PHYSICAL ACTIVITY AND RELATIONSHIP FUNCTIONING: MEDIATION ROLES OF SEXUAL SATISFACTION AND SELF-ESTEEM

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Little research has examined the role of physical activity in relationship functioning. Utilizing two heterosexual subsamples of 618 females and 155 males, results indicated that physical activity was positively correlated with sexual satisfaction and self-esteem for the female subsample, but was not significant for the male subsample. For both subsamples, although physical activity was not a significant unique predictor of relationship functioning in regression analyses, sexual satisfaction and self-esteem each significantly contributed the variance relationship functioning. The findings of this study increase our knowledge of mechanisms that impact sexual satisfaction, self-esteem, and physical activity among women, which in turn can potentially guide treatment planning and interventions.

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Review of the Literature

According to the American Psychological Association (APA; 2016) more than 90 percent of individuals marry by the age of 50 in Western cultures. However, approximately 40 to 50 percent of married couples in the United States divorce. Married couples have been shown to influence one another's diet and exercise behaviors (Schafer, Keith, & Schafer, 2000; Verheijden, Bakx, van Weel, Koelen, & van Staveren, 2005), with preliminary findings indicating women tend to be more motivated than men to increase their physical activity to match their husband's level of exercise activity (Monin et al., 2015). In older adult populations, longitudinal research suggests that physical activity prevents depressive symptoms and promotes increased self-esteem (Monin et al., 2015), both of which are related to relationship functioning (Fortier, Guerin, Williams, & Strachan, 2015). Furthermore, sexual satisfaction has been linked to both physical activity and relationship satisfaction (Gerber, Johnson, Bunn, & O'Brien, 2005; Thomas, Hess, & Thurston, 2015).

Relationship Functioning and Satisfaction

Approximately one third of married individuals report feeling relationally distressed at any given time (Whisman, Beach, & Snyder, 2008), and cohabiting couples (i.e., unmarried yet living together) are at even higher risk for separation and distress (Bramlett & Mosher, 2002). Overall, research has indicated that divorce and relationship distress are linked with poorer mental and physical health among adults in their mid-30's (Doss et al., 2016). For example, relationship distress and divorce are strongly correlated with anxiety, mood, and substance use

disorders (Whisman, 2007), cardiovascular disease (Zhang & Hayward, 2006), and poor immune functioning (Jaremka, Glaser, Malarkey, & Kiecolt-Glaser, 2013).

Relationship satisfaction is a global evaluation of a marriage or close romantic relationship that includes evaluations of negative and positive aspects of the relationship (Erol & Orth, 2014). While evidence suggests that simply being married or in a close romantic relationship correlates with greater personal well-being, relationship satisfaction has been described as one of the greatest predictive factors for continuation of the relationship (Erol & Orth, 2014). There are numerous overall health benefits related to maintaining a positive committed marital relationship. For example, marital quality has been associated with mental and physical health, as well as job performance among individuals in their mid-20's (Hofman, Finkel, & Fitzsimons, 2015).

Sexual satisfaction is "an affective response arising from one's subjective evaluation of the positive and negative dimensions associated with one's sexual relationship" (Lawrance & Byers, 1995, p. 268). In addition to an overall evaluation, sexual satisfaction involves both physical pleasure and emotional satisfaction (Laumann et al., 1994). Sexuality is an integral aspect of romantic relationships and sexual satisfaction is closely associated with relationship stability and satisfaction (Byers, 2005; Laumann, Gagnon, Michael & Michaels, 1994; Sprecher, 2002). Sex can be defined several ways, but most committed relationships will include some form of sexual intercourse or genital stimulation at some point (Schwartz & Young, 2009). Yeh, Lorenz, Wickrama, Conger, and Elder (2006) reported that individuals who are sexually satisfied tend to be satisfied and happy with their marriages, and endorse better marital quality, which in turn may reduce marital instability.

Research suggests that high sexual satisfaction is associated with more frequent sexual activity (Blair & Pukall, 2014; Higgins et al., 2011), longer duration of one's most recent sexual experience (Blair & Pukall, 2014; Carpenter, Nathanson, & Kim, 2009), and better sexual functioning for couples in their 30's (Heiman et al., 2011). Although early research focused on the frequency of sex in predicting sexual satisfaction, the current literature suggests that the quality of the sexual relationship is linked to other factors as well (Christopher & Kisler, 2004), including a couple's overall relationship satisfaction and their sexual satisfaction (Sprecher & Cate, 2004).

Relationship functioning and satisfaction are influenced by a number of individual factors. Evidence suggests that self-esteem affects the way people function in relation to others (Erol & Orth, 2013; Murray, Holmes, & Griffin, 2000). Individuals' perception of their own level of worth influences their style of interacting with their environment and has a significant impact on shaping their interpersonal relationships (Mund, Finn, Hagemeyer, Zimmerman, & Neyer, 2015). In romantic relationships, self-esteem increases when people feel validated, cared for, and understood by their partner, which can in turn, lead to greater relationship satisfaction for partners in their mid-20's (Knee et al., 2008). Individuals with high self-esteem may also exhibit more relationship enhancing behaviors, whereas individuals with low self-esteem tend to exhibit more relationship-damaging behaviors (Orth, Robins, & Widaman, 2011). Interestingly, in a 12-year longitudinal study, Orth et al. (2012) reported that early self-esteem predicted later relationship satisfaction, but early relationship satisfaction did not predict later self-esteem. Thus, activities that help individuals increase their self-esteem, such as physical activity, may contribute to the development and maintenance of healthy relationships.

Psychological Factors

In the general population, exercise has consistently been correlated with mental health and well-being (Stathopoulou et al., 2006), with epidemiological studies exhibiting an inverse relationship between exercise and mental illness (North, McCullagh, & Tran, 1990). The International Society of Sport Psychology (ISSP; 1992) claimed that exercise reduces anxiety, depression, neuroticism, and stress for men and women of all ages. Ample research documents the strong positive relationship between self-esteem and physical activity. The positive benefits of physical activity on self-perception apply across a broad age range, from adolescents to older populations. For example, prospective studies on geriatric populations suggest that engaging in regular exercise is related to higher self-esteem (Maher et al., 2013). Among college-aged individuals, physical activity helps to improve social well-being, self-esteem, and positive self-perception, with a stronger effect for those who already reported lower levels of self-esteem (Li, Xu, Liu, 2014). In addition, Joseph, Royse, Benitez, and Pekmezi (2013) found that college students who participated in high levels of physical activity reported higher levels of self-esteem.

Links between physical activity and self-esteem suggest that exercise may indirectly affect other areas of psychological health via mutual associations with self-esteem. Researchers have demonstrated that an increase in exercise is associated with improvements in self-esteem for people diagnosed with mental illnesses (Li et al., 2014). Kamarudin and Omar-Fauzee (2007) indicated that exercise is associated with enhanced self-esteem and body image for college-aged individuals. Overall, substantial evidence highlights the physical and psychological benefits of exercise across the life cycle, with the potential to enhance the quality of life for people of all ages (Kamarudin & Omar-Fauzee, 2007). These links have important implications for how individuals feel about themselves as well as their relationships.

Physical Activity

Physical activity is defined as any bodily movement that requires energy expenditure (WHO, 2016). Existing research has established that frequent physical activity has a vast array of beneficial effects on both physiological and psychological health (Domazet et al., 2015). Consistent physical activity has long been regarded as an integral factor for a healthy lifestyle (Kamarudin & Omar-Fauzee, 2007). The current literature estimates that approximately 35% of Americans report consistent physical activity and a smaller percentage participate in physical activity for the recommended 30 minutes a day (Larsen et al., 2015). These numbers are concerning due to the deleterious effects that a lack of exercise has on the human body. A substantial amount of research illustrates the negative health consequences of sedentary behaviors (Larsen et al., 2015).

An important question to address is how much exercise is enough to experience the potential benefits? The National Institute on Aging recommends that individuals participate in 30 minutes of vigorous exercise daily, 7 days a week (Kennedy, 2007). However, Manson, Hu, and Rich-Edwards, (1999) found that adult women who walked for 3 hours a week at a brisk pace exhibited similar benefits compared to those that participated in vigorous forms of exercise. In 2003, the United States Department of Health and Human Services (USDHHS) recommended participating in moderately-intensive activities that result in small increases in breathing and heart rate for approximately 30 minutes to be performed at least 5 days a week or vigorous-intensive activities for 20 minutes that result in significant increases in breathing and heart rate for at least 3 days a week. More recently, the Center for Disease Control (CDC; 2008) released guidelines encouraging individuals to participate in approximately 150 minutes of moderate aerobic activity per week or 75 minutes of high intensity aerobic physical activity per week, as

well as mixing moderate intensity exercise with two days of weight-lifting.

Physical Activity, Relationship Functioning, and Sexuality

Exercising has long been tied to adaptive health outcomes, with research suggesting that participating in physical activity can have significant positive results. Fuller-Tyszkiewicz, Skouteris, and McCabe (2012), found that individuals of all ages who engage in exercise programs saw significant improvements in body satisfaction. An exciting aspect of this research is that the improvements in body satisfaction do not vary according to intensity, mode of activity, amount of exercise per session, or length of the intervention. This suggests that engaging in even minimal exercise can have a positive impact on how individuals view themselves, and in turn, their romantic relationships.

Current research suggests that physical activity may also be related to improved sexual function and activity. Multiple studies have assessed the relationship between physical activity and erectile dysfunction (ED). Many of these studies have reported that higher amounts of exercise are correlated with improved sexual functioning for couples of all ages (Bacon et al., 2003; Esposito et al., 2004). Interestingly, a meta-analysis found a dose-response relationship between ED and exercise, suggesting that as men engaged in higher levels of physical activity, they experienced less incidence of ED (Cheng, Ng, Ko, & Chen, 2006). Overall, individuals who engage in mild to moderate levels of exercise reported lower rates of sexual dysfunction compared to those who did not exercise at all (Paiva et al., 2016). Further, scheduling consistent bouts of exercise improved orgasm function in some individuals (Lorenz & Meston, 2014).

