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Effects of Exercise on Clinical Couple Interactions

Samantha Karma-Jean Simpson

A thesis submitted to the faculty of
Brigham Young University
in partial fulfillment of the requirements for the degree of
Master of Science

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ABSTRACT

Effects of Exercise on Clinical Couple Interactions

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Master of Science

Research has shown that exercise has the potential to improve couple relationships. This study contributes to current literature by examining the associations between exercise, its duration, and its intensity and daily clinical couple interactions. Participants were 22 married couples in a treatment-as-usual setting who completed daily diaries about daily behaviors and marital interactions. Multilevel models were run, and results showed that wives who exercised were more likely to report a negative interaction with their husband that day. When wives exercised longer, both they and their husbands were more likely to report positive interactions that day. Interestingly, if husbands exercised longer on a given day, their wives were less likely to report positive interactions and there was no association between husbands' perception of interactions and their own exercise duration. Finally, we found that when wives exercised more intensely, both she and her husband were less likely to report positive marital interactions. These results have implications for clinicians working with couples in therapy.

Keywords: exercise, couple therapy, marital interactions, therapy interventions, daily diary

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Effects of Exercise on Clinical Couple Interactions

Marriage and family therapy has been shown to be effective in improving the relationships of most couples in therapy (Lebow, Chambers, Christensen, & Johnson, 2012; Shadish & Baldwin, 2003; Sprenkle, 2012); however, some clients do not see progress. In one study, nearly one third of couples did not improve over the course of therapy (Whisman & Snyder, 1997). Another study found that only half of treated couples showed significant improvement, and some cases even showed significant deterioration (Snyder, Castellani, & Whisman, 2006). In contrast, recent research has also found that couple therapy facilitates positive change for approximately 70% of couples who report distress going into therapy (Lebow et al., 2012). These contradicting findings indicate that there is still much we don't understand about which factors may make the difference between couples whose relationships improve in therapy, and those that do not.

Studies have examined a variety of factors that may predict change in individual and couple therapy. They have studied factors such as client factors (i.e. personality, religious background, attachment security, emotional control, etc.; Dalglish et al., 2015; Karam, Blow, Sprenkle, & Davis, 2015), therapist factors (i.e. skill, trustworthiness, etc.; Wampold, 2001), therapeutic alliance (Dalglish et al., 2015), and therapeutic models and interventions used in session (Doss, Thum, Sevier, Atkins, & Christensen, 2005). Potentially impactful areas that have seen little attention, however, are how clients' physiology, physical exercise, sleep hygiene, and mindful meditation practices may influence couple processes and their process of change in couple therapy.

Stephen Porges's Polyvagal Theory (2007) explores humans' physiological stress response and how we recover from stressors or threats to our safety. While Porges's work makes

no direct connections to how these processes might impact couple interactions, the principles found within Polyvagal Theory are relevant to the present study. In this study, we utilize Porges's theory, combined with findings in existing literature, to bridge the theoretical gap between human physiology and couple relationships.

This notion is supported by various studies showing that physical exercise can help balance emotional responses (Deslandes et al., 2009; Smith, 2006; Stathopoulou, Powers, Berry, Smits, & Otto, 2006), improve therapy client outcomes (Johnson, Mennenga, Ellsworth, & Nancoo, 2012), and predict higher marital quality (Eisenberg, Hofer, & Vaughan, 2007; English, John, & Gross, 2013; Frye-Cox & Hesse, 2013; Ledermann, Rudaz, Guy Rudaz, & Bradbury, 2010; Levenson, Haase, Bloch, Holley, & Seider, 2014; Thompson, 1991). By improving one's emotional reactivity to anxiety-producing interactions and events (Johnson, Bradford, & Miller, 2015), physical exercise may thus better equip individuals to handle individual and relationship stressors. Therefore, we suggest that physical exercise may be a helpful factor in improving the relationships of clinical couples.

In addition to examining whether one's individual exercise influences their marital interactions, this study also investigates whether one spouse's reports of exercise are also linked to their marital interactions that day. Examining such partner effects makes sense in the context of Polyvagal Theory, because if one spouse's emotional responses are being influenced by their daily exercise or lack thereof, the other spouse's reports of marital interactions (whether positive or negative) are likely to be influenced, as well. Theoretically, as either spouse exercises, they can increase their ability to balance emotional responses (Deslandes et al., 2009; Smith, 2009; Stathopoulou et al., 2006). Because humans are known to unconsciously mirror the emotions and autonomic nervous system responses of other people (Decety, 2011), it can be assumed that as

one spouse increases their ability to balance emotional responses, similar emotional responses may be observed in the other spouse. Therefore, the other spouse, who may not have exercised that day, may still be more likely to report improved interactions with their spouse if their spouse has exercised.

The purpose of this study is to evaluate the role of physical exercise in improving the interactions of couples in therapy by examining data from clinical couples' daily self-reports of exercise and relationship interactions. We hypothesize that greater duration and intensity of exercise will predict increased reports of positive couple interactions and decreased negative couple interactions scores recorded at the end of that day. The results of this study will inform clinicians' suggestions regarding habits that may improve couple relationships.

Literature Review

Within the framework of Polyvagal Theory (Porges, 2007), this study will examine the relationship between physical exercise and the daily relationship interactions of clinical couples. In this section we outline the basic assumptions of Polyvagal Theory and the literature that supports it. Additionally, we define the variables of relationship interactions and physical exercise and describe their importance in understanding the role of physiology in couple relationships.

