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Extending the Dual Effects Model of Social Control to Non-Targeted Health Behavior

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The Dual Effects Model of Social Control posits that individuals can influence the health behavior of their partners, but research has not yet tested whether its influence can spread to non-targeted health behavior. This study tested influence of control on targeted (diet, physical activity) and non-targeted (sleep) health behavior. Participants (N = 66) completed a 7-day in-home assessment in which perceived control, diet, physical activity, and sleep were measured. Analyses revealed no significant effect of positive control on targeted or non-targeted health behavior. Although results were non-significant, this study provides a novel contribution to the literature, in that it is the first study to test the effect of control on non-targeted health behavior.

Keywords: Health-related social control, sleep, health behavior, diet, physical activity

Over the past several decades, research has consistently demonstrated the relevance of biobehavioral factors on human health and functioning (Baum & Posluszny, 1999; Taylor, 2018). However, the 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 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 quality of sleep has also been associated with increased 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 behaviors from a 24-hour perspective allows for the inclusion of all relevant biobehavioral factors in the study of health and illness. It is important to note that many health-related behaviors occur in a social context, and studying health behaviors in this context have helped to expand our understanding of social and behavioral influences on health (Umberson & Karas Montez, 2010). The influence of romantic partners on health has been studied extensively (Kiecolt-Glaser & Newton, 2001; Kiecolt-Glaser & Wilson, 2017), and the Dual Effects Model of Social Control (Tucker & Anders, 2001) is a theoretical framework that been successfully used for decades to study the impact of partner influence on health behaviors (Craddock, vanDellen, Novak, & Ranby, 2015). This paper will first introduce the Dual Effects Model of Social Control, then provide rationale and support for the inclusion of health behavior interdependence and sleep in the model, followed by a discussion of the current study.

Introduction to Health-Related Social Control

Health-related social control is the attempt to control or influence another individual's health behavior (Lewis & Rook, 1999), and the Dual Effects Model of Social Control provides a theoretical framework for studying health in the dyadic context. 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 behaviors, or second, may evoke a negative psychological and behavioral backlash by making the individual feel guilty or pressured about their health (Tucker & Anders, 2001). Thus, social control may lead to both increases and decreases in healthy behaviors (Craddock et al., 2015; Tucker & Anders, 2001), and this complex relationship may depend on the nature of the control attempt.

Overall, positive control (e.g. modeling healthy behavior, discussions about health, encouraging healthy behaviors, positive contingencies) is associated with increases in dietary adherence, exercise, stress management, and other health enhancing behaviors (Craddock et al., 2015; Novak & Webster, 2011). In contrast, negative control (e.g. forcing attitudes about health, nagging or repeated attempts to change unhealthy behaviors, using fear or guilt, negative contingencies) is predictive of ignoring attempts, doing the opposite of what their spouse is trying to get them to do, and hiding of unhealthy behaviors (Tucker, Orlando, Elliott, & Klein, 2006) such as poor dietary adherence (Novak & Webster, 2011).

A limitation of the current application of the Dual Effects Model is the limited scope of behavioral outcomes. To our knowledge, research on this model has focused exclusively on the behavioral impact on the target behavior (i.e., the behavior 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; Prochaska, Spring, & Nigg, 2008). Thus, control attempts targeting specific health behaviors have the potential to influence non-targeted health behