DUAL EFFECTS MODEL OF SOCIAL CONTROL: EXTENDING THE MODEL TO 24-HOUR HEALTH BEHAVIOR

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The Supervisory Committee certifies that this ***disquisition*** complies with North Dakota State University's regulations and meets the accepted standards for the degree of

MASTER OF SCIENCE

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ABSTRACT

The Dual Effects Model of Social Control suggests that partners can positively and negatively influence the health behaviors of their partner. However, the model fails to consider the impact of control on non-targeted health behaviors, such as sleep. The current study sought to expand this model by including sleep continuity and duration as outcomes related to control efforts targeting diet and exercise. Partner control and objective sleep data were collected via daily sleep diaries and Fitbit Charge HR. Regression models were used to test the direct and indirect effects of control on sleep duration and continuity and the extent to which affective response mediates this relationship. Negative control had a significant effect on negative affect, but not on sleep continuity or duration. Positive control had a significant effect on positive affective response, but the full mediation model was not supported. Recommendations for future research using the proposed model are discussed.

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INTRODUCTION

Over the past several decades, a plethora of evidence has accumulated which demonstrates the relevance of biobehavioral factors on human health and functioning. For example, excessive alcohol use (Room, Babor, & Rehm, 2005), smoking (Ezzati & Lopez, 2003), and unhealthy diet (Correia & Waitzberg, 2003; Klahr et al., 1994) have been implicated in the development and maintenance of several chronic diseases. However, the majority of evidence to date is missing several key considerations. First, health behaviors do not occur in isolation of each other and change in one often results in change of another (Johnson et al., 2008), and many models of health behavior change do not take this into account. Second, the literature largely consists of waking health behaviors, but Irish and colleagues (2014) have promoted a 24-hour approach to the study of health and behavior that includes both waking health behaviors and sleep. Sleep is a physiological process that is strongly influenced by behavioral choices (e.g., sleep timing, sleep environment), and poor sleep has also been associated with morbidity (Cappuccio et al., 2008; Chandola, Ferrie, Perski, Akbaraly, & Marmot, 2010; Yaggi, Araujo, & McKinlay, 2006) and all-cause mortality (Cappuccio, D'Elia, Strazzullo, & Miller, 2010). Thus, evaluating health-related behavior from a 24-hour perspective allows for the inclusion of all relevant biobehavioral factors in the study of health and illness. Lastly, it is important to note that many health-related behaviors occur in a social context. Although the majority of health behavior research considers only the individual, evaluation of health behaviors in a dyadic context would further expand our understanding of social and behavioral influences on health. This paper will first review the literature using the Dual Effects Model of Social Control (a theoretical framework describing the pathways that underlie social control's influence on health), then provide rationale and support for the inclusion of health behavior interdependence and sleep in the model, and then discuss the current study. The literature review focuses solely on control within romantic dyads.

Review of Health-Related Social Control

Social control is the attempt to control or influence an individual's health (Lewis & Rook, 1999). The Dual Effects Model of Social Control provides a theoretical framework for studying health in the dyadic context (see figure 1). This model posits that receipt of control influences health via two distinct pathways (Tucker & Anders, 2001). First, it positively influences health behaviors by encouraging individuals to engage in healthy behavior. Second, negative control may evoke a negative psychological backlash by making the individual feel guilty or pressured about their health. Thus, social control may lead to both increases *and* decreases in healthy behaviors (Tucker & Anders, 2001). This complex relationship may depend on the nature of the control attempt. Positive and negative control have independent effects on health behaviors, such that positive control typically has a positive influence on health behaviors, and negative control typically has a negative effect on health behaviors.

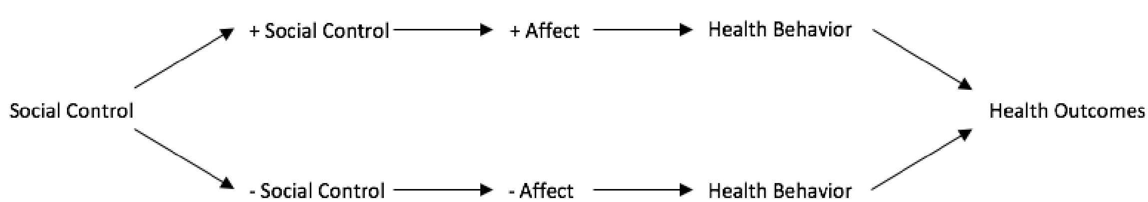

Figure 1. Dual Effects Model of Social Control (Tucker & Anders, 2001)

Positive control can take several forms, and encompasses behavior that often elicits positive responses from the recipient. These behaviors include, but are not limited to, engaging in and/or modeling healthy behavior, facilitating discussions about their health, showing encouragement to engage in healthy behaviors, avowing unhelpful behaviors, and setting positive contingencies. Examples of these tactics include reminding your partner to follow their diet, complimenting your partner about their exercise, and suggesting healthy foods to eat. Tucker and Mueller (2000) found that engaging and modeling in healthy behaviors were the most commonly used tactic. An example of modeling behavior is when the partner actively engages in a behavior (e.g. eating healthy) so that they may engage in the behavior as well. In contrast, negative control elicits a contrasting behavioral response and often does not facilitate healthy behaviors. Examples of negative forms of control are trying to force attitudes about health, nagging or repeating requests to change unhealthy behaviors, setting negative contingencies, using fear or guilt, and expressing negative emotions or concern. This type of behavior can range from showing disapproval when healthy behaviors are not taking place, to the partner stating that they will not live long if they do not change their behavior with the intention of inducing guilt and fear. Examples of negative control include raising conerns about your partner's diet, making your partner feel guilty or scared about the consequences of not exercising, and telling your partner to not eat dessert.

An important facet of the relationship between positive control and health behavior is positive affect. In fact, this may serve as the underlying mechanism mediating control and health behavior. In Novak and Webster's (2011) weight loss study, reinforcing control was associated with greater positive affect in participants actively trying to lose weight, but this affect did not predict diet or exercise. However, other studies have found associations between affect following receipt of control and health behaviors. Tucker and Anders (2001) reported that in married couples, positive control led to positive health behaviors, and positive affect also predicted desired health behaviors.

Similar to positive control, affect may play an important role in negative control as well. The model states that there is a psychological backlash to the receipt of negative control. In a study of married couples, negative control was associated with negative affect, and this affect was then associated with poorer health behaviors (i.e. exercising less, smoking and drinking more) (Tucker & Anders, 2001). It was tested whether negative affect mediated the relationship between negative social control and poor health behavior, but the model was not fully supported. Authors suggest that this was not fully supported because control had a direct effect on behavior, while also having additional effects on affect. In other words, affect does not directly influence behavior, but rather is another consequence of control. Although this model was not supported, similar results have been found elsewhere. In a study of weight loss patients, monitoring control was slightly associated with lower positive affect and poorer diet (Novak & Webster, 2011). In sum, negative control may lead to psychological distress, thus facilitating poor health behaviors.

Overall, positive control is associated with increases in positive health behaviors (Craddock, VanDellen, Novak, & Ranby, 2015). For example, Novak and Webster (2011) found that both instrumental and reinforcing control led to greater dietary adherence during a weight loss study. Moreover, reinforcing control also predicted greater exercise. Similarly, when married couples utilized positive control, this led to greater exercise, stress management, diet, and other health enhancing behaviors (Lewis & Butterfield, 2007).

While positive control is associated with increases in health behaviors, negative control is predictive of ignoring the attempts, doing the opposite of what their spouse is trying to get them to do, and hiding of unhealthy behaviors (Tucker, Orlando, Elliot, & Klein, 2006). For example, monitoring control led to poorer dietary adherence (Novak & Webster, 2011). Monitoring may be viewed by many individuals as a negative form of control, such that they feel guilty or ashamed that they need considerable attention from their spouse. Moreover, using guilt as a control tactic can lead to not only ignoring the attempt, but also hiding unhealthy behaviors (Tucker et al., 2006).

One limitation of the current application of the Dual Effects Model is the limited scope of behavioral outcomes. Research on this model has focused exclusively on the behavioral impact on the target behavior (i.e., the one that the partner is attempting to control). However, it is well documented that health behaviors do not occur in isolation, and that changes to one health behavior will likely result in changes to others (Johnson et al., 2008). Sleep, in particular, is known to be related to many waking health behaviors including diet, exercise, smoking, and alcohol use (Irish, Kline, Gunn, Buysse & Hall, 2015), and emerging evidence suggests that sleep is linked to many social processes.

Evidence Supporting the Inclusion of Sleep

Sleep has recently garnered attention as a social process (see Troxel 2007, 2010 for comprehensive reviews). 61% of adults in the United States sleep with a partner (NSF Poll, 2005), so if we only look at sleep within the individual we are not capturing the whole picture. Bed partners are a strong influence on sleep, so much so that just having your partner in your bed in itself influences sleep (Monroe, 1969; Pankhurst & Horne, 1994). These studies show that having a partner in your bed impairs your objective sleep quality, while at the same time improving subjective reports of sleep quality. This distinction illustrates the complex social process of bed sharing.

Similar to health behaviors such as exercise and diet, it is hypothesized here that control would influence sleep. First, positive control may have a positive effect on sleep. Positive control not only facilitates enhancing health behaviors, but is also associated with greater relationship satisfaction (Craddock et al., 2015). This increased satisfaction can have a myriad of effects on sleep. Partners serve as social zeitgebers, such that they serve as a cue for going to bed at night and waking up in the morning. Increased relationship satisfaction can increase the likelihood of going to bed with your partner rather than avoiding concordant sleep behavior. Greater satisfaction may also elicit pre-sleep comfort, buffering psychological distress and pre-sleep rumination (Troxel, Buysse, Hall, & Matthews, 2009; Troxel, 2007, 2010). This, in turn, creates an intimate, safe environment, facilitating deep and restorative sleep.

The psychological backlash from control may also influence sleep. Previous studies have shown that interpersonal distress impairs objective sleep quality. In a study of both insomniacs and healthy controls, it was found that more interpersonal distress was associated with arousal in both groups (Gunn, Troxel, Hall, & Buysse, 2014). Distress stemming from partners may have a compounding effect on sleep quality, such that the source of conflict is lying in bed with you. This proximal stressor may also increase the likelihood of avoiding your partner at bed time, thus disrupting the regulative effect of this social zeitgeber. In fact, when compared to couples who were well adjusted, less adjusted couples had a greater discrepancy in their sleep schedule (De'Waterman & Lange, 1998). Relatedly, affect serves an important role in sleep. For example, one study found that sleep deprivation decreased positive affect, but did not decrease negative affect, the following day (Talbot, McGlinchey, Kaplan, & Harvey, 2010). Moreover, daily positive affect can facilitate healthy sleep, and daily negative affect is associated with increased sleep onset latency (Kalmbach, et al., 2014). Lastly, the link between interpersonal conflict and impaired sleep may be mediated by mental health. Relationship discord is associated with poor mental health (Fincham, Beach, Harold, & Osbore, 1997), which in turn is a risk factor for poor sleep (Papp, Goeke-Morey, & Cummings, 2007). In sum, sleep fits naturally as a behavioral outcome into the Dual Effects Model of Social Control and is likely to be influenced by partners' attempts to control other health-related behaviors.

The Current Study

The purpose of the current study was to test a Revised 24-Hour Dual Effects Model of Social Control (see figure 2) which examined the effects of control on non-targeted health behaviors and expanded its definition of health-related behaviors to include both sleep and waking behaviors. This study was the first to examine the impact of control on sleep, and had two primary hypotheses. First, it was hypothesized that control would influence sleep duration and continuity (total sleep time and number of awakenings). More specifically, participants who experienced high levels of positive control would have greater sleep duration and fewer awakenings, while those who experienced high levels of negative control would have lower sleep duration and more awakenings throughout the night. Second, the relationship between social control and sleep would be mediated by affective response, such that positive affect would mediate the relationship between positive social control and better sleep outcomes, while negative affect would mediate the relationship between negative social control and worse sleep outcomes.

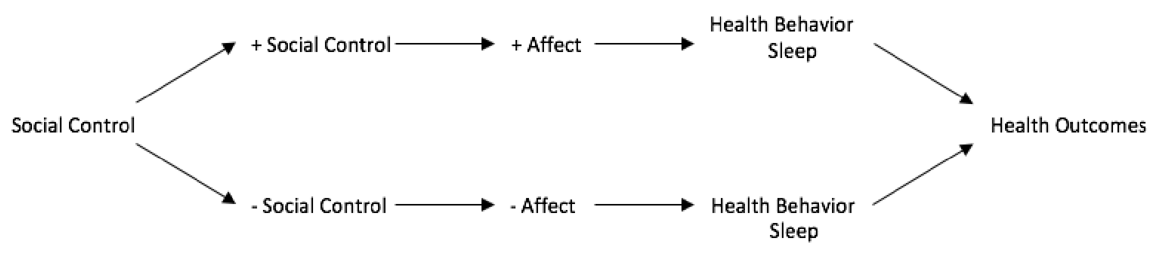

Figure 2. Extended Dual Effects Model of Social Control

METHODS

Participants

Participants of the present study include a subset of participants enrolled in a parent study designed to examine sleep, diet, and physical activity. The parent study recruited 214 recently enrolled members of a commercially available weight loss program that utilizes wellness coaches and reduced calorie meals to promote weight loss. Participants' data will be used if they report currently being in a cohabiting, romantic relationship.

Seventy-five participants were included in the final sample for the present analyses. All participants were Caucasian, most (85%) were female. Age ranged from 24 to 70 years, with an average age of 48 (11) years. Household income was high, with an average household income of $111,210 ($61,862) per year. All participants were cohabitating, married, and were married for an average of 21 (11.5) years.

Procedure

All study procedures and materials were approved by the Institutional Review Boards of North Dakota State University and Sanford Health. Participants were notified of the opportunity to participate in this study through an email announcement sent to new members by the weight loss program marketing team. This email contained a link to a screening assessment administered online by the secure, Psych Data service. Individuals first read a brief description of the study and electronically signed a consent form if they chose to participate.

The screening assessment included 8 items to evaluate the exclusion criteria of the parent study. Specifically, participants who completed the screener were ineligible for further participation if they were younger than 18 years of age, were currently being treated for a sleep disorder, had an irregular sleep schedule (e.g., night shift, nighttime child care), were physically unable to engage in physical activity, did not have internet access and a computer at home, already had a Fitbit account, or had been part of Profile for more than four weeks, and must have provided valid email, phone number, and mailing address. In addition, the screening assessment included a question to determine whether or not the individual was in a committed, romantic relationship. The current study only included individuals who indicated that they were married or cohabiting.

Following completion of the screener, eligible individuals were contacted via email and invited to participate in the study. This email included a link to the time 1 survey. Prior to beginning this survey, participants read and virtually signed an online consent document. In addition, several self-report measures were administered as part of the parent study which assessed relevant demographic, health-related, and psychosocial variables. This survey also included several measures specific to the proposed project, including questions about dyadic expectations for partner involvement in their weight loss and the Relationship Assessment Scale (RAS) (Hendrick, Dicke, & Hendrick, 1998). In order to maintain some consistency of duration of enrollment in the weight loss program, participants had 48 hours to complete this survey following receipt of the invitation. If the participant stated on the demographic questionnaire that they are currently married and/or cohabitating, their data were used for the present analyses.

After completing the time 1 assessment, a one-week, remote, in-home assessment to measure sleep and receipt of partner control was conducted. Participants received a package via postal mail that included a Fitbit Charge HR along with detailed instructions in the use of the device. The Fitbit provided an objective measure of several daily sleep and physical activity characteristics. Participants wore the Fitbit for one week on their non-dominant wrist to measure sleep and physical activity. Participants continuously wore the Fitbit throughout the assessment period, only removing it to charge the device (every 3-4 days), when there was risk of submerging the device in water, or damaging it through activity (e.g., contact sports). Devices were linked to email accounts owned by the research team so participants were not able to view their data during the study. Concurrently, participants were asked to complete a revised form of the Pittsburgh Sleep Diary (Monk et al., 1994) upon waking each morning and at bedtime each night for one week. These daily assessments were administered online by Psych Data and measured receipt of control by their romantic partner. At the end of a week, participants returned the Fitbit device in a prepaid shipping envelope.

On this last day of the in-home assessment, participants received a link to the time 2 assessment via email. This assessment included measures of affective response to partner control via the Positive and Negative Affect Schedule (PANAS) (Watson, Clark, & Tellegen, 1988) and a number of other measures being used for the parent study. After completion of the study, participants received a personalized report detailing their sleep, diet, and physical activity as assessed by the Fitbit along with $50 compensation.

Measures

Sleep. Sleep was assessed using a Fitbit Charge HR. This is a commercially available wrist worn accelerometer which uses movement to infer sleep and wake states in 60-second epochs. Validation studies show that Fitbits are an acceptable tool for obtaining objective sleep data (Montgomery-Downs, Insana, & Bond, 2012). Participant's sleep quality was measured with two different dimensions: total sleep time (TST) and number of awakenings. TST represents the number of minutes the individual was asleep between initial sleep onset and final awakening at the end of the nocturnal rest interval. Number of awakenings represents the number of times the individual woke up between initial sleep onset and final awakening. Each of these statistics were derived from Fitbit's sleep-wake algorithm, and each participant had 1-7 intervals depending on successful device syncing and study adherence.