Polyvagal Theory

Porges' (2007) Polyvagal Theory suggests that the Autonomic Nervous System plays a role in emotional regulation and relationship functioning. When individuals perceive a threat to their safety, the sympathetic nervous system (SNS) is activated to initiate either a fight/flight or freeze response. This deactivates the parasympathetic nervous system (PNS), a system essential for social engagement and connection. In order to maintain a physiologic profile conducive of

connection, spouses must learn to activate the parasympathetic nervous system; to “navigate preconscious, as well as conscious processes, manage physiological and neurological responses to perceived (not actual) threats, and have fewer anxiety-producing interactions” (Johnson et al., 2015, p. 7). Essentially, our ability to connect emotionally with other people finds its roots in biological responses.

Polyvagal Theory states that there are two vagal (neural) pathways that influence the balance between PNS and SNS activation (Porges, 2007). The ability to regulate one’s autonomic reactivity, or balance between social engagement (PNS) and safety/protection (SNS) responses (i.e. vagal tone) has been linked to relationship functioning in that couples with high reactivity exhibit increased conflictual interactions, whereas couples with low reactivity indicate fewer conflictual interactions (Roisman, 2007). Research by Daniel Siegel (2015) suggests that each individual has an autonomic “window of tolerance,” which marks their physiological capacity to respond to perceived threats without over-activating the SNS. A wider window of tolerance means a spouse can endure more stress before engaging in a fight or flight response, and an individual with a higher vagal tone has greater ability to calm down more quickly after the fight or flight response activates, instead of feeling anxious or angry for long periods of time (Johnson et al., 2015; Porges, 2011; Siegel, 2015).

Using this theoretical framework, which helps explain the *why* and *how* behind positive and negative couple interactions, this study aims to explore how couples in therapy can improve their interactions by moderating physiological processes. Physical exercise, specifically, has been shown to improve autonomic regulation, which can help couples better manage relationship interactions. When one exercises regularly, for example, the window of tolerance (Siegel, 1999) can widen and vagal tone may improve (Johnson et al., 2012; Johnson et al., 2015), which could

improve couples' ability to navigate relationship stressors without becoming emotionally flooded. Essentially, when clients implement even small amounts of exercise into their daily routine, they can improve their physiological capacity to balance the activation of their social engagement response (PNS) and their defend/protect response (SNS). In turn, this increased capacity to balance the PNS and SNS may promote improved marital interactions by facilitating improved autonomic physiology, emotional behavior, and emotional experience (Ben-Naim Hirshberger, Ein-Dor, & Mikulincer, 2013).

Physical Exercise

A growing body of research shows that physical exercise is vital to maintaining and improving mental health. One study, for example, found that overweight participants in a 12-week pedometer-based walking program who walked 10,000 steps or more each day had significantly lower anxiety, depression, anger, fatigue, and total mood distress scores when compared to their scores before intervention (Yuenyongchaiwat, 2016). Another study examining physical activity, occupational stress, and mental health found that higher levels of physical activity are correlated with resilience to occupational stress and good mental health (Gerber, Jonsdottir, Lindwall, & Ahlberg, 2014).

Exercise has been shown to improve chemical processes that regulate mood and stress. Studies have shown that physical exercise may stimulate the release of the neurotransmitters serotonin (Dremencov, Lapinova, Lacinova, & Jezova, 2015) and dopamine (Craft & Perna, 2004), which help maintain mood balance, prevent depression, and promote a sense of reward. In other research, low-intensity exercise has been shown to reduce levels of cortisol, a hormone that is released alongside stress (Hill et al., 2008). These studies support the idea that exercise has the

potential to improve spouses' general functioning and pre-conscious and conscious responses to positive and negative relationship interactions.

Potential Relational Benefits of Exercise

While research has established that exercise benefits to the physical and mental health of individuals, researchers are only beginning to explore how exercise may influence couple relationships, and even these findings are often contradictory. Recent research, for example, has indicated that couple relationships benefit from individual and especially conjoint couple exercise (Yorgason, Johnson, Hill, & Selland, 2018). In contrast, a recent study of clinical couples found that the number of hours that female spouses spent exercising predicted an increase in argument intensity between the couple, (Johnson et al., 2017). Another recent study found no significant relationship between daily exercise and partners' daily rating of their relationship, but a positive relationship between exercising and how partners felt about themselves (Johnson et al. 2018). The task at hand, therefore, is to parse out why existing results have been so mixed.

Our study is similar to two innovative studies that also examined the role of exercise in couple relationships. Yorgason et al. (2018) recently performed a study of 192 older, heterosexual, married, nonclinical couples (59 to 63 years of age), drawing a secondary sample from the Family Legacy Study (Call, Otto, & Spenner, 1982; Otto, Call, & Spenner, 1981). Their participants, who joined the initial study beginning in 1966, were contacted in 2010 and completed daily diary surveys across 14 days that measured the presence of exercise (exercised or did not), whether they exercised individually or conjointly, and positive and negative marital events. In their analyses, Yorgason et al. (2018) controlled for education, number of times married, and number of years in their current marriage. Although they collected data for duration

and intensity of exercise, these data were not used in their analyses. Results indicated that individual exercise on a given day was associated with more positive marital events and higher daily marital satisfaction, and patterns in these results were more consistent for wives than for husbands. Conjoint exercise on a given day was also associated with nearly all marital outcomes for both husbands and wives (Yorgason et al., 2018), suggesting that couples who exercise together may experience more positive outcomes.

Another study similar to ours was performed by Johnson et al. (2017). Their sample consisted of 36 heterosexual couples in couple therapy who completed surveys for an average of 16.4 days (767 couple days total). The average age of male participants was 30.1 years ($SD = 6.7$), and the average age of female participants was 28.8 years ($SD = 6.0$), differing greatly from the older sample in the study performed by Yorgason et al. (2018). The study analyzed data for reported relationship satisfaction and stress, arguments, presence of exercise, and hours spent exercising. Their study did not account for whether couples exercised independently or conjointly. Unexpectedly, their results showed a positive relationship between female hours of exercise and argument intensity for both spouses. The number of hours males exercised was not significantly related to any variables, but male daily stress was positively related to female report of argument intensity. Their findings suggest that although there is empirical support of the benefits of exercise for individuals, clinical couples may also experience increased argument intensity in relation to exercise.