Other cross-sectional and longitudinal studies have shown strong positive associations between physical activity and sexual satisfaction (Gerber, Johnson, Bunn, & O'Brien, 2005;

Greendale, Hogan, & Shumaker, 1996). For instance, among menopausal women, more physical activity was associated with greater sexual satisfaction (Dennerstein, Lehert, Guthrie, & Burger, 2007), as well as better overall sexual functioning (Greendale, Hogan, & Shumaker, 1996). As one possible mechanism explaining the link between sexual arousal and exercise, moderate physical activity before the presentation of sexual stimuli may increase the sympathetic nervous system activity, particularly for women (Meston & Gorzalka, 1996; Lorenz & Meston, 2014). Despite limited research on physical activity and relationship satisfaction, with self-esteem and/or sexual satisfaction as mediators, there is reason to believe that these constructs are related to one another (Erol & Orth, 2014; Rehman, Gollan, & Mortimer, 2007).

Current Study

The current study focused on the relationships between physical activity, sexual satisfaction, and self-esteem are related to relationship functioning in heterosexual male and females. Couples were recruited with the intention of analyzing them as dyadic units, but the system planned for linking members of a couple together failed. As a result, it was necessary to analyze the data with the individual as the unit of analysis. Furthermore, because participants were intentionally recruited along with their romantic partners, the full sample of individual participants could not be considered a random sample from the population of interest. Analyzing relationship partners together in a single model without controlling for the mutual influences between members of the same couple would violate the assumption of independence, underestimating error variance and resulting in inflated type 1 error rates. Thus, the data were analyzed in two separate models, one including only participants who identified as heterosexual males and a second with only participants who identified as heterosexual females. The

assumption was that heterosexual males are unlikely to have a partner who also identifies as a heterosexual male, and likewise for heterosexual females, so that each dataset contained no couples. Unfortunately, participants who did not identify as heterosexual were excluded from the analyses because there was no definitive way to separate them from their partners. Therefore, the following hypotheses apply for both the heterosexual male and female analyses.

1) Physical activity will be correlated with (a) relationship functioning, (b) sexual satisfaction, and (c) self-esteem.

2) Physical activity, sexual satisfaction, and self-esteem, will account for a significant proportion of the variance in relationship functioning.

3) Sexual satisfaction will mediate the relationship between physical activity and relationship functioning (Figures 2 and 3).

4) Self-esteem will mediate the relationship between physical activity and relationship functioning (Figures 2 and 3).

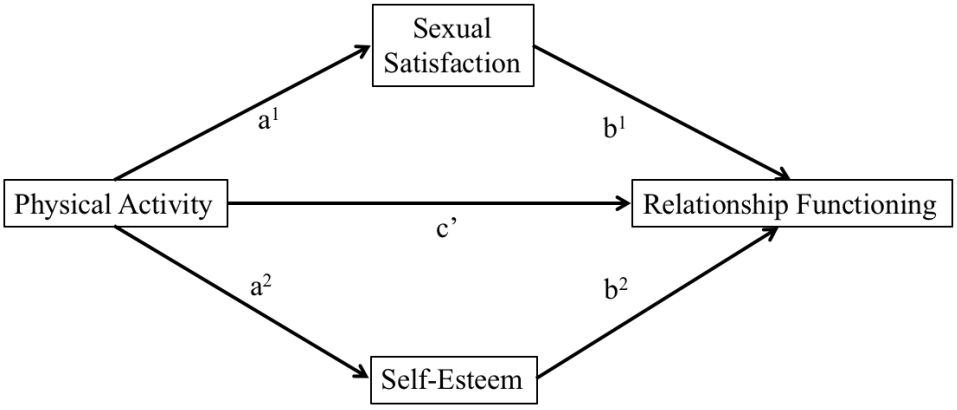

Figure 1. Physical activity and relationship functioning as mediated by self-esteem and sexual satisfaction.

Methodology

Participants

The present study was part of a larger project examining the psychological and relational functioning among collegiate and community couples. This research project recruited

participants who were in a committed monogamous relationship of six months or longer, and ages 18 or older. Participants completed a demographic questionnaire and measures of health and wellness, medical history issues, relationship functioning, as well as other measures not utilized in the current study.

The total sample consisted of 1,046 females (79.8%) and 226 males (17.8%). In order for our sample to match the criteria set for our study, we created exclusion rules to eliminate those that did not. We excluded participants who answered "no" to "Are you currently in a romantic relationship of six months or longer?" (n =63). Participants who skipped the consent question (n =1) were not included. To increase reliability of the data, we excluded participants who answered "Yes" to "I clicked through these choices randomly and/or quickly to receive credit" (n =1) or did not respond to that question at all (n =429). In order to accurately assess genuine responses, we excluded participants that took less than seven minutes to complete the questionnaire (n = 0), which is slightly below the average of 10-15 minutes, taken by the practice respondents prior to the onset of the study.

The resulting heterosexual female subsample consisted of 618 individuals with a mean age of 33.02 (Range = 19-73). The majority of participants identified as White/European Americans (n = 498; 80.6%), as well as 9.4% identifying as Hispanic/Latino/Mexican American (n = 58), 3.6% Asian/Pacific Islander (n = 22), 2.9% Bi-racial or Multiracial (n = 18), 1.0% African American (n = 6), .6% Native American (n = 4), and 1.9% "other" (n = 12). For the purposes of analysis, ethnicity was recoded as white (n = 498; 80.6%) or non-white (n = 120; 19.4%). In regard to educational achievement, 38.0% of this subsample endorsed a Bachelor's Degree (n = 235), 26.7% a Graduate Degree (n = 165), 19.1% Some College (n = 118), 11.7% Technical/2-year Degree (n = 72), 4.0% a High School Degree (n = 25), and .5% indicated

Below High School (*n* = 3). The most common reported income was over $75,000 (173; 28.0%), then 19.7% $45,000-$60,000 (*n* = 122), 17.5% $30,000-$45,000 (*n* = 108), 12.8% $15,000-$30,000 (*n* = 79), 12.8% $60,000-$75,000 (*n* = 79), and 9.1% below $15,000 (*n* = 56), and one additional participant (0.2%) who left that question blank. For the purposes of analysis, income information was summarized with a median split, with 374 participants (60.5%) having high income (over $45,000) and 242 (39.3%) having low income (below $45,000).

Our heterosexual male subsample of interest consisted of 155 individuals with a mean age of 35.75 (Range = 19-88). The majority of participants identified as White/European Americans (126; 81.3%), but also included 12.9% Hispanic/Latino/Mexican American (*n* = 20), 2.6% Bi-racial or Multiracial (*n* = 4), 1.3 % African American (*n* = 2), .6% Asian/Pacific Islander (*n* = 1), and 1.3% "other" (*n* = 2). For the purposes of analysis, ethnicity was summarized into white (*n* = 126; 81.3%) and non-white (*n* = 29; 18.7%) categories. In regard to educational achievement, 38.1% of this subsample endorsed a Bachelor's Degree (*n* = 59), 22.6% Graduate Degree (*n* = 35), 20.0% Some College (*n* = 31), 9.0% Technical/2-year Degree (*n* = 14), 9.0% High School Degree (*n* = 14), and 1.3% Below High School (*n* = 2). The distribution of incomes was similar to in the female subsample, with the plurality of individuals earning over $75,000 (56; 36.1%), but also included 18.2% $45,000-$60,000 (*n* = 28), 11.7% $15,000-$30,000 (*n* = 18), 11.0% $60,000-$75,000 (*n* = 17), 10.4% $30,000-$45,000 (*n* = 16), and12.3% below $15,000 (*n* = 19), with one additional participant (0.6%) who left the question blank. For the purposes of analysis, income information was summarized with a median split, with 101 participants (65.2%) having high income (above $45,000) and 53 participants (34.2%) having low income (below $45,000).

Measures

The Background Information Questionnaire and Mental Health Survey (Riggs & Jacobvitz, 2002; Riggs, Jacobvitz & Hazan, 2002) obtains information about demographics and other factors, such as history of psychological health, psychotropic medication, previous counseling, history of relationships, and early family experiences (e.g., death of family member, parental divorce). Items were added to the original instrument to gather pertinent data regarding physical abilities/disabilities that may limit or impede physical activity levels.

The Revised Dyadic Adjustment Scale (RDAS; Busby, Christensen, Crane, & Larson, 1995) is a 14-item self-report measure to assess marital quality in a romantic partnership. It is composed of the total RDAS scale and three subscales: consensus, cohesion, and satisfaction. The consensus subscale assesses decision making, values, and affection on a 6-point likert-type scale ranging from 0 (*always disagree)* to 5 (*always agree*). An example is, "Please indicate the extent of agreement or disagreement between you and your partner regarding religious matters." The satisfaction subscale covers stability and conflict items on a 6-point likert-type scale ranging from 0 (*all the time*) to 5 (*never*). An example item is, "How often do you discuss or have you considered divorce, separation, or termination in your relationship?" Finally, The cohesion subscale address activities and discussion in the relationship on a 6-point likert-type scale ranging from 0 (*never*) to 5 (*more often*). An example is, "Do you and your mate engage in outside interests together?" On this measure, lower scores reflect higher marital distress. The RDAS has shown good internal consistency and reliability (Crane, Middleton, & Bean, 2000). In the current study, the total RDAS scale ($\alpha = .82$ for both the male and female datasets) was the outcome variable.