Partner Control. Partner control was assessed daily as part of the bedtime sleep diary with an adapted measure of social control used in Franks et al. (2006) and Stephens et al. (2010). The measure included 2 positive (questions 1 and 3) and 2 negative (questions 2 and 4) control strategies. The positive vs. negative nature of the behaviors was defined by the perceived behavioral strategy, not the affective response it elicited. Although it is generally the case that positive control elicits positive affect and negative control elicits negative affect, the standard approach to measurement of social control does not explicitly assess the emotional response in order to define the type of control. Participants responded to four items with a yes or no response: Today, did your partner…: 1) prompt or remind you to do things to take care of your health (e.g. reminded you to follow your diet), 2) warn you about the consequences of not taking care of your health (e.g. raised concern about your diet, made you feel guilty or scared about the consequences of not exercising), 3) do something to encourage you to improve your health (e.g. suggested healthier foods to eat, complimented you about exercising), 4) try to stop you from doing things that are not good for your health (e.g. told you not to eat dessert)? Each day was coded as experiencing positive control (i.e., responding yes to question 1 or 3), experiencing negative control (i.e., responding yes to question 2 or 4), or no experienced control. Participants were then given a score based on the percentage of reported days that they received control. For instance, if a participant completed 5 sleep diaries and reported positive control on 2 of those days, they received a score of 40%. Scores were calculated for received positive control and negative control.

Affective Responses to Partner Control. The PANAS was administered to measure emotional responses to partner control after participants completed the week long in-home assessment. A list of 10 negative affective responses (e.g., upset, guilty, irritable) and 10 positive affective responses (e.g., determined, attentive, enthusiastic) were presented and participants were asked to indicate the extent to which they experienced these affective responses over the past week in response to their partner's control in regard to their weight loss behaviors. Each question was scored on a 1 (*very slightly or not at all*) to 5 (*extremely*) scale and positive and negative affect subscales were scored by summing the response to positive and negative affective items separately (scores for each subscale range from 10-50). This scale is reliable, valid, and widely used in measuring and discriminating positive and negative affect (Watson, Clark, & Tellegen, 1988). This measure had good reliability in the present sample: positive affect (α=.96), negative affect (α=.90).

Covariates. Other dyadic factors are likely to influence the impact of partner control on health, and therefore will be included as covariates in the analyses. Specifically, high relationship quality and concordant expectation of partner control may attenuate the effects of control on health behavior (Knoll, Burkert, Scholz, Roigas, & Gralla, 2012; Rook et al., 2011; Seidel, Franks, Stephens, & Rook, 2012).

Relationship satisfaction was measured with the RAS (Hendrick et al., 1998). This scale included 7 items that query participants about their current romantic relationship (e.g., How well does your partner meet your needs? In general how satisfied are you with your relationship?; How good is your relationship compared to most?; How often do you wish you hadn't gotten into this relationship?). Responses ranged from 1 to 5, with higher scores indicating greater relationship satisfaction. Items were summed to compute a total satisfaction score ranging from

7-35. The RAS is a valid measure of relationship satisfaction, and is correlated with other validated assessments of marital satisfaction (Vaughn & Matyastik Baier, 1999). This measure had good reliability in the present sample (α=.95). Dyadic expectations of health-related partner involvement were assessed with a single item ("Your spouse's involvement is essential for your health") which were included as a part of the RAS. Responses ranged from 1 (strongly disagree) to 6 (strongly agree). The use of similar single item measures of dyadic expectations is standard in this literature (e.g., Seidel et al., 2012).

DATA ANALYSIS

Of the 1,011 individuals screened for the parent project, 650 were ineligible based on exclusion criteria: under the age of 18 years old (0.05%), currently being treated for a sleep disorder (17.8%), had an irregular sleep schedule (22.2%), were unable to engage in physical activity (10.3%), did not have internet access at home (1.2%), had a personal Fitbit account (55.7%), and were enrolled in Profile for 4 weeks or longer (2.9%). Of the 361 eligible participants, 314 were invited to participate in the Time 1 survey. In some cases, the number of eligible individuals was greater than the number of available study devices. In such cases, individuals were randomly selected to receive the survey invitation and the remaining individuals were placed on a wait list to be contacted only if other participants declined to complete the Time 1 survey within 48 hours. Once individuals on the wait list were enrolled in the weight loss program for more than 4 weeks (exclusion criteria based on response to the screener) they were removed from the wait list and notified that they would not be invited to participate. Of the 314 individuals who received invitations to the Time 1 survey of the parent study, 214 participants completed it. The present study included only those participants involved in romantic, cohabitating relationships which was 82.8% of the total parent sample. A further 101 of these participants were excluded from present analyses for attrition or missing data, resulting in a final sample size of 75 for the present analyses. Independent sample t-tests and chi-square analyses were conducted to identify differences in sociodemographic or key study variables between participants who were and were not included in the present analyses. Results indicated that those who were excluded were significantly more likely to be cohabiting but unmarried compared to those who were included (χ^2 =10.82, p=.001). Of the 176 participants examined, only 11 (7%) reported unmarried cohabitation and all 11 were among the excluded participants.