We hope to disentangle the contradicting existing findings of these by examining the influences of variables not previously researched in regard to exercise and marital interactions. In the present study, we control for negative marital interactions and satisfaction with marital interactions, which no study, to our knowledge, has done before. Additionally, we include sleep

duration and sleep quality as covariates, because sleep has been empirically linked to marital interactions (Yorgason et al., 2016). Finally, the present study is the first, to our knowledge, that has examined how intensity of exercise may impact couple interactions. It is important to note that even within the clinical samples, none of the three studies discussed above included exercise as a clinical assignment; if participants reported exercise, it was because they chose to exercise as part of their routine that day and not as a mandated task.

Present Study

Using daily diary responses from the first four sessions of couple therapy, this study addresses daily influences of spouses' exercise on their relational interactions. Utilizing the principles of Polyvagal Theory (Porges, 2007), this study aims to provide clinicians with information that may inform their treatment of clinical couples. In particular, we examined the following hypotheses:

1. Husbands and wives report increased positive marital interactions on days when they or their spouse exercise.
2. Husbands and wives report decreased negative marital interactions on days when they or their spouse exercise.
3. Husbands and wives who exercise for longer periods of time will report increased positive marital interactions when they or their spouse exercise.
4. Husbands and wives who exercise for longer periods of time will report decreased negative marital interactions when they or their spouse exercise.
5. Husbands and wives who exercise with more intensity will report increased positive marital interactions on days when they or their spouse exercise.

6. Husbands and wives who exercise with more intensity will report decreased negative marital interactions on days when they or their spouse exercise.

Method

Procedures

This study draws from data obtained from the Changing Hearts and Minds in Relationships (CHAMPS) project, in which a variety of physiological and relational data were collected in order to better understand the role of physiology in couple therapy. Upon consenting to participate in the CHAMPS study, couples participated in four couple therapy sessions. Over the course of these sessions, each spouse filled out a daily diary survey that was emailed to both spouses each day. Each daily diary survey included questions regarding sleep, exercise, stress levels, events with one's spouse that day, satisfaction surrounding couple interactions that day, emotions concerning one's spouse, and music listened to that day. In addition to the daily diaries, physiological data was collected on a daily basis through accelerometers, in session through electrodes worn by clients and therapist, and through two MRI scans performed immediately before and after four sessions of therapy. For the purposes of this study, only daily diary data was used in data analyses.

Participants

Twenty-two married couples seeking couple therapy at a university clinic were recruited for our study by being asked at intake if they would like to participate in the CHAMPS study as part of their couple therapy experience. Participating couples were required to have been married for at least one year, have no substance abuse or addictions, and have at least one spouse with a score below 13.5 on the CSI-4 (Couple Satisfaction Index; Funk & Rogge, 2007) indicating clinical levels of marital distress. Each participant was compensated with a digital copy of their

MRIs, four free sessions of couple therapy, and \$200 (\$400 per couple). The average household income of our sample was between \$35,000 and \$45,000, and each couple had an average of 2.6 children.

Males. The males in our sample had an average age of 30.14. Among them, 23.8% (n = 5) had Bachelor's degrees, 4.8% (n = 1) had attended vocational or technical schools, 47.6% (n = 10) had attended some college, and 23.8% (n = 5) had Master's or professional degrees. Males had a racial distribution of 71.4% White, European Descent (n = 15); 4.8% Black, African Descent (n = 1); 9.5% Asian (n = 2); and 14.3% Hispanic (n = 3). Among them, 4.8% reported having no religious or spiritual preference (n = 1), 9.5% reported being believers with no organized religion (n = 2), and 85.7% were Mormon/LDS (n = 18).

Females. The females in our sample had an average age of 28.6. Among them, 14.3% (n = 3) had GEDs or high school degrees, 14.3% (n = 3) had Associate degrees, 28.6% (n = 6) had Bachelor's degrees, 4.8% (n = 1) had attended vocational or technical schools, 33.3% (n = 7) had attended some college, and 4.8% (n = 1) had Master's or professional degrees. Females had a racial distribution of 90.5% White, European Descent (n = 19); 4.8% Asian (n = 1); and 4.8% Hispanic (n = 1). Among them, 4.8% (n = 1) reported having no religious or spiritual preference, 4.8% (n = 1) reported being believers with no organized religion, and 90.5% (n = 19) were Mormon/LDS.

Measures

Daily relationship interactions. Modified versions of the Daily Perceptions of Spousal Support and Negative Spousal Behavior scales will be used to measure positive and negative marital events on a daily basis (Neff & Karney, 2005). These scales were modified to change the reference to "partner/spouse," rather than "spouse," and add five marital events to the original

list. Positive items include: a partner helping with something important, saying something that made them feel loved, a partner listening to or comforting them, sharing physical intimacy, enjoying a leisure activity with a partner, and providing care for one's partner. Negative items include: having an argument with a partner, a partner letting them down or breaking a promise, being criticized by one's partner, and being unable to spend time with one's partner. Each partner indicated whether each event had happened to them that day (1 = Yes, 0 = No), and a count of positive and negative events comprised the two scales.

Exercise. This construct was measured through daily diaries completed by each spouse. Both members of the couple reported each evening whether they exercised that day, the duration of the exercise in minutes, the intensity level of the exercise (1 = barely hard, 5 = average, 10 = extremely hard), and the kind of exercise they did (i.e. run, walk, lift weights, etc.). Participants did not specify whether they exercised alone or with someone.