The Global Measure of Sexual Satisfaction (GMSEX; Lawrance & Byers, 1998) is a 5-item measure of sexual satisfaction, which assesses various aspects of sexual satisfaction. Participants are asked to evaluate the quality of their sexuality on five 7-point bipolar items: Good-Bad, Pleasant-Unpleasant, Positive- Negative, Satisfying-Unsatisfying, and Valuable-Worthless. An example item is, "In general, how would you describe your sexual relationship with your partner?" Although the original scoring instructions for GMSEX suggest taking the sum of all items (Lawrance & Byers, 1998), we used the mean instead to avoid introducing bias for the single participant who answered some but not all of the GMSEX items (N=1; 0.4%). The GMSEX has excellent internal consistency (.96 in samples of married couples) and convergent validity (Mark, Herbenick, Fortenberry, Sanders, & Reece, 2014). The alpha coefficient of the GMSEX was .96 in the current study for both the male and female datasets.

The Paffenbarger Physical Activity Questionnaire (PPAQ; Paffenbarger, Wing, & Hyde, 1978) is a measure of physical activity participation, which provides estimates of total energy expended in physical activity per week. Participants reported their involvement in vigorous, moderate, and light activity, as well as time spent sitting and sleeping over a typical week, which were then combined in a weighted sum to produce an estimate of metabolic expenditure (MET) in activity as per Simpson (2011). A sample item is, "On a usual weekday and a weekend day, how much time do you spend on the following activities? (Total for each should add to 24 hours). Vigorous activities (digging in the garden, strenuous sports, jogging, aerobic dancing, sustained swimming, brisk walking, heavy carpentry, and bicycling on hills, etc)." The MET values assigned to the sleeping, sitting, light, moderate, and vigorous physical activity intensity categories were .9, 1, 3, 4.5, and 7, respectively. For each physical activity intensity category, the number of hours reported was multiplied by the corresponding MET weight to get a MET×hr

score for a typical day during the week and weekend. To estimate total weekly activity, the MET×hr score for weekday activity was multiplied by 5 and the MET×hr score for weekend activity was multiplied by 2, and the resulting quantities were summed. This resulted in an estimate of energy expenditure expressed in units of MET×hr per week. The PPAQ has high test-retest reliability, convergent validity with physical activity records, and is significantly correlated with measures of cardiovascular fitness (Ainsworth, Leon, Richardson, Jacobs, & Paffenbarger, 1993; Siconolfi et al., 1985).

The Rosenberg Self-Esteem Scale (RSES; Rosenberg, 1965) is a 10-item self-report scale designed to assess global self-esteem. Participants are asked to mark their responses on a 4-point likert-type scale ranging from 1 (*strongly disagree*) to 4 (*strongly agree*). The total scores can range from 10 (which indicates low levels of self-esteem) to 40 (high levels of self-esteem) and the RSES contains an equal number of positively and negatively worded items. A "positive" item example is, "I feel that I'm a person of worth, at least on an equal basis with others." A "negative" item includes "At times I think I am no good at all." This scale has demonstrated strong convergent, discriminant, and predictive validity and reliability (Hatcher & Hall, 2009). The alpha coefficient of the RSES was .92 for females and .89 for males in the current study.

Procedures

This study was part of a larger project investigating relational and sexual functioning among committed couples**.** The University's Institutional Review Board (IRB) reviewed and approved the procedures for online and in-person data collection with both college and community samples, however, only online collection methods were utilized. To ensure adequate representation of our population of interest, recruitment of couples and individuals took place at

both campus and community locations, such as local businesses, churches, restaurants, and university-approved locations. Tabling was done outside of pre-approved shopping locations, as well as in specific buildings on the campus of a large public university. Investigators explained the study and provided interested participants with a flyer describing the study. Flyers provided an access code for the online survey, which took approximately 15-25 minutes to complete. An informed consent notice (see Appendix D) included a description of the study, primary investigator's contact information, and potential risks and benefits. After reading information about the study, participants indicated consent by clicking an "I agree" button. Participants were offered the opportunity to participate in a raffle with the possibility of winning one of eight $25 gift cards for completing the questionnaire. When the individuals completed the online questionnaire, they were provided with a special code for their partner to access the survey, which was intended to link partners' codes to identify couples.

Participants completed the survey using Qualtrics; subsequently data was downloaded to SPSS and evaluated for missingness and statistical assumptions. The overall sample was separated into two subsamples of heterosexual males and heterosexual females. Across the four instruments and in both datasets, data were missing completely at random ($p > .05$) according to Little's Missing Completely At Random test (MCAR). Missingness was handled through the use of Full Information Maximum Likelihood (FIML) estimation. Respondents of both subsamples did not fill out the Paffenbarger Physical Activity Questionnaire (PPAQ) in the manner that the instructions outlined such that their responses for each day did not total 24 hours. For example, some participants reported their response in minutes rather than hours, wrote their answers in the form of a fraction, or listed written words along with their numbers. Therefore, a set of rules was created in order to systematically address the inconsistencies amongst the responses (See

appendix G). After these rules were created, the PPAQ's responses were cleaned according to those rules and MET scores computed from the cleaned PPAQ responses. All of the participants' responses were rescaled to 24 hours per day in order to adjust for individuals reporting in the incorrect unit (e.g. minutes) and participant errors in arithmetic (e.g., responses totaling to 23 or 25 hours per day). Participants with extreme responses, greater than 3 standard deviations from the mean, on any item after rescaling were excluded (n = 12 cases, 7.7% in the male dataset; n = 62 cases, 10% in the female dataset).

To test our first hypothesis and as an initial test of the associations among the key variables, we examined correlations among the variables. To test our second hypothesis, we ran an ordinary multiple linear regression predicting relationship functioning from physical activity, sexual satisfaction, and self-esteem, controlling for age, race, and income level. To test our third and fourth hypotheses, we utilized path analyses to test whether sexual satisfaction (GMSEX) and/or self-esteem (RSES) mediated the relationship between physical activity (PPAQ MET score) and relationship functioning (RDAS total score). Path analysis was conducted to estimate the associations between physical activity, self-esteem, sexual satisfaction, and relationship functioning. The path models were estimated using the lavaan package for structural equation modeling (Rosseel, 2012) in the R statistical language (R Core Team, 2016).

Results

Preliminary Analyses

Means and correlations among key variables are presented in Tables 1 and 2. Prior to testing hypotheses, we examined RDAS total in association with demographic variables. In the female subsample, age was negatively correlated with relationship functioning, $r(616) = .099$, p

= .013, suggesting that older age corresponds to lower relationship functioning for women. Results of one-way ANOVAs demonstrated additional links between demographic variables and relationship functioning for both subsamples. Specifically, education level was significantly associated with relationship functioning in the female dataset, $F(1, 616) = 16.42$, $p < .001$, such that women with a Bachelor's degree or higher ($M = 3.72$, $SD = 0.48$) reported better relationship functioning than females with less than a Bachelor's degree ($M = 3.54$, $SD = 0.61$). For males, ethnicity was significantly associated with relationship functioning, $F(1, 153) = 3.929$, $p < .05$, such that white men ($M = 3.71$, $SD = 0.46$) reported better relationship functioning than men who identified other ethnic backgrounds ($M = 3.50$, $SD = 0.68$). Based on these findings, we controlled for age and education in analysis with our female subsample, and controlled for ethnicity in analyses with our male subsample.

Main Analyses

Pearson correlations assessed bivariate relationships among the key variables, providing mixed support for Hypothesis 1 (see Tables 1 and 2). Contrary to the predictions, the correlation between physical activity and relationship functioning levels was not significant for heterosexual males, $r(135) = -.096$, $p = .266$, nor heterosexual females, $r(522) = .081$, $p = .063$. Similarly, for heterosexual males, physical activity level was not significantly associated with sexual satisfaction, $r(135) = .080$, $p = .353$, nor self-esteem $r(135) = .128$, $p = .137$. For our female subsample, however, physical activity level was significantly associated with sexual satisfaction, $r(520) = .093$, $p = .034$, and self-esteem, $r(522) = .089$, $p = .041$. In other words, results did not support hypotheses regarding links between physical activity level and key variables for men, but

significant positive associations for the female subsample were found for physical activity and both sexual satisfaction and self-esteem.

Table 1

Correlation Matrix for Males

	1	2	3	4	5
1. MET		-.10	.08	.13	.09
2. RDAS_tot			.41***	.26**	.07
3. GMSEX				.10	-.11
4. RSES					.16*
5. Age					
Mean	360.88	3.67	6.01	3.23	35.75
SD	94.66	0.51	1.29	0.54	13.77
Range	185.1 - 689.8	1.14 - 4.64	1 - 7	1.8 - 4	19 - 88

Table 2

Correlation Matrix for Females

	1	2	3	4	5
1. MET		.08	.09*	.09*	.08
2. RDAS_tot			.43***	.30***	-.10*
3. GMSEX				.10*	-.21***
4. RSES					.11**
5. age					
Mean	352.08	3.66	5.87	3.12	33.02
SD	84.55	0.53	1.49	0.60	11.10
Range	158.4 - 735	1.07 - 4.79	1 - 7	1 - 4	19 - 73

To test our second hypothesis, hierarchical regression analyses assessed the amount of variance in relationship functioning that could be accounted for by physical activity, sexual satisfaction, and self-esteem (See Table 3). The initial step included demographic variables and

the second step included the variables of interest. After controlling for ethnicity, the overall model explained 26% of the variance in relationship functioning in the male sample (R^2 = .259, $F(4,132) = 11.507$, $p < .001$). Although physical activity was not a significant unique predictor, sexual satisfaction and self-esteem significantly contributed the variance in men's relationship functioning. For the heterosexual females, after controlling for age and education, the overall model was significant and explained 30% of the variance in relationship functioning (R^2 = .302 $F(5,516) = 44.735$, $p < .001$). Similar to the men, physical activity was not significant, but sexual satisfaction and self-esteem uniquely predicted variance in relationship functioning levels among women. While the second hypothesis was supported in both subsamples, the lack of contribution to relationship functioning by physical activity was not expected.