These groups did not differ on any other sociodemographic or key study variables. Although the rates of exclusion were high, these analyses suggest that there are minimal differences between those who were and were not included in final analyses and therefore the generalizability of our remaining sample remains acceptable.

Descriptive statistics were used to explore the normality of study variables. Negative control was significantly and positively skewed and therefore was transformed by square root transformation, which corrected the normality of the distribution. The transformed version of this variable was used in all analyses presented. Pearson product-moment correlations were calculated to examine bivariate relationships among study variables and potential covariates; Spearman's Rho correlations were calculated for gender. To improve parsimony and maximize power, only covariates with significant correlations to study variables were included in final analyses.

We hypothesized that positive control would be associated with greater total sleep time and fewer nighttime awakenings, and that these relationships would be mediated through positive affective response. It was also hypothesized that negative control would be associated with decreased total sleep time and increased number of nighttime awakenings, and that this relationship would be mediated through negative affective response. The direct and indirect effects of perceived control on sleep duration and continuity were tested using the PROCESS Macro (Hayes, 2012). The PROCESS Macro uses nonparametric, bootstrapping procedures (5,000 samples) to estimate 95% bias corrected confidence intervals. SPSS version 22 was used for all analyses.

RESULTS

Sample characteristics are displayed in Table 1. On average, participants were healthy sleepers, with a mean sleep duration of 7 hours and 10 minutes, and an average of 8.48 awakenings per night. Participants reported a relatively low number of control attempts. On average, they reported positive control attempts on 25.2% of study days and negative control on 4% of study days. In fact, most participants (82.3%) reported a complete absence of negative social control across all study days. In addition, participants were generally happy with their relationships and reported high positive affect in response to their partners' control attempts.

Bivariate correlations (see Table 2) revealed that, as expected, positive control was associated with positive affect ($r=.47$, $p<.001$) and negative control was associated with negative affect ($r=.34$, $p<.05$). Positive control was also associated with number of awakenings ($r=.24$, $p<.05$), but no other correlations between positive or negative control and sleep duration or continuity were found to be significant. Finally, dyadic expectations was the only proposed covariate that was significantly correlated with any of the control or sleep variables. Positive social control was positively associated with dyadic expectations ($r=.26$, $p<.05$), such that greater expectation of partner involvement was related to greater frequency of positive control attempts. Therefore, dyadic expectations was included as a covariate in positive control models only.

Table 1

Demographic and health characteristics

Gender, *n(%)*	
Male	12(14.5%)
Female	71(85.5%)
Age, *Mean(SD), years*	47.66(10.99)
Race, *n(%)*	
Caucasian	83(100%)
Income, *Mean(SD), dollars*	111,209.88(61,862.90)
Education, *n(%)*	
High School	17(20.5%)
Associates/Professional	16(19.3%)
Bachelor's	28(33.7%)
Graduate	22(26.5%)
Marital Status, *n(%)*	
Married	83(100%)
Relationship Duration, *Mean(SD), years*	20.89(11.55)
Positive Control, *Mean(SD), % study days received*	25.21(30.12)
Negative Control, *Mean(SD), % study days received*	4.06(9.79)
Total Sleep Time, *Mean(SD), minutes*	429.89(68.11)
Awakenings, *Mean(SD),*	8.47(6.69)
Positive Affect, *Mean(SD)*	25.66(12.01)
Negative Affect, *Mean(SD)*	14.82(6.49)
Dyadic Expectations, *Mean(SD)*	4.21(1.64)
Relationship Satisfaction, *Mean(SD)*	30.39(5.54)

Table 2

Bivariate correlations

Variables	1	2	3	4	5	6	7	8	9
1. Positive Control	_								
2. Negative Control	.07	_							
3. Total Sleep Time	-.07	.02	_						
4. Awakenings	.24*	.19	-.13	_					
5. Positive Affect	.47**	.16	-.06	.28*	_				
6. Negative Affect	-.023	.34**	-.02	.18	.19	_			
7. Dyadic Expectations	.26*	-.12	-.05	.20	.29*	-.11	_		
8. Relationship Satisfaction	.20	-.20	-.05	-.017	.25*	-.09	.36**	_	
9. Gender$^{\alpha}$	.16	.18	-.15	.153	.18	.12	.04	-.25*	_

*Significant at the 0.05 level
**Significant at the 0.01 level
α indicates Spearman correlation
0=female, 1=male

Based on these correlations, a mediation model was tested to examine positive affect as a mediator between positive control and number of awakenings (see Figure 3). Results suggest that, after controlling for dyadic expectations, positive control was marginally associated with number of awakenings (B=4.82, SE=2.51, p=.06), such that more perceived positive control attempts were associated with more disrupted sleep. The indirect effect of positive control on number of awakenings via positive affect was not significant (B=1.73, SE=1.42, 95% CI=-.69-4.95).