Covariates. Several covariates were included in our analyses because of their empirical links to the research hypotheses at hand. Daily stress, for example, was included because it has been linked to marital argument intensity (Johnson et al., 2017). Additionally, negative relational interactions and satisfaction with marital interactions were entered into our analyses as covariates in order to have results that focused solely on the interactions at hand. Finally, quality and duration of sleep were included as covariates because of sleep's empirical links to marital interactions as mediated through mood (Yorgason et al., 2016).

Data Analysis Strategy

Multilevel models were run in IBM SPSS Statistics 25 software to examine associations between exercise, exercise duration, exercise intensity, daily positive marital interactions, and daily negative marital interactions. Because this study collected data nested within couples on

multiple points across time, there are two sources of non-independence that must be taken into account during analyses: within individuals across time and between spouses in a marriage (Johnson & Miller, 2014). Multilevel models allowed us to determine the effects of exercise on both individuals over time as well as on the marital relationship, accounting for non-independence (Gonzalez & Griffin, 2012). Because this study is largely exploratory, and we wanted to examine as many factors as possible in relation to couple interactions and exercise, we ran two multilevel models for each of our six research questions, with the alpha level set at .05.

It should be noted that our measurement for minutes that participants exercised contained several outliers, with two instances of husbands exercising for more than three hours, and fifteen instances of wives exercising for more than three hours. Upon checking for whether these were within-person outliers, we found that these were largely from one female participant engaging in an exercise on many occasions, and two other participants engaging in long periods of exercise that were atypical for them within the time frame of our study. Removing these outliers from our analyses made no statistical difference in the results of our multilevel models, so we left them in.

Results

Preliminary analyses were conducted to describe exercise frequency, intensity, and duration for both husbands and wives (see Table 1). Husbands and wives reported exercising on 29% and 36% of the days in the study, respectively. Husbands reported exercising for an average of approximately 16 minutes per day at an average intensity of 5.6 out of 10, whereas wives reported exercising for an average of 22 minutes per day at an average intensity of approximately 5.5 out of 10. In terms of marital interactions, husbands and wives reported a negative marital interaction on approximately 70% of days, and approximately two positive marital events on any

given day during the study. We ran two multilevel models for each of our six research questions, the results from which are outlined in this section.

Table 1.

Descriptive Statistics for the Sample (n = 22 couples)

Variable	<i>M</i>	<i>SD</i>	Range	<i>n</i> ^a
Exercise				
Husband exercise	.29	0.46	0-1	662
Wife exercise	.36	0.48	0-1	701
Husband exercise minutes	16.04	33.43	0-300	666
Wife exercise minutes	21.61	47.91	0-560	708
Husband exercise intensity	5.59	1.86	1-10	194
Wife exercise intensity	5.46	2.13	1-10	252
Positive marital interactions				
Husband	1.82	1.74	0-6	803
Wife	2.10	1.75	0-6	803
Negative marital interactions				
Husband	.65	0.94	0-4	803
Wife	.70	1.02	0-4	803

Note. ^aNumber represents the number of days reported across all daily reports.

Hypothesis 1: Husbands and Wives Will Report Increased Positive Marital Interactions on Days When They or Their Spouse Exercise.

In order to answer our first research question, we ran two multilevel models examining whether husbands and wives exercised and whether either spouse's exercise was associated with positive marital interactions on any given day (see Table 2). Stress, negative relational interactions, satisfaction with marital interactions, quality of sleep, and duration of sleep were controlled for because of their potential influences in the relationship between couple interactions and their influence on emotional regulation. Husbands' and wives' exercise were controlled for. Both models were overall non-significant for both husbands (Wald $X^2 = 2.50$, p

= .29) and wives (Wald $X^2 = 0.29$, $p = .87$). There were no statistical associations between exercise and positive marital interactions for husbands who exercised ($b = -.09$, $p = .61$), nor for husbands whose wives exercised ($b = .25$, $p = .12$). Results were also non-significant for wives who exercised ($b = -.04$, $p = .82$) and for wives whose husbands exercised ($b = -.09$, $p = .64$).

Thus, our first hypothesis was unsupported.

Table 2.

Multilevel Model of Husband and Wife Presence of Exercise Predicting Positive Marital Interactions

Variable	Wife			Husband		
	<i>b</i>	<i>SE</i>	<i>p</i>	<i>b</i>	<i>SE</i>	<i>p</i>
Positive marital interactions						
Husband	-.19	.13	.16	.12	.13	.38
Wife	-.04	.15	.77	-.12	.15	.44
Control Variables						
Husband's exercise duration	-.01	.00	.01**	.01	.01	.42
Wife's exercise duration	.01	.00	.00***	.01	.00	.04*
Husband's exercise intensity	.24	.13	.01**	.02	.15	.90
Wife's exercise intensity	-.22	.08	.01**	-.29	.15	.05
Husband's Stress	-.03	.12	.80	.14	.17	.39
Wife's Stress	-.13	.10	.22	-.15	.09	.08
Husband's reported negative interactions	.26	.25	.29	-.19	.35	.58
Wife's reported negative interactions	-.11	.27	.67	-.38	.40	.34
Husband's satisfaction with interactions	.10	.10	.31	.62	.26	.01**
Wife's satisfaction with interactions	.78	.15	.00***	-.02	.25	.94
Husband's sleep quality	.04	.09	.63	.11	.12	.37
Wife's sleep quality	-.01	.12	.91	-.03	.14	.84
Husband's sleep duration	.08	.07	.24	-.06	.07	.39
Wife's sleep duration	.11	.16	.49	-.01	.15	.92

Note: * $p < .05$, ** $p < .01$, *** $p < .001$

Hypothesis 2: Husbands and Wives Will Report Decreased Negative Marital Interactions on Days when They or Their Spouse Exercise.

