population.

This study provided support for a relationship between SS and PA in wheelchair users. Further, it found a mechanism to explain this relationship. In addition, it found support for relationships between SS and several psychosocial and psychological correlates. Support was also found for a psychological and psychosocial correlate of PA. The biopsychosocial model provided an ideal framework to describe correlates of PA. Future research should further explore SS using this model. In addition, more research is needed examining the relationship between PA and SS and potential mediators of this relationship.

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