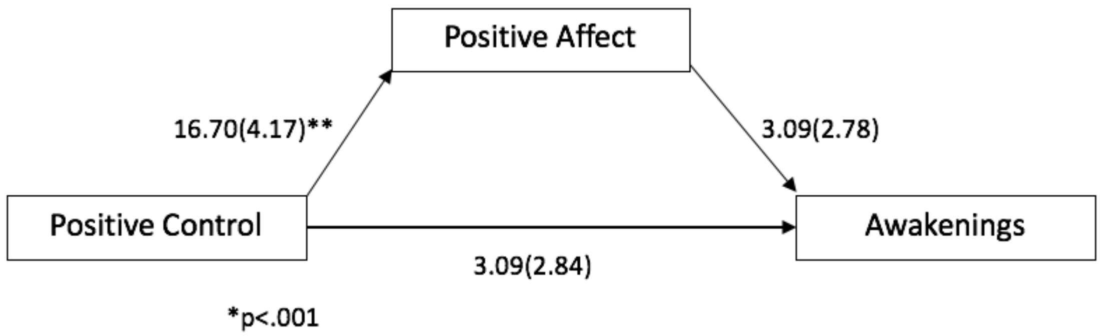

Figure 3. Indirect Effect of Positive Control on Nighttime Awakenings
Full mediation model testing the direct and indirect effects of control on awakenings, mediated through positive affect. Values represent unstandardized coefficients.
Direct effect: 4.82(2.51)
Indirect effect: 1.73(1.42)

DISCUSSION

The purpose of the current study was to examine whether the effects of partner control targeted toward weight loss behaviors might also influence non-targeted health behaviors, such as sleep (see Figure 2). This research endeavor extends the Dual Effects Model of Social Control in two important theoretical ways. First, it acknowledges the interdependence between multiple health-related behaviors, and second, it extends the traditional view of health behavior to include 24-hour behavior (i.e., sleep). To date, these two novel approaches have not been examined. It was hypothesized that when romantic partners targeted diet and exercise behavior with control attempts, it would influence sleep, a non-targeted health behavior.

Results of the present study confirm that, consistent with other studies (Craddock et al., 2015), positive control was associated with positive affect and negative control was associated with negative affect. These results are consistent with the first part of the pathways in the social control model (see Figure 1) which posits that affect is a primary mechanism by which social control influences behavior and health.

In addition, results revealed that positive control was significantly and positively associated with number of nighttime awakenings. This relationship is contrary to our hypothesis and conceptual model because it suggests that positive control is associated with worse sleep. Although no research to date has examined the relationship between sleep and control (either targeted toward weight loss or sleep), studies suggest that affect and sleep quality are positively associated (Selvi, Gulec, Agargun, Besiroglu, & 2007; Steptoe, O'Donnell, Marmot, & Wardle, 2008). Thus, we expected that positive control (which elicits positive affect) would be associated with better sleep, but the present data do not support this hypothesis. Bivariate analyses suggested that total sleep time was not significantly associated with positive control and that neither total sleep time nor number of awakenings was associated with negative control. Thus, a mediation model was tested only to examine positive affect as a mediator between positive control and number of nighttime awakenings. The marginally significant direct and nonsignificant indirect effect do not provide strong support for the study hypotheses.

Taken together, these data did not support our extension of the Dual Effects Model of Social Control. The present findings may suggest that the impact of control does not extend to related, but untargeted, health behaviors as proposed, or that sleep does not fit well with the traditional model of social control. However, these results must be interpreted with caution as there are several methodological factors to consider and a need for replication so these results can be placed in a broader context.

The homogeneity of our sample was a primary limitation. First, the gender distribution of the sample was less balanced than expected with 85% females. Evidence suggests that control may have a greater influence on the health-related behavior of men compared to women (Seidel et al., 2012; Westmaas, Wild, & Ferrence, 2002). Moreover, women are more likely than men to provide control, and therefore less likely to receive control attempts from their male partners (Umberson, 1992). Indeed, the reported receipt of control attempts by partners was very low in this sample. On average, positive control attempts were reported on 25% of study days and negative control attempts were reported on only 4% of study days. Therefore, it is difficult to know whether the null findings represent a true nonsignificant relationship between control and sleep or merely an absence of adequate levels of the primary independent variable and therefore impossible to accurately evaluate in the present study. To explore the latter possibility, we conducted exploratory analyses to test the relationship between control and its target weight loss behaviors (i.e., diet and physical activity) which were measured over the same time period as sleep. Bivariate correlations revealed no significant associations between positive control and average daily calories (r=-.07, p=.55), fat intake (r-.05=, p=.67), minutes of activity (r=-.20, p=.08), or calories burned through physical activity (r=-.16, p=.16). There were also no significant associations between negative control and average daily calories (r=.05, p=.68), fat intake (r=.21, p=.09), minutes of activity (r=-.02, p=.88) or calories burned through physical activity (r=-.00, p=.98). Though not a primary aim of the present study, these analyses reveal a substantial problem with interpretation of our findings. If control has no significant impact on its target weight loss behaviors, then the premise for our hypotheses is unsupported and it would be unlikely that control would have the hypothesized extended influence on sleep.