Table 3

Regression Model Testing Hypothesis 2

	(Males)	(Females)
White	0.253*	
	(0.107)	
Age		-0.004*
		(0.002)
Bachelor's or higher		0.143**
		(0.044)
MET	-0.058	0.026
	(0.040)	(0.020)
GMSEX	0.170***	0.155***
	(0.031)	(0.015)
RSES	0.199***	0.219***
	(0.073)	(0.034)

(table continues)

	(Males)	(Females)
Constant	3.460***	3.541***
	(0.097)	(0.036)
Observations	137	522
R^2	0.259	0.302
F Statistic	11.507*** (df = 4; 132)	44.735*** (df = 5; 516)

*p < .05; **p < .01; ***p < .001. Age, GMSEX, and RSES are centered. MET is Z-scored.

To test our third and fourth hypotheses, we used path modeling to assess whether sexual satisfaction and self-esteem mediated the association between physical activity levels and relationship functioning (Figures 2 and 3). We used bootstrapped standard errors for each path estimate as well as for the test of the mediated effect. For men, after controlling for ethnicity we used path modeling to assess whether sexual satisfaction and self-esteem mediated the association between physical activity levels and relationship functioning (Figures 4 and 5). For men, the association of physical activity was not significant for relationship functioning (b = -0.055, Z = -1.434, p = .152) Physical activity did not significantly predict sexual satisfaction (b = 0.105, Z = 0.979, p = .328) nor self-esteem (b = 0.066, Z = 1.426, p = .154), although both sexual satisfaction (b = 0.165, Z = 5.401, p < .001) and self-esteem (b = 0.227, Z = 3.247, p < .05) did predict relationship functioning. The test of the mediated path from physical activity to relationship functioning was not significant via sexual satisfaction (b = 0.017, Z = 0.993, p = .320) nor self-esteem (b = 0.015, Z = 1.353, p = .176).

For heterosexual females, after controlling for age and education, the association between physical activity and relationship functioning in the context of the mediation model was not significant (b = 0.028, Z = 1.329, p = .184). Physical activity did not significantly predict sexual satisfaction (b = 0.126, Z = 1.785, p = .074) nor self-esteem (b = 0.051, Z = 1.811, p = .070).

However, both sexual satisfaction (b = 0.138, Z = 7.882, p < .001) and self-esteem (b = 0.216, Z = 6.383, p < .001) predicted relationship functioning. The test of the mediated path from physical activity to relationship functioning was not significant via sexual satisfaction (b = 0.017, Z = 1.710, p = .087) nor self-esteem (b = 0.011, Z = 1.743, p = .081).

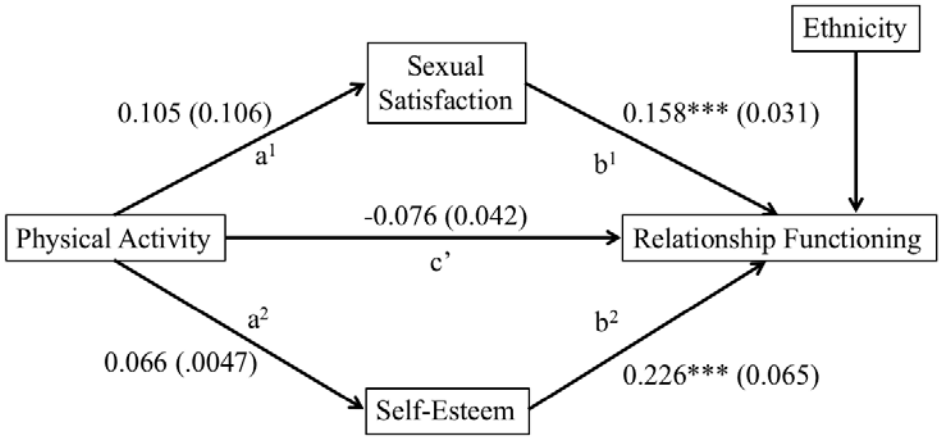

Figure 2. Mediated paths for males, controlling for ethnicity.

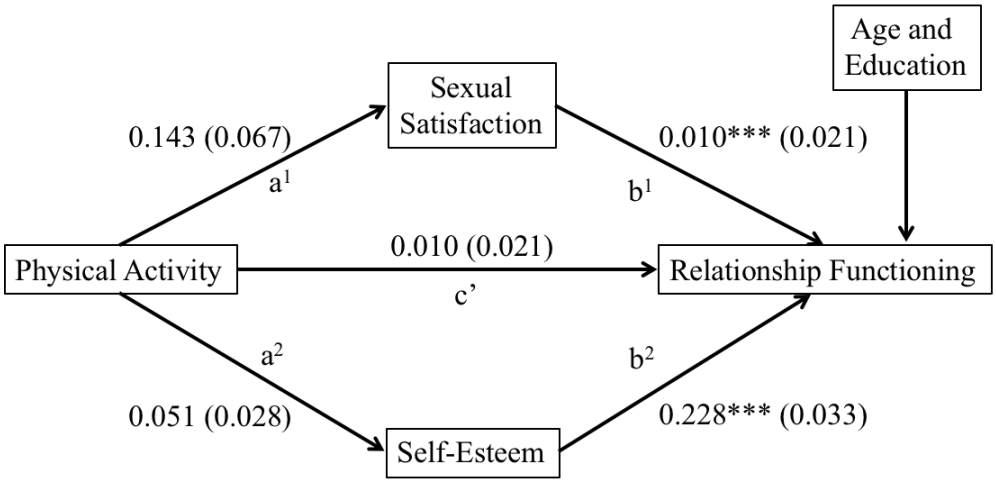

Figure 3. Mediated paths for females, controlling for age and education.

Discussion

The present study aimed at extending the research and knowledge base regarding sexual

satisfaction, self-esteem, and physical activity in regard to relationship functioning. Several of our findings are consistent with existing research, however, other expected effects failed to emerge. Consistent with previous research (Hess et. al, 2009; Weaver & Byers, 2006), physical activity was significantly positively correlated with sexual satisfaction for heterosexual women. Similarly, physical activity was positively correlated with self-esteem in the female dataset. This finding lends further support to the positive correlation between physical activity and self-esteem observed in extant research (Joseph, Royse, Benitez, & Pekmezi, 2013; Li, Xu, & Liu, 2014; Maher et al., 2013). It is possible that a byproduct of physical exercise could be a greater sense of self, which might allow for more confidence, comfortability, and/or enjoyment of sexual encounters or their physical appearance. Physical activity has also been correlated with increasing endorphins, the sense of euphoria and well-being, thus causing them to feel better about themselves and experiencing greater joy in activities (Gupta & Mittal, 2015).

However, our findings contrast with previous literature on a number of hypotheses. Among both men and women, physical activity was not correlated with relationship functioning. Previous research highlights that physical health and exercise is frequently associated with marital quality (Hofman, Finkel, & Fitzsimmons, 2015). According to Burke, Gianguillio, Gilliam, Beilin, and Houghton (2003), research generally supports the notion that when spouses' physical and mental health needs are being met through diet and physical activity, the health of their marriage may also improve. While physical activity is an important health behavior, it is possible that its effects are limited to the individual and do not extend to relationship functioning. Exercise is often an individual activity with few opportunities to interact unless partners choose to participate together and support one another if achieving health goals.

Overall hypotheses were not supported in the heterosexual male subsample, possibly due to the small subsample of male participants. However, cultural factors might also be in play. For example, previous research suggests that women typically exercise for greater amounts of time overall compared to men (Amagasa et al., 2017). However, men are typically more likely to be involved in sports activities compared to women, who are more likely to engage in active household chores (Monin et al., 2015).

Implications

Findings suggest that for women, interventions designed to increase physical activity levels could impact self-esteem and sexual satisfaction. Although our findings are unable to infer causality, women may benefit from increasing physical activity. Previous research has highlighted the strong positive relationship of physical activity on a number of different health outcomes, particularly relationship functioning. However, the majority of the studies reviewed, emphasized sampling of predominantly community individuals (Monin et al., 2015; North, McCullagh, & Tran, 1990), whereas our sample also include college students, who may be in better shape metabolically, by virtue of their youth. Thus, it is possible that our sample did not engage in as many exercise behaviors as other studies (Amagasa et al., 2017). Additionally, physical activity is difficult to assess within research studies. Self-report measures may not accurately reflect actual exercise behaviors due to errors in recall, social desirability, or inflation of actual performed physical activity. Studies utilizing wearable devices that track exercise have been more successful in producing physical activity and their variables of interest (Fortier, Guerin, Williams, & Strachan, 2015).

Limitations and Conclusions

Current results are limited by several factors. First, our design was cross-sectional and correlational, so the study's single time-point design limits our ability to understand these concepts over time and causality cannot be inferred. Future research may benefit from implementing longitudinal designs for these variables of interest. Overall, there were some significant challenges with the data. First, the linking procedure planned to identify couples was ineffective. It is unclear what caused the problem, but in consultation with a statistician, we speculate that the random number generator repeated numbers (i.e., assigned the code to more than one couple) or that participants incorrectly recalled and/or entered in their pairing code number. Two possible fixes for this would be to assign participants unique short, common words and avoid words that are close in spelling to one another, to minimize the potential for typos that would line up incorrect partners. Or, researchers could have a unique, randomly generated survey link at the end of the study that asks the first participant of the couple to enter their partner's email address. This way, the participants would have the unique link sent to them for them to fill out the survey, and then use the web links to connect the dyads in the dataset.