In order to answer our second research question, we ran two multilevel linear models examining whether husbands and wives exercised and whether either spouse's exercise was associated with negative marital interactions on any given day (see Table 3). Stress, negative relational interactions, satisfaction with marital interactions, quality of sleep, and duration of sleep were controlled for because of their potential influences in the relationship between couple interactions and their influence on emotional regulation. Husbands' and wives' exercise were also controlled for. The model for husbands was non-significant (Wald $X^2 = 1.97$, $p = .37$), but the model for wives was significant (Wald $X^2 = 13.27$, $p = .001$). Contrary to our hypothesis, if wives reported exercising, they were more likely to report a negative marital interaction that day ($b = .28$, $p < .001$) when controlling for if husbands also exercised. There were no statistical associations between exercise and negative marital interactions among husbands who exercised, husbands whose wives exercised, nor among wives whose husbands exercised. Thus, our second hypothesis was unsupported; in fact, we found significant results that contradicted our expected outcomes.

Table 3.

Multilevel Model of Husband and Wife Exercise Predicting Negative Marital Interactions

Variable	Wife			Husband		
	<i>b</i>	<i>SE</i>	<i>p</i>	<i>b</i>	<i>SE</i>	<i>p</i>
Negative marital interactions						
Husband	.10	.09	.23	-.11	.09	.21
Wife	.28	.09	.00***	.09	.10	.38
Control Variables						
Husband's exercise duration	.00	.00	.67	.00	.00	.50
Wife's exercise duration	.00	.00	.88	.00	.00	.25
Husband's exercise intensity	.03	.06	.67	-.08	.07	.26
Wife's exercise intensity	.01	.05	.80	.01	.10	.89
Husband's Stress	-.01	.06	.88	.07	.09	.39
Wife's Stress	.04	.04	.35	-.05	.05	.31
Husband's reported negative interactions	.35	.15	.02*	-	-	-
Wife's reported negative interactions	-	-	-	.41	.14	.00**
Husband's satisfaction with interactions	.20	-.07	.00**	-.36	.06	.00***
Wife's satisfaction with interactions	-.31	.08	.00***	.09	.08	.24
Husband's sleep quality	-.09	.07	.22	.09	.05	.07
Wife's sleep quality	-.03	.05	.85	-.06	.08	.39
Husband's sleep duration	.08	.03	.33	.02	.04	.54
Wife's sleep duration	.35	.07	.23	-.11	.07	.12

Note: * $p < .05$, ** $p < .01$, *** $p < .001$

Hypothesis 3: Husbands and Wives Who Exercise for Longer Periods of Time Will Report Increased Positive Daily Marital Interactions on Days when They or Their Spouse Exercise.

To answer our third research question, we ran two multilevel models examining husbands' and wives' exercise duration and whether it was associated with positive and negative marital interactions on any given day (see Table 4). Stress, negative relational interactions, satisfaction with marital interactions, quality of sleep, and duration of sleep were controlled for because of their potential influences in the relationship between couple interactions and their influence on emotional regulation. The models were significant overall for both husbands and wives (Wald $X^2 = 41269.43$, $p < .001$; Wald $X^2 = 27567.78$, $p < .001$). In support of our third hypothesis, we found that exercise duration was linked to positive marital interactions. First, if the longer wives exercised on any given day, the more likely both she and her husband were to report positive interactions that day ($b = .01$, $p < .001$; $b = .01$, $p = .04$). Interestingly, if husbands exercised on a given day, his wife was less likely to report positive interactions that day, and there was no association with his own perception of interactions and his exercise duration ($b = -.01$, $p = .01$; $b = .01$, $p = .42$). Thus, our third hypothesis was partially supported.

Table 4.

Multilevel Models of Husbands' and Wives' Duration and Intensity of Exercise Predicting Positive Marital Interactions

Variable	Husband			Wife		
	<i>b</i>	<i>SE</i>	<i>p</i>	<i>b</i>	<i>SE</i>	<i>p</i>
Exercise Duration						
Husband	.01	.01	.42	-.01	.00	.01**
Wife	.01	.00	.04*	.01	.00	.00***
Exercise Intensity						
Husband	.01	.15	.90	.01	.15	.90
Wife	-.29	.15	.05*	-.22	.13	.01**
Control Variables						
Husband's Stress	-.15	.09	.08	-.03	.12	.80
Wife's Stress	.15	.17	.39	-.13	.10	.22
Husband's reported negative interactions	-.38	.40	.34	.26	.25	.29
Wife's reported negative interactions	-.19	.35	.58	-.11	.27	.67
Husband's satisfaction with interactions	-.02	.25	.94	.10	.10	.31
Wife's satisfaction with interactions	.63	.26	.01*	.78	.15	.00***
Husband's sleep quality	-.03	.14	.84	.04	.09	.63
Wife's sleep quality	.11	.12	.37	-.01	.12	.91
Husband's sleep duration	-.01	.15	.92	.08	.07	.24
Wife's sleep duration	-.06	.07	.39	.11	.16	.49

Note: * $p < .05$, ** $p < .01$, *** $p < .001$

Hypothesis 4: Husbands and Wives Who Exercise for Longer Periods of Time Will Report Decreased Negative Marital Interactions on Days when They or Their Spouse Exercise.