Several methodological factors may help explain why partner control did not influence health-related behaviors in the present study, most notably the approach taken to measure control. Partner control was measured for one week using a daily diary. This approach is unusual in that most studies of control use a more aggregate, retrospective measure of perceived control. With one exception that utilized a daily diary measure (Novak & Webster, 2011), the finding that control influences health-related behaviors is based solely on general, retrospective measures of control (e.g., Franks et al., 2006; Tucker & Anders, 2001). Perhaps the influence of control is not achieved immediately and the control attempts must accumulate over time to reach their full potency. This cumulative effect parallels other social constructs. For example, daily hassles (i.e., minor daily stressors) do not have an immediate impact on health but over time can accumulate and lead to poor psychological and physical health (Gouin, Glaser, Malarkey, Beversdorf, & Kiecolt-Glaser, 2012). Further, the present study only measured the perception of control received by the participant, and did not measure the partner's perception of control given to the participant. In recent studies, dyadic data has revealed that examining the differences between received and given control adds important insight into the utility of control. When an instance of control is reported as given by the partner, but not perceived by the target, this is referred to as invisible social control (Stephens et al., 2010). Invisible control is more effective than direct control, particularly in regards to affective response (Luscher et al., 2014). These findings parallel those reported in the study of invisible social support, which suggest that receiving support and being aware of that support can result in negative emotions such as shame or guilt, whereas receiving support without awareness results in more positive emotional responses (Bolger, Zuckerman, & Kessler, 2000). Thus, it is plausible that cumulative and/or invisible social control may drive the relationship between social control and health related behaviors. However, neither form of control was assessed in the present study and it is possible that the null results were a consequence of this measurement limitation.

Although the low rates of control prevented robust testing of our primary aims, the present results do contribute valuable knowledge to our limited understanding of partner control. First, this was a novel extension to the Dual Effects Model of Social Control. No study to date has considered the effects of control on non-targeted behaviors or the inclusion of 24-hour health, and this model provides an important framework to consider social influence on health. Second, this study demonstrated that control is associated with affect in a weight loss sample, similar to previous studies. This relationship is important, because it represents a primary pathway between social influence and physical health. Lastly, our methodology and results draw attention to the possibility that the ability to measure the true effect of social control on health-related behavior is dependent on the type of control (e.g., cumulative, invisible). This insight should guide future studies to better evaluate the construct of social control. A clear understanding of the concept of control is necessary in order for the construct to be integrated into health behavior intervention and promotion efforts.

Partners may play an important role in health-related interventions. In fact, interventions that include the partner have already shown promise. In a review, Martire et al. (2004) suggest that couples based interventions may be more efficacious than basic, individualized health care. For example, evidence suggests that partners' control affects adherence to continuous positive airway pressure (CPAP) treatment for obstructive sleep apnea, which has important implications for serious health consequences such as cardiovascular disease (see Mead & Irish, 2016). Current studies suggest that positive partner collaboration increases CPAP adherence (Baron, Gunn, Czajkowaski, Smith, & Jones, 2012), while making your partner feel pressured to use CPAP decreased adherence (Baron, Smith, Berg, Czajkowski, Gunn, Jones, 2011). Future research that clarifies the role of social control as a means of improving the health of a significant other will help clinicians to utilize partners to maximize the adherence to health behavior change and subsequent improvements in health outcomes. For example, partners may receive education on recommended changes in health behaviors and communications skills to promote positive control and support. Patients might receive suggestions for strategies to communicate their needs to their partners or manage their affective responses to social interaction.

In light of the significant health benefits of positive health behavior change, the low adherence to such behavior change recommendations, and the promising role of the partner in maximizing the success of such lifestyle changes, this line of inquiry merits further investigation. The revised model in this study provides a new theoretical framework for studying the relationships between partner health-related control and health behavior.

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