Another limitation of the current study is the number of participants that participated in the study. While the total number of individuals that participated reached greater than 1,200, there were far more heterosexual females than males. Future research may also want to ensure greater number of racial and sexual identity diversity.

Physical activity levels are a challenging concept to capture through self-report assessments and might be better represented by behavioral measures of physical activity, as there are biases in self-report measures. Many participants had difficulty correctly filling out the Paffenbarger Physical Activity Questionnaire, so future researchers might find it beneficial to

create assessment constraints that would more clearly show participants that their responses equal 24-hours a day. If participants reported less or more than the 24-hour mark, they could be prompted with an error message notifying the participant. It is possible that more clear instructions could have been utilized.

A strength of this study is the inclusion of community and college individuals as it expands the possibility of generalizing the results. Our sample was diverse among several demographic variables such as age, income, and educational achievement. The initial hopes for this study were to assess the variables of interest amongst romantic dyads in order to assess the correlations and impact of partners responses. Several setbacks were encountered, including a large number of missing responses for the physical activity questionnaire, difficulty in scoring this measure, and failed dyadic pairing procedures. It is our hope that future researchers will continue to explore the associations between physical activity, self-esteem, sexual satisfaction, and relationship functioning.

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APPENDIX A

EXTENDED LITERATURE REVIEW

According to the American Psychological Association (APA; 2016) more than 90 percent of individuals marry by the age of 50 in Western cultures. However, of this 90 percent, approximately 40 to 50 percent of married couples in the United States divorce. A person's connections with others often influence how they feel about themselves and the relationships they value. Relationships have a significant impact on daily life, including the kinds of goals that people pursue as well as the resources they have to pursue those goals (Hofman, Finkel, & Fitzsimons, 2015). For example, romantic partners have been shown to influence one another's diet and exercise behaviors (Schafer, Keith, & Schafer, 2000; Verheijden, Bakx, van Weel, Koelen, & van Staveren, 2005), with preliminary findings indicating women tend to be more motivated than men to increase their physical activity to match their husband's level of exercise activity (Monin et al., 2015). Longitudinal research suggests that physical activity prevents depressive symptoms and increases self-esteem (Monin et al., 2015), both of which are related to relationship functioning (Fortier, Guerin, Williams, & Strachan, 2015). Furthermore, sexual satisfaction has been linked to both physical activity and relationship satisfaction. The goal of this study is to better understand the associations between physical exercise, sexual satisfaction, and relationship adjustment. Guided by the Interpersonal Exchange Model of Sexual Satisfaction (Lawrance & Byer, 1992, 1995), we suggest a theoretical model linking these three constructs. Specifically, we hypothesize that physical activity and sexual satisfaction will account for a significant proportion of the variance in dyadic adjustment, and sexual satisfaction will mediate the relationship between physical exercise and dyadic adjustment. We will also explore the contributions and mediating roles of self-esteem and depression in this association.

Theoretical Framework

Sexual satisfaction is a multifaceted construct that includes both emotional satisfaction

and physical pleasure, as well as a global subjective evaluation of an individual's sex life (Laumann, Gagnon, Michael & Michaels, 1994). The Interpersonal Exchange Model of Sexual Satisfaction (IEMSS) was developed by Lawrance and Byer (1992, 1995) to explain sexual satisfaction by considering the costs and rewards that can be exchanged in a sexual relationship. Exchange models assess interpersonal relationships and what partners invest and gain from their romantic relationships (Nye, 1982). Social exchange perspectives have successfully predicted relationship satisfaction (Berscheid & Reis, 1998; Cate, Lloyd, & Long, 1988; Davidson, 1984; Lawrance & Byers, 1995; Michaels, Edwards, & Acock, 1984), which is a key variable in the proposed study. Rather than viewing sexual satisfaction solely in behavioral terms (i.e., orgasmic frequency, sexual activity, or frequency), Lawrance and Byers (1995) believed that affective experiences derived from one's sexual relationship are an important component to consider. "Rewards" are seen as exchanges that are enjoyable and gratifying to the individual, whereas, "costs" are exchanges that require physical or mental effort or cause embarrassment, anxiety, or pain (Thibaut & Kelly, 1959). Therefore, in an exchange model, the greater the rewards exceed one's costs, the higher likelihood that the relationship or sexuality will be appraised as "satisfying" (Byers, 1999).

The IEMSS takes into account the interpersonal nature of sexual activity within a coupled relationship and the level of sexual rewards and costs, as well as the perceived equality of such rewards and costs (Byers, 1999). Therefore, sexual satisfaction will be higher when the accumulated levels of rewards are greater than the costs and if the partner believes that there is equality regarding their own and their partner's levels of rewards and costs (Schmiedeberg & Schroder, 2016). According to the IEMSS, there are four clear dimensions that influence sexual satisfaction (Lawrance & Byers, 1995). First, the model proposes that satisfaction within the

sexual relationship will be higher to the extent that relationship satisfaction is higher (Byers, 1999). Next, sexual satisfaction will be greater when the level of rewards in the sexual relationship is higher than the level of sexual costs. Third, sexual satisfaction will be greater when the level of rewards and costs in the sexual relationship are close to what that individual *expects* to experience in their sexual relationship (Byers, 1999). Lastly, higher sexual satisfaction is believed to be related to higher perceived equality between partners' levels of costs and rewards, and greater perceived balance of personal costs and rewards in the sexual relationship (Byers, 1999). Based on the IEMSS framework we will consider both the behavioral and affective factors that may relate to relationship and sexual satisfaction.

Relationship Functioning and Satisfaction

Approximately one third of married individuals report feeling relationally distressed at any given time (Whisman, Beach, & Snyder, 2008), and cohabiting couples (i.e., unmarried yet living together) are at even higher risk for separation and distress (Bramlett & Mosher, 2002). Overall, research has indicated that divorce and relationship distress are linked with poorer mental and physical health among partners (Doss et al., 2016). For example, relationship distress and divorce are strongly correlated with anxiety, mood, and substance use disorders (Whisman, 2007), cardiovascular disease (Zhang & Hayward, 2006), and poor immune functioning (Jaremka, Glaser, Malarkey, & Kiecolt-Glaser, 2013). Clearly, individual health and well-being would benefit from working towards relationships that are harmonious and satisfactory to both partners.

Within the current literature, there appears to be significant variance in regards to how to define relationship satisfaction. For the purpose of this study, relationship satisfaction is defined as a global evaluation of a marriage or close romantic relationship, including evaluations of

negative and positive aspects of the relationship (Erol & Orth, 2014). While evidence suggests that simply being married or in a close romantic relationship correlates with greater personal well-being, relationship satisfaction has been described as one of the greatest predictive factors for continuation of the relationship (Erol & Orth, 2014). Better relationship functioning is associated with high levels of affection and dedication to the relationship (Sprecher, 2002). There are numerous overall health benefits related to maintaining a positive committed marital relationship. For example, marital quality has been associated with mental and physical health, as well as job performance (Hofman, Finkel, & Fitzsimons, 2015). In addition, individuals who feel satisfied with their romantic relationships are likely to experience higher levels of happiness and be more focused in the pursuit of their goals. Perception is a key factor, as spouses' perception of emotional intimacy not only predicts their own marital satisfaction but also that of their partners, suggesting that when one person feels particularly connected with his or her partner, the other partner is also more likely to perceive higher amounts of relationship satisfaction (Yoo, Bartle-Haring, Day, & Gangamma, 2014).

Luo and Tuney (2015) argued that communication is critical to maintaining a close relationship and included it as one of the five key characteristics shared by couples who have high levels of happiness and marital satisfaction. Brashier and Hughes (2012) reported that effective communication is key for sustaining healthy dyadic functioning over time among both heterosexual and same-sex relationships. Without effective communication and appropriate emotional regulation, individuals tend to become defensive or withdraw from conflict situations, which may later predict marital dissatisfaction and dissolution (Litzinger & Coop Gordon, 2005). Specifically, in a study by Christensen and Heavey (1990), distressed partners reported less mutually constructive communication, greater demand-withdrawal communication, more

avoidance of communication, and greater amounts of conflict or psychological distance compared to non-distressed couples.

Research consistently documents a strong correlation between relationship satisfaction and communication. Yoo et al., (2014) reported that spouses who believed their partners communicated positively were more likely to feel happy and satisfied with their romantic relationship. These researchers concluded that individuals were more likely to feel sexually and emotionally intimate with their significant other when they perceived that their partners' communication style was more positive, which in turn increased their relationship satisfaction. Partners who are unable to effectively communicate with one another often suffer from heightened dissatisfaction in their romantic relationships. Brashier and Hughes (2012) found that poor communication predicts marital distress; in particular, communication about sex, sexual satisfaction, and relationship satisfaction are important factors in the maintenance of a healthy relationship.

Once a relationship has been formed, it needs to be actively maintained (Hromatko, Bajoghli, Rebernjak, Joshaghani, & Tadinac, 2015). Self-disclosure has been identified as an important factor to maintain a relationship. MacNeil and Byers (1997) indicated that openness to self-disclosure is related to greater relationship satisfaction. Research suggests that both sexual and nonsexual forms of self-disclosure can lead to greater sexual satisfaction (Byers & Demmons, 1999). Moreover, mutual self-disclosure can result in greater relationship satisfaction (MacNeil & Byers, 2009). The ability to identify and express emotions, convey empathy, and manage challenging emotions are essential for maintaining healthy relationships (Cordova, Gee, & Warren, 2005). Overall, communication is an important factor as it can facilitate or impede intimacy within romantic relationships, with positive communication experiences generally

associated with higher levels of intimacy because partners are able to discuss their vulnerabilities and mutually validate each other's self-disclosure (Yoo, Bartle-Haring, Day, & Gangamma, 2014).