To answer our fourth research question, we ran two multilevel models examining husbands' and wives' exercise duration and whether it was associated with negative marital interactions on any given day (see Table 5). Stress, negative relational interactions, satisfaction with marital interactions, quality of sleep, and duration of sleep were controlled for. The models were significant overall for both husbands and wives (Wald $X^2 = 280.39$, $p < .001$; Wald $X^2 = 706.35$, $p < .001$). Contrary to our hypothesis, however, we found no significant associations

between exercise duration and negative marital interactions. First, there was no association between positive daily marital interactions and duration of exercise for husbands who exercised ($b = .00, p = .50$), nor for husbands whose wives exercised ($b = .00, p = .25$). Similarly, we found no significant associations for wives who exercised ($b = .00, p = .88$), nor for wives whose husbands exercised ($b = .00, p = .67$). Thus, our fourth hypothesis was unsupported.

Table 5.

Multilevel Model of Husbands' and Wives' Duration and Intensity of Exercise Predicting Negative Marital Interactions

Variable	Husband			Wife		
	<i>b</i>	<i>SE</i>	<i>p</i>	<i>b</i>	<i>SE</i>	<i>p</i>
Exercise Duration						
Husband	0.00	.00	.50	.00	.00	.67
Wife	0.00	.00	.25	.00	.00	.88
Exercise Intensity						
Husband	-.08	.07	.26	.03	.06	.67
Wife	.01	.10	.89	.01	.05	.80
Control Variables						
Husband's Stress	.07	.09	.39	-.01	.06	.88
Wife's Stress	-.05	.05	.31	.04	.04	.35
Husband's reported negative interactions	-	-	-	.36	.15	.02*
Wife's reported negative interactions	.42	.14	.00***	-	-	-
Husband's satisfaction with interactions	-.36	.06	.00***	.20	.07	.00***
Wife's satisfaction with interactions	.09	.08	.24	0.31	.08	.00***
Husband's sleep quality	.09	.05	.08	-.09	.07	.22
Wife's sleep quality	-.06	.08	.39	-.01	.05	.85
Husband's sleep duration	.02	.04	.55	-.03	.03	.32
Wife's sleep duration	-.11	.07	.12	.08	.07	.23

Note: * $p < .05$, ** $p < .01$, *** $p < .001$

Hypothesis 5: Husbands and Wives Who Exercise More with More Intensity Will Report Increased Positive Marital Interactions on Days when They or Their Spouse Exercise.

In order to answer our fifth research question, we ran two multilevel models examining husbands' and wives' exercise intensity and whether it was associated with positive and negative marital interactions on a given day (see Table 4). Stress, negative relational interactions, satisfaction with marital interactions, quality of sleep, and duration of sleep were controlled for. The models were significant overall for both husbands and wives (Wald $X^2 = 41269.43$, $p < .001$; Wald $X^2 = 27567.78$, $p < .001$). Contrary to our hypothesis, we found that when wives exercised more intensely, both they and their husbands were less likely to report positive marital interactions ($b = -.22$, $p < .01$; $b = -.29$, $p = .05$). There was no significant relationship, however, between positive marital interactions and exercise intensity for husbands who exercised, nor for wives whose husbands exercised. Thus, our fifth hypothesis was unsupported; in fact, we found significant results that contradicted our expected outcomes.

Hypothesis 6: Husbands and Wives Who Exercise More with More Intensity Will Report Decreased Negative Marital Interactions on Days when They or Their Spouse Exercise.

In order to answer our sixth research question, we ran two multilevel models examining husbands' and wives' exercise intensity and whether it was associated with negative marital interactions on a given day (see Table 5). Stress, negative relational interactions, satisfaction with marital interactions, quality of sleep, and duration of sleep were controlled for. The models were significant overall for both husbands and wives (Wald $X^2 = 280.39$, $p < .001$; Wald $X^2 = 706.35$, $p < .001$). Contrary to our hypothesis, however, we found no significant associations between exercise intensity and negative marital interactions. First, there was no association between negative daily marital interactions and intensity of exercise for husbands who exercised

($b = -.07, p = .26$), nor for husbands whose wives exercised ($b = .01, p = .89$). Similarly, we found no significant associations for wives who exercised ($b = .01, p = .80$), nor for wives whose husbands exercised ($b = .03, p = .67$). Thus, our sixth hypothesis was unsupported.

Discussion

Previous research has identified various psychological benefits of exercise for individuals (Deslandes et al., 2009; Forcier et al., 2006) as well as for couples (Yorgason et al. 2018). Further, duration of exercise has been linked to couples' daily interactions in a study similar to ours (Johnson et al., 2017). The present study expands upon existing research by examining how the presence of exercise, its duration, and its intensity may predict daily reports of positive and negative marital interactions among 22 couples in therapy. In partial support of our hypotheses, there were various links between exercise and marital interactions. The directions of those relationships, however, were mixed, and several of them even contradicted our original hypotheses that husbands and wives who exercised would report better interactions with their spouse.

Presence of Exercise and Marital Interactions

Our hypothesis that husbands and wives who exercised and whose spouses exercised would report better marital interactions, for example, was unsupported, in that wives who exercised on a given day actually reported more frequent negative interactions with their husbands. Although this study is the first to find that wives' exercise may predict increased frequency of negative marital interactions, this finding is similar to previous work that found a positive relationship between wives' hours of exercise and argument intensity for both spouses (Johnson et al., 2017). While both such findings do not coincide with research that suggests that exercise is helpful for couples, this relationship may be explained by the fact that our analyses

don't account for whether exercise happens before or after a marital event. It is possible that the link can be interpreted in this way: as a couple has more negative interactions, the female spouse exercises more.

If our findings are accurate, however, and wives who exercise on a given day are, in fact, more likely to report more frequent negative interactions with their husbands, this phenomenon could be attributed to the motivations that drive them to exercise. For example, research comparing females' autonomous, intrinsic exercise motives versus external motives has found that only autonomous exercise motives predict higher levels of physical self-esteem (Wilson & Rodgers, 2002). Our study does not include measurements of self-esteem nor of exercise motives, which may be potential potentially moderate the relationship between female exercise and negative marital interactions. In other words, it is possible that if females' motives for exercising are external, such motives may play a part in the increased negative interactions we observed in our sample.

Additionally, it is also possible that the couples in our sample viewed exercise as selfish. There are researchers who have examined personality and exercise motivation, and how those two things play a role in exercise frequency. They have suggested that "it seems that a certain level of 'selfish-ness' is required for the engagement in frequent exercise; time spent at the gym tends to be time devoted to the self" (Lewis & Sutton, 2011, p. 93). It may follow, then that within relationships where the occurrence of female exercise predicts negative couple interactions, exercise may be perceived as something selfish that takes away from the couple relationship. The fact that these findings only exhibited when female partners exercised may explained by differences in the way women and men are socialized around self-care and recreation. In one book about women, doctors, and exercise one author noted that, "few

cultures...have devised the means to encourage women to quest as well as to bear children, while most cultures have devised ways to satisfy men in their constructive activities,” (Vertinsky, 1990, p. 234). It may be that such societal norms continue to exist even today, and that it may be seen as more selfish for female partners than for male partners to take time for exercise. If female exercise is perceived within a marriage as a selfish indulgence, it may explain its association with negative marital interactions.

Exercise Duration and Marital Interactions

Our hypothesis that husbands and wives who exercised longer and whose spouses exercised longer would report better marital interactions showed mixed results and was only partially supported. In general, exercise duration was linked to positive marital interactions, but not negative ones. Further, wives’ exercise duration positively predicted both husband’s and wives’ reports of positive marital interactions, while husbands who exercised longer were actually less likely to report positive marital interactions. We hypothesize that these diverging findings may be attributed to differences in how each spouse perceives their own and their partner’s exercise duration. It may be, for example, that wives who exercise longer view their own time dedicated to exercise as time they do not have to participate in childcare or household work. It is well established that heterosexual women do the majority of household tasks (Bianchi, Sayer, Milkie, & Robinson, 2012; Newkirk, Perry-Jenkins, & Sayer, 2017). Therefore, perhaps when female spouses exercise for longer periods, they see it as “time off” from such responsibilities.

Additionally, when wives exercised longer, we not only observed increases in their own reports of positive marital interactions, but also in the husbands’ reports. This finding supports the notion of partner effects in our hypotheses—that one spouse’s exercise may actually

influence the other spouse's reports of their marital interactions. This may be because wives who spend longer periods of time exercising may also feel more positively toward their husbands because they get to spend time taking care of themselves. This may especially be true if the time wives spend exercising is made possible by husbands then engaging in household tasks normally left to the female spouse. Therefore, the husbands in our sample may have been influenced by their wives viewing them more positively, thus explaining their own reports of increased positive interactions in connected to their wives' exercise duration. It is also possible, however, that there is a direct link between wives' exercise duration and their husbands' increased reports of positive interactions.

Our study also found that as husbands exercised longer, their wives were less likely to report positive marital interactions. It may follow, then, that when husbands spend longer periods of time exercising, wives who bear most of the household responsibilities may view their husbands' time at the gym or spent in recreational sports negatively. It is possible, too, that wives perceive their husbands' longer exercise duration as an indicator of a problem within the relationship. In one study examining the recreation in low-income couples, a male participant reported engaging in independent exercise during times of relational distress (Moore & Henderson, 2018). These findings are congruent with other outcomes that have shown that clinical couples are more likely to perceive a spouse's alone time as rejection due to relationship problems and insecurities (Johnson, 2012; Bowlby, 2005). Because this study did not account for whether couples exercised individually or together, conjoint versus independent exercise within clinical couples is something that should be examined in future research.

Exercise Intensity and Marital Interactions

Our hypothesis that husbands and wives that exercised more intensely and whose spouses exercised more intensely would report better marital interactions was contradicted by our finding that wives' exercise intensity actually negatively predicted both spouses' reports of positive marital interactions. This finding, although contradictory to research that may suggest that exercise improves couple interactions, is similar to recent research showing that wives' exercise may be associated with increased argument intensity between couples (Johnson et al., 2017). Ours is the first study, to our knowledge, to examine the link between exercise intensity and couple interactions.

It is possible, because neither study accounts for order of events, that when couples have a lack of positive marital events, or when they have an argument, females are more likely to exercise more intensely as an emotional outlet. It is also possible, however, that our findings are accurate and that women who exercise more intensely are, indeed, more likely to report fewer positive interactions with their husbands. This may have something to do with the motivation driving them to exercise. In a recent study about the types of motivation driving one's exercise behaviors (Duncan, Hall, Wilson, & Jenny, 2010), researchers found that most exercise behaviors (frequency, duration, and intensity) were predicted across both genders by integrated, or autonomous, regulation. Female exercise intensity, however, appeared to be the only factor driven by introjected regulation. Introjected regulation has been defined as the desire to obtain intrapersonal rewards, (e.g., pride or self-esteem) or to avoid self-inflicted punishments (e.g., guilt or shame). Thus, it may be that the wives in our sample were exercising out of a desire to avoid guilt or shame, both emotions that may be moderating factors in the frequency of positive interactions in clinical couples. In order to disentangle these findings, further research should be

done that examines exercise intensity in the contexts of whether husbands and wives exercise alone, with a friend, in a group, or together as a couple.

Similar to our finding that female exercise duration predicted reports of increased positive interactions from both partners, we found that both partners were less likely to report positive interactions if the wife exercised more intensely. This additional observation of partner effects in our study further supports our hypothesis that one spouse's exercise does have the potential to influence the reports of the other partner regarding marital interactions. It could be that the reports of the exercising partner act as a mediating factor for the second partner's reports: as wives exercise more intensely, they are less likely to report positive interactions, thus reducing the husband's reports of positive interactions. However, it could also be that there is a direct relationship between one partner's exercise and their spouses' reports. Future analyses should be run to determine the exact nature of the partner effects we observed.