Relationships in adulthood naturally entail some conflict and stress. Conflict management is an integral component of promoting relationship satisfaction and preventing relationship dissolution (Roberson, Fish, Olmstead, & Fincham, 2015). Communication, particularly related to problem solving, has a high and direct correlation to the quality of the spousal relationship (Merves-Okin, Amidon, & Bernt, 1991). Conversely, conflict can be associated with decreased relationship satisfaction, often predicting declines in satisfaction over time (Gordon & Chen, 2016).

Couple conflict has been linked to poor health outcomes, and identified as an antecedent to ineffective parenting, relationship dissolution and even domestic violence (Gordon & Chen, 2016). Couples who experience distress in their relationship are also more likely to avoid engaging with one another, which can further exacerbate communication difficulties (Brashier & Hughes, 2012). Additionally, distressed couples often display more negative affect and negatively-toned reciprocity compared to non-distressed couples (Gottman & Levenson, 1986). Roberson, Fish, Olmstead and Fincham (2015), reported that many relationship difficulties can be attributed to ineffective conflict management skills, such as negative problem solving, criticism, and failure to admit responsibility.

Often used to describe partners' general level of closeness to one another, the term "intimacy" is conceptualized as a multidimensional construct that can be assessed in the physical, interpersonal, intellectual, and affective domains of the couple relationship (Yoo et al., 2014). It is possible that increasing levels of intimacy can improve relationship satisfaction.

Couples often report higher levels of relationship satisfaction when they experience greater feelings of intimacy (Dandeneau & Johnson, 1994; Schaefer & Olson, 1981; Yoo et al., 2014). Affectionate displays by partners in a relationship are also related to higher levels of marital satisfaction, whereas antagonistic behavior is related to being less satisfied in their relationship (Schoenfeld, Loving, Pope, Huston, & Stulhofer, 2015).

The absence of intimacy can have a significant negative impact on relationships. When initially building a relationship, failure to establish intimacy has been shown to predict negative relationship outcomes such as marital dissolution (Waring, 1988). Lack of intimacy is commonly cited as the primary reason why couples seek marital therapy (Doss, Simpson, & Christensen, 2004; Geiss & O'Leary, 1981; Veroff, Kulka, & Douvan, 1981) and is frequently associated with other relationship struggles, such as jealousy between partners and a lack of security (Crowe, 1997). Individuals who lack intimacy in their relationships have been shown to experience higher levels of stress-related symptoms, recover more slowly from illness, develop more illnesses in general and demonstrate a greater likelihood of relapse or reoccurrence of physical ailments (Hook, Gerstein, Detterich, & Gridley, 2003).

Sexual Satisfaction

One of the more frequently used definitions for sexual satisfaction is "an affective response arising from one's subjective evaluation of the positive and negative dimensions associated with one's sexual relationship" (Lawrance & Byers, 1995, p. 268). In addition to an overall evaluation, sexual satisfaction involves both physical pleasure and emotional satisfaction (Laumann et al., 1994). Sexuality is an integral aspect of romantic relationships and sexual satisfaction is closely associated with relationship stability and satisfaction (Byers, 2005; Laumann, Gagnon, Michael & Michaels, 1994; Sprecher, 2002). Sex can be defined several

ways, but most committed relationships will include some form of sexual intercourse or genital stimulation at some point (Schwartz & Young, 2009). Yeh, Lorenz, Wickrama, and Conger (2006) reported that individuals who are sexually satisfied tend to be satisfied and happy with their marriages, and endorse better marital quality, which in turn helped reduce marital instability.

Research suggests that high sexual satisfaction is associated with more frequent sexual activity (Blair & Pukall, 2014; Higgins et al., 2011), longer duration of one's most recent sexual experience (Blair & Pukall, 2014; Carpenter, Nathanson, & Kim, 2009), and better sexual functioning (Heiman et al., 2011). During sexual activity, perceived partner responsiveness also has been associated with higher levels of sexual satisfaction (Birnbaum & Reis, 2006). Although early research focused on the frequency of sex in predicting sexual satisfaction, the current literature suggests that the quality of the sexual relationship may be linked to other factors as well (Christopher & Kisler, 2004). For example, there is a strong positive association between a couple's relationship satisfaction and their sexual satisfaction (Sprecher & Cate, 2004). Extant literature highlights that how one partner feels about the couple's sex life may impact how the other partner feels. Consistent with the IEMSS, individuals' perceptions of the sexual relationship as rewarding compared to costly contribute to their partners' sexual satisfaction even beyond their own self-report of rewards and costs (Byers & Wang, 2004).

In addition to frequency, satisfaction with sex has been found to be associated with factors such as number of orgasms, oral-genital contact, partner characteristics, and intimacy (Haavio-Mannila & Kontula, 1997). In the context of established relationships, both men and women indicate a preference for engaging in affectionate behaviors such as cuddling, caressing, and shared intimacy with a partner after sex or sexual acts (Hughes & Kruger, 2011). Heiman et

al. (2011) found that sexual frequency was related to sexual satisfaction but not relationship happiness for men and women, suggesting that there may be some level of independence in relationship satisfaction and sexual activity. These results, however, have not been consistently supported by extant literature, as the degree of independence and dependence between these two variables has been debated (Heiman et al., 2011).

While sexual satisfaction is central to the health of romantic relationships, it is also important to recognize differences related to the developmental stages of individuals and relationships. Litzinger and Coop Gordon (1983) found that individuals in romantic relationships rated sexual satisfaction as one of the most integral aspects of marital functioning and happiness. Previous researchers have noted a decline in marital satisfaction as the length of the marriage increased (Liu, 2003). In married couples, Schmiedeberg and Schroder (2016) found that peak sexual satisfaction occurred in the second half of the first year of the marriage, which was then followed by a significant decline from the second year onward. Donnelly (1993) reported that lower marital satisfaction was associated with greater likelihood of sexual inactivity as well as termination of the relationship. Extant literature also suggests that couples become unhappy when sexual access declines and that cohabiters are particularly dissatisfied if genital sexuality decreases or disappears (Schwarz & Young, 2009). Furthermore, poor and ineffective communication may lead to decreased relationship satisfaction, and in turn, sexual dissatisfaction.

In a general sense, effective communication between partners is positively related to the quality of their sexual relationship (Schenk, Pfrang, & Rausche, 1983). On the other hand, couples who experience difficulties with communicating often experience sexual problems (Fay, 1977). Thomas, Hess and Thurston (2015), reported that certain psychosocial factors such as

quality of communication with romantic partner, value of sex, and relationship satisfaction, are highly related to sexual satisfaction. They added, however, that good communication in a general sense, not only effective sexual communication was associated with higher sexual satisfaction.

Sexual communication and communication in general are commonly believed to be integral to sexual satisfaction. Communication allows individuals to share their preferences in regards to their sexual needs, desires, and wants (Cupach & Comstock, 1990). Coffelt and Hess (2014) reported that sexual communication contributes to sexual satisfaction, relationship satisfaction, marital satisfaction, and marital quality. Conversely, a general lack of openness has been cited as a common problem in regards to romantic relationships and often results in marital dissatisfaction because partners are unable to understand what difficulties the other person may be experiencing (Petronio, 2002). Partners in a committed relationship may find it challenging to create, develop, and maintain emotional closeness and intimacy when ineffective communication processes are present (Yoo, Bartle-Haring, Day, & Gangamma, 2014).

Psychological Factors

Relationship functioning and satisfaction are influenced by a number of individual factors. A growing body of evidence suggests that self-esteem affects the way people function in relation to others (Erol & Orth, 2013; Murray, Holmes, & Griffin, 2000). How individuals perceive their own level of worth influences their style of interacting with their environment and has a significant impact on shaping their interpersonal relationships (Mund, Finn, Hagemeyer, Zimmerman, & Neyer, 2015). More specifically, individuals view and assess the world in a particular manner, which then can evoke reactions that verify their views about themselves and their worth (Swann, 2012). In romantic relationships, self-esteem increases when people feel validated, cared for, and understood by their partner, which can in turn, lead to greater

relationship satisfaction (Knee et al., 2008). Individuals with high self-esteem may also exhibit more relationship enhancing behaviors, whereas individuals with low self-esteem may tend to exhibit more relationship-damaging behaviors (Orth, Robins, & Widaman, 2011). Interestingly, in a 12-year longitudinal study, Orth et al. (2012) reported that early self-esteem predicted later relationship satisfaction but early relationship satisfaction did not predict later self-esteem. Thus, activities that help individuals increase their self-esteem, such as physical activity, may contribute to the development and maintenance of healthy relationships.

Conversely, there is a considerable amount of evidence that indicates relationship satisfaction is correlated with depression, although the causal direction is currently unknown (Fincham, Beach, Harold, & Osborne, 1997; Kurdek, 1999). According to an epidemiological study in the United States (Kessler, 1994), approximately 4.9% of individuals between the ages of 15 and 54 reported a current diagnosis of major depressive disorder and 17% reported lifetime major depression. Individuals suffering from major depressive disorder are characterized by increased interpersonal distress, and more relationship problems compared to normative samples, and also rate their marriages as less satisfactory (Barrett & Barber, 2007; Gotlib & Whiffen, 1989; Whisman & Uebelacker, 2009). Additionally, individuals diagnosed with depression have a greater likelihood of experiencing a relapse of their depressive symptoms, as well as a longer recovery period (Feidler, Backenstrass, Kronmuller, & Mundt, 1998). Research consistently supports the notion that individuals living with a depressed spouse are at risk for negative outcomes, possibly because romantic relationships with a depressed partner are characterized by a lower frequency of positive communication behaviors (e.g., smiling, eye contact, self-disclosure) and higher frequency of negative communication behaviors (e.g., verbal aggression, withdrawal, blame) (Rehman, Gollan, & Mortimer, 2007). With romantic relationships often

serving as the primary social support for individuals, it is understandable that interpersonal factors are one of the strongest predictors of the duration and course of an episode of depression (Brown & Moran, 1994; Hooley & Teasdale, 1989).

Physical Activity

Physical activity is defined as any bodily movement that requires energy expenditure (WHO, 2016). Existing research has established that frequent physical activity has a vast array of beneficial effects on both physiological and psychological health (Domazet et al., 2015). Consistent physical activity has long been regarded as an integral factor for a healthy lifestyle (Kamarudin & Omar-Fauzee, 2007). For example, physical activity has been associated with better cognitive performance and improved brain functioning in elderly and cognitively impaired subjects (Domzet et al., 2015).

The current literature estimates that approximately 35% of Americans report consistent physical activity and an even smaller percentage participate in physical activity for the recommended 30 minutes a day (Larsen et al., 2015). These numbers are concerning due to the deleterious effects that a lack of exercise has on the human body. A substantial amount of research illustrates the negative health consequences of sedentary behaviors (Larsen et al., 2015). Rates of conditions associated with an inactive lifestyle, such as cardiovascular disease, diabetes, and obesity are high and increasing at an alarming rate. Larsen et al. (2015) suggested that the cost of treating diabetes alone accounts for approximately 20% of health care expenditures in the United States. These findings highlight the importance of making changes to curb current societal trends that are moving towards a more sedentary and unhealthy lifestyle.

An important question to address is how much exercise is enough to experience the potential benefits? The National Institute on Aging recommends that individuals participate

in 30 minutes of vigorous exercise daily, 7 days a weak (Kennedy, 2007). However, Manson, Hu, and Rich-Edwards, (1999) found that adult women who walked for 3 hours a week at a brisk pace exhibited similar benefits compared to those that participated in vigorous forms of exercise. In 2003, the United States Department of Health and Human Services (USDHHS) recommended participating in moderately-intensive activities that result in small increases in breathing and heart rate for approximately 30 minutes to be performed at least 5 days a week or vigorous-intensive activities for 20 minutes that result in significant increases in breathing and heart rate for at least 3 days a week. More recently, the Center for Disease Control (CDC; 2008) released guidelines encouraging individuals to participate in approximately 150 minutes of moderate aerobic activity per week or 75 minutes of high intensity aerobic physical activity per week, as well as mixing moderate intensity exercise with two days of weight-lifting.

Aerobic or anaerobic activities have been found to yield similar health benefits, with aerobic exercise referring to physical work sustained for long periods of time (i.e., swimming or distance running) and anaerobic exercise involving high intensity work over short periods of time (i.e., sprinting or weight lifting) (de Coverley Veale, 1987). However, mixed recommendations can be found in the literature, with some arguing in favor of high intensity physical activity (Barabasz, 1991; Cox, Thomas, Hinton, & Donahue, 2006; Daley & Welch, 2003; Watanabe, Takeshima, Okada, & Inomata, 2001), whereas others have proposed that low or moderate intensity exercise yields greater psychological benefits benefits (Bixby & Lockbaum, 2006; Plante & Rodin, 1990; Steptoe & Cox, 1988; Tate & Petruzzello, 1995). Regardless of the intensity, the research indicates that the mood of healthy individuals who exercise on a consistent basis is altered immediately after a period of vigorous physical activity (de Coverley Veale, 1987), suggesting that even small bouts of exercise may have an impact on

one's overall psychological and physical health.

Physical activity and exercise have been linked to reduced risks of acquiring over 25 chronic illnesses or conditions (Larsen, Gilmer, Pekmezi, Napolitano, & Marcus, 2015), including stroke, diabetes, Alzheimer's disease, Parkinson's disease, coronary heart disease, breast and colon cancers, as well as hypertension (Joseph, Royse, Benitez, & Pekmezi, 2013; Deslandes et al., 2009). Physical activity may also be useful in managing the medical and emotional difficulties presented by arthritis and other chronic pain conditions (Smith, 2006). Epidemiological studies have highlighted that exercise protects against premature mortality, reduces cardiovascular morbidity and on average, extends the lifespan (Kamarudin & Omar-Fauzee, 2007; Kaplan, Strawbridge, Cohen, & Hungerford, 1996). Longitudinal research has indicated that consistent moderately vigorous exercise may reduce the risk of death by 23% (Paffenbarger et al., 1993). In fact, the World Health Organization (2016) asserted that a lack of physical activity is the fourth leading risk factor for death around the world.

Overall, exercise and a healthy diet have been found to reduce the disease risk and physical decline in cancer survivors, with some research suggesting an inverse relationship between exercise and cancer (Adams, Mosher, Blair, Snyder, Sloane, Denmark-Wahnefried, 2015). Other research suggests that physical activity can be used as an intervention that may help fight the negative consequences of menopause (Elavsky, 2010). Despite the wide-spread knowledge of the positive health benefits related to exercise, few Americans regularly engage in physically active endeavors (Larsen et al., 2015).

In the general population, exercise has consistently been correlated with mental health and well-being (Stathopoulou et al., 2006), with epidemiological studies exhibiting an inverse relationship between exercise and mental health (North, McCullagh, & Tran, 1990). People who

engage in physical activity are characterized by higher psychological well-being and have sharper minds with higher cognitive abilities, specifically in frontal executive functioning of the brain (de Geus & de Moor, 2008; Hillman, Erickson, & Kramer, 2008). The International Society of Sport Psychology (ISSP; 1992) claimed that exercise reduces anxiety, depression, neuroticism, and stress for men and women of all ages.

The literature supports the notion that any form of exercise, ranging from light to moderate, can alleviate depressive symptoms in people that are experiencing mild-to-moderate depression (Legrand, 2014). Results of a meta-analysis by Berry, Smits, and Otto (2006) indicated that physical activity can be a powerful intervention for individuals who have been diagnosed with clinical depression. For the management of depression and anxiety, physical activity can improve the prognosis, reduce the severity and related levels of medication, as well as counteract the reductions in functional activity that tend to accompany these conditions (Dubbert, 2002). Early research suggested that exercise affected neurological functioning, which in turn reduced depressive feelings (Deslandes et al., 2009). However, new research suggests that social and cognitive mechanisms may also play a significant role in the inverse relationship between physical activity and depression (Pickett, Yardley, & Kendrick, 2012). Given that low self-esteem is common among depressed individuals, one potential mechanism to explain the reduction of depressive symptoms may be an improvement in self-esteem (Legrand, 2014).

In addition to reducing depressive symptoms and increasing mood and psychological well-being, consistent regular activity has been associated with a decreased risk of developing dementia, cognitive impairment, and Alzheimer's disease in older adult populations (Opdenacker, Delecluse, & Boen, 2009). In particular, among the elderly, physical activity is correlated to the reduced risk of depression and research suggests that even low-intensity

exercise is associated with reduced risk of cognitive mental decline (Smith, 2006). In populations diagnosed with schizophrenia, physical activity may also provide several health benefits, such as improving glycemic control, reducing the risk of cardiovascular disease, and reducing excess weight (Scheewe et al., 2013; Stubbs et al., 2015). In one meta-analysis, Gorczynski and Faulkner (2010) reported small yet significant improvements in the mental health of patients who participated in physical activity. These findings suggest that consistent exercise might not only help prevent and manage physical comorbidities of schizophrenia, but also might improve psychological symptomatology and overall well-being (Rosenbaum et al., 2014; Firth et al., 2015).

Ample research documents the strong positive relationship between self-esteem and physical activity. The literature also suggests that exercise is positively associated with physical self-concept and global self-concept in adult populations (Schneider, Dunton, & Cooper, 2008). The positive benefits of physical activity on self-perception apply across a broad age range, from adolescents to older populations. For example, prospective studies on geriatric populations suggest that engaging in regular exercise is related to higher self-esteem (Maher et al., 2013). More specifically, among college-aged individuals, physical activity helps to improve social well-being, self-esteem, and positive self-perception, with a stronger effect for those who already reported lower levels of self-esteem (Li, Xu, Liu, 2014). In addition, Joseph, Royse, Benitez, and Pekmezi (2013) found that college students who participated in high levels of physical activity reported higher levels of self-esteem. Thus, regular exercise not only may protect against the progression and development of chronic diseases for older adults, but may also improve self-esteem across all age groups (Joseph et al., 2013).

Links between physical activity and self-esteem suggest that exercise may indirectly affect other areas of psychological health through their associations with self-esteem. Researchers have demonstrated that an increase in exercise is associated with improvements in self-esteem for people diagnosed with mental illnesses (Li et al., 2014). Kamarudin and Omar-Fauzee (2007) indicated that exercise is associated with enhanced self-esteem as well as body image. Overall, substantial evidence highlights the physical and psychological benefits of exercise across the life cycle, with the potential to enhance the quality of life for people of all ages (Kamarudin & Omar-Fauzee, 2007). These links have important implications for how individuals feel about themselves as well as their relationships.

Physical Activity, Relationship Functioning, and Sexuality

Exercising has long been tied to adaptive health outcomes, with research suggesting that participating in physical activity can have significant positive results. Fuller-Tyszkiewicz, Skouteris, and McCabe (2012), found that individuals who engage in exercise programs saw significant improvements in body satisfaction. An exciting aspect of this research is that the improvements in body satisfaction do not vary according to intensity, mode of activity, amount of exercise per session, or length of the intervention. This suggests that engaging in even minimal exercise can have a positive impact on how individuals view themselves, and in turn, their romantic relationships. Previous research has highlighted how individuals in romantic relationships can influence the diet and exercise behaviors of their partner (Schafer, Keith, & Schafer, 2000; Verheijden, Bakx, van Weel, Koelen, & van Staveren, 2005).

Research suggests that positive health changes could be integrated into our close relationships, particularly with significant others (Burke, Gianguillio, Gillam, Beilin, & Houghton, 2003). Consistent with previous findings, Monin and colleagues (2015) found that

husbands' exercise was related to increases in their wives' physical activity, suggesting that interventions implemented with one partner may indirectly impact the other partner. In addition, husbands' physical activity and depressive symptoms positively correlated with changes in wives' exercise and depressive symptoms. More specifically, participation in physical activity can increase one's overall health, which may in turn increase the likelihood that partners will be able to attend to their romantic relationship physically, mentally, and emotionally.

As individuals age, it is likely that their weight will increase as well. Longitudinal research indicates that weight also increases after marriage (Burke et al., 2003). With this weight gain, it is possible that individuals might become more dissatisfied with their outward appearance, resulting in a decrease in self-esteem. However, the health of individuals as well as the health of their relationship may be improved by reciprocal support between the two partners working to establish positive, health-related behaviors for diet and exercise (Burke et al., 2003). A partner's interest in physical exercise may be psychologically meaningful to individuals who want to be included in matters that are important to their partners (Monin et al., 2015). When both partners participate in exercise together, it may significantly influence their feelings of closeness and marital satisfaction, which in turn may contribute to their individual psychological health (Graham, 2008). These findings are promising in that they suggest potential mediators for negative health outcomes and a potential avenue for treatment.

More physical exercise is common among sexually active elderly individuals, and thus may indirectly affect emotional intimacy (Anderson, 1998). Physical exercise may also have interpersonal benefits for couples due to its link with mental health, which has been highlighted in current research as being associated with relationship functioning. Fortier, Guerin, Williams, and Strachan (2015) argued that one simple and natural way to improve positive affect is to

engage in regular physical activity. Women appear to be particularly responsive to the affective benefits of physical activity, but there is a general strong positive correlation between good mood and physical activity among men and women (Fortier, Guerin, Williams, & Strachan, 2015). Physical exercise, in general, promotes better life satisfaction and organic functional capabilities (Anderson, 1998). Little research addresses the connection between physical activity and relationship satisfaction. The proposed study will fill gaps in the literature that will improve our conceptual understanding of how these two variables are related.

Current research suggests that physical activity may have an association with improved sexual function and activity. Multiple studies have assessed the relationship between physical activity and erectile dysfunction (ED). Many of these studies have reported that higher amounts of exercise are correlated with improved sexual functioning (Bacon et al., 2003; Esposito et al., 2004). Interestingly, a meta-analysis found a dose-response relationship between erectile dysfunction and exercise, suggesting that as men engaged in higher levels of physical activity, they experienced less incidence of ED (Cheng, Ng, Ko, & Chen, 2006). Overall, individuals who engage in mild to moderate levels of exercise reported lower rates of sexual dysfunction compared to those who did not exercise at all (Paiva et al., 2016). Further, scheduling consistent bouts of exercise improved orgasm function in some individuals (Lorenz & Meston, 2014).

Other cross-sectional and longitudinal studies have shown strong positive associations between physical activity and sexual satisfaction (Gerber, Johnson, Bunn, & O'Brien, 2005; Greendale, Hogan, & Shumaker, 1996). For instance, among menopausal women, more physical activity was associated with greater sexual satisfaction (Dennerstein, Lehert, Guthrie, & Burger, 2007), as well as better overall sexual functioning (Greendale, Hogan, & Shumaker, 1996). For individuals diagnosed with depression and/or prescribed anti-depressant medication, physical

activity not only was associated with a reduction in symptoms of depression, but also appeared to improve sexual functioning, especially for antidepressant-induced sexual dysfunction (Hoffman et al., 2009). As one possible mechanism explaining the link between sexual arousal and exercise, moderate physical activity before the presentation of sexual stimuli may increase the sympathetic nervous system activity, particularly for women (Meston & Gorzalka, 1996; Lorenz & Meston, 2014). Lastly, sexual inactivity may also have detrimental effects, including cardiovascular risk factors and other conditions such as diabetes, high cholesterol, and hypertension (Bach, Mortimer, Vandewwerd, & Corwin, 2013).

APPENDIX B

ADDITIONAL RESULTS

To test hypotheses, we utilized multilevel modeling (MLM), which is suggested by Campbell and Kashy (2002) when estimating the APIM. MLM estimates all model parameters within a single equation (Cook & Kenny, 2005) and in doing so, allowed us to account for within subject variability due to measurement error (Kenny, 1996). With heterosexual couples, a two intercept APIM model with distinguishable dyads was performed to assess the actor and partner effects for men and women separately (Cook & Kenny, 2005). For same-sex couples, we used APIM for indistinguishable dyads. Estimates of effects from the variables were interpreted as unstandardized regression coefficients (Kenny, Kashy, & Cook, 2007). Therefore, a two-intercept APIM model was used to estimate the partner and actor effects for each spouse separately (Cook & Kenny, 2005). For the mediation hypotheses, we followed recommendations for testing mediation with dyadic data (West, Popp, & Kenny, 2008; Kenny, Korchmaros, & Bolger, 2003). Specifically, initial direct MLMs were ran to determine that (a) the independent variable significantly predicted the dependent variable, (b) the mediator significantly predicted the dependent variable, and (c) the independent variable significantly predicted the mediator. These paths were not significant, therefore, a full MLM was not conducted with the independent variable and mediator entered into the same model. Due to non-significance, mediation was not possible. Additionally, due to the inability to reliably match couples and this process failing, the planned MLM's according to APIM were unable to be conducted.

We hypothesized that:

1) Actor physical activity (PPAQ) would be correlated with actor dyadic adjustment (RDAS total), sexual satisfaction (GMSEX), and self-esteem (RSES).

2) Physical activity (PPAQ), sexual satisfaction (GMSEX), and self-esteem (RSES), would account for a significant proportion of the variance in dyadic adjustment (RDAS total).

3) Sexual satisfaction (GMSEX) would mediate the relationship between physical activity (PPAQ) and dyadic adjustment (RDAS total). Specifically, we hypothesized actor-actor, partner-actor, partner-actor, and partner-partner mediation.

4) Self-esteem would mediate the relationship between physical activity (PPAQ) and dyadic adjustment (RDAS total). Specifically, we hypothesize actor-actor and actor-partner mediation.

APPENDIX C

INFORMED CONSENT NOTICE

University of North Texas Institutional Review Board

Before agreeing to participate in this research study, it is important that you read and understand the following explanation of the purpose, benefits, and risks of the study and how it will be conducted. You must be 18 years of age or older to participate. Your participation is completely voluntary and you may withdraw at any time.

Title of Project: Relationship Functioning in Romantic Contexts

Principal Investigator: Shelley Riggs, Ph.D., Associate Professor, University of North Texas (UNT) Department of Psychology

This research study has been reviewed and approved by the UNT Institutional Review Board (940.565.4643). Contact the UNT IRB with any questions regarding your rights as a research subject.

Purpose of the Study:
You are being asked to participate in a research study investigating how romantic relationships are impacted by dating mediums and fitness level and how these may relate to mental health and interpersonal satisfaction outcomes. The primary goal of this study is to learn what factors help or hinder the overall functioning of individuals in romantic and domains, which will inform couple therapeutic interventions.

Study Procedures:
We are asking you to complete 8 brief online questionnaires regarding your dyadic experiences in romantic and parental contexts. Your participation is voluntary. We anticipate that it will take you approximately 15-25 minutes to complete the questionnaires.

Foreseeable Risks:
Participation in this online survey involves risks to confidentiality similar to a person's everyday use of the Internet. Although not expected, it is possible that you may experience some discomfort as a result of the questions asked in this survey. If excessive discomfort is experienced, you may choose to stop answering questions at any time without penalty. If you feel that you need to discuss your discomfort further, please contact the researcher who will refer you to appropriate services. If your need is urgent, please consider contacting the National Suicide Prevention Lifeline (1.800.273.8255)

The researchers have tried to prevent any problem that could happen because of this research, but the study may involve risks to the subject that are currently unforeseeable. You may contact the researchers if there is a problem, and they will do their best to help you. However, the University of North Texas does not provide medical services or financial assistance for problems that might occur as a result of taking part in this research.

Benefits to the Subjects or Others:
This study is expected to allow us to better understand the impact of several psychosocial variables related to interpersonal and psychological functioning. The indirect benefit of your

participation may be your contribution to the knowledge base regarding the effects of marital aspects on mental health.

Compensation for Participants:
If you choose to do so, your identification code will be entered into a raffle for the possibility of winning a $25 VISA gift card.

Procedures for Maintaining Confidentiality of Research Records:
All information gathered in this study will be kept confidential to the extent that is allowed by law. A number of steps will be taken to minimize the risk of loss of confidentiality. The survey will include no identifying information. A code, rather than your name, will be used by the researchers. Only the Principal Investigator and research assistants will have access to the data. The data collected will not be shared with any individuals or agencies, and will only be used for research or educational purposes. It is anticipated that the research will be published in a psychological journal; however, no identifying information will be included in any publication of the data collected in this study.

Questions about the Study:
You may contact the Principal Investigator at 940.565.2671 or by email at riggs@unt.edu or send an email to the project's graduate student researchers at familyattachmentlab@unt.edu

Please print this consent form for your records.

By clicking the "I Accept" button below, you are agreeing that you understand your rights as a research subject, and you voluntarily consent to participate in this study. You also understand what the study is about and how and why it is being conducted.

If you agree to participate in this study, please click the "I Accept" button below. If you choose not to participate, please click the "Reset" button and close your browser.

I accept, proceed to survey

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