Clinical Implications

The present study has implications for clinicians working with couples in therapy. First, therapists should be aware that current research about exercise and its links to couple interaction is mixed. Our study combined with other research shows that sometimes exercise is associated with positive relational outcomes, and sometimes it is associated with negative ones. Because we do not yet have a grasp on what makes the difference between such divergent outcomes, it may be helpful for clinicians to discuss how exercise influences their clients individually and within their specific couple relationship.

Specifically, our findings regarding partner effects may be helpful to couple therapists. We found that when females exercised longer, both partners reported more positive interactions. However, when females exercised more intensely, both partners reported fewer positive

interactions. These findings have two implications for clinicians: First, therapists can mention the opposite nature of these relationships in regards to exercise duration vs. intensity, and discuss with couples how they see duration and intensity of exercise influencing their own relationship. Second, the partner effects we observed can inform the therapy process. Therapists can help spouses consider the implications of one spouse's exercise for the other spouse's experience of their marital interactions that day. This conversation may help spouses recognize perceptions they may or may not have regarding their spouse's exercise behaviors and how they relate to their interactions with each other.

Psychoeducation about the basic assumptions within Polyvagal Theory may also be helpful to couples in therapy. Beyond exercise as a potential way to increase vagal tone, Polyvagal Theory's basic tenets may benefit couples as they navigate the therapy process. Through psychoeducation, couples can better understand the physiological background behind why they may be responding reactively to their spouse, and how they may learn to decrease anxiety-inducing interactions in the future. In this case, it may very well be that knowledge is power for couples experiencing relational distress.

Therapists may also discuss with couples the differences found between conjoint and independent exercise and how they relate to couple interactions. We do know from a non-clinical study that exercising together seems to be related with positive marital outcomes (Yorgason et al., 2018), whereas independent exercise has shown mixed relationships with couple interactions. In having conversations with clinical couples about exercise, it may be helpful for therapists to discuss the role that conjoint exercise has had in their relationship thus far, and whether they might see it as a potentially helpful tool throughout the time of therapy.

In discussing independent exercise with couples, it may be helpful to talk with spouses about a variety of factors that may potentially influence whether such exercise is linked to positive or negative relational interactions. Therapists may ask, for example, how each spouse perceives the other's time spent exercising away from them. Do they view this time apart as an indication of problems in the relationship? Does it bring up feelings insecurity? In cases where one spouse bears the majority of household tasks, is time exercising perceived as time spent shirking family responsibilities? What is one's motivation for exercise, and how does that relate to their self-esteem and relational interactions? Such questions may help clinicians get to the heart of whether exercise may be utilized as a helpful intervention.

Limitations and Strengths

The present study is limited by several factors that may have impacted our findings. For example, our sample had an average household income of between \$35,000 and \$45,000 and most of our participants had attended at least some college. Couples with lower education or income may not have as much discretionary time to exercise and may experience different results if they were to exercise together given different life contexts and stressors. We suggest that the present study be replicated with a focus on how exercise may influence couples of various income and education levels differently.

Further limiting our results is the lack of information about the context in which exercise was performed. One crucial factor to look at, for example, is whether spouses exercised alone, with a friend, in a group, or together as a couple. It is possible that each of those contexts may influence marital interactions differently. More research is needed, too, to flesh out the contradicting results we found here in terms of exercise's effects on marital interactions, particularly when it comes to the duration and intensity of exercise. It is important to note that

the effects of exercise may be curvilinear and that at some point, increasing the frequency, duration, or intensity of exercise may no longer increase its effects on couple interactions.

Additionally, future studies about the effects of exercise should increase the focus of their measurements on clients' physiology. It is possible, for example, that the measures we used to observe relationship interactions contained individual items that may not be sensitive to changes in vagal tone. Several items, such as "providing care for one's partner," "a partner letting them down or breaking a promise," or "being unable to spend time with one's partner," may have only weak associations with changes in vagal tone, which would potentially impact the relationship between exercise and relationship interactions. Another way to build upon this study's physiological focus would be to use physiological data instead of daily diary reports. The greater CHAMPS project from which this study is derived contains respiratory sinus arrhythmia (RSA) data, the quantification of which has shown to be a reliable, noninvasive tool for investigating vagal tone (Hayano et al., 1990). The RSA data was not prepared in time for this study, however, so it was not included alongside the daily diary responses.

Finally, our study ran multiple models in order to examine a large number of hypothesis. This method allowed us to gain a broad, exploratory view of how exercise, its duration, and its intensity may be linked to the interactions of clinical couples. However, our large number of statistical models increases the risk for type I error. Therefore, future researchers examining any of these constructs may benefit from running fewer models and narrowing their research questions so that more specific analyses can be performed.

Despite these limitations, our findings add to the growing body of research linking physical activity and marital functioning. We believe that by including additional contextual factors surrounding spouses' exercise, we may gain insight into why our results were mixed. Future

researchers should examine the roles that exercise motivation, conjoint exercise, and relational distress may play in the link between exercise and marital interactions.

Conclusion

A number of factors influence clinical couples' marital interactions, and it is important that clinicians and researchers understand the potential influences of healthy lifestyle behaviors in the context of couple therapy. Clinicians wanting to use exercise as a clinical intervention should be aware of the potential for decreased positive interactions and increased negative interactions between couples and discuss with their clients how it may influence them. The current information available on exercise, its duration, and its intensity, as well as how they relate to marital functioning, is sparse. Future research should consider couple factors that may influence the link between exercise and marital interactions, as well as contextual factors surrounding spouses' exercise behaviors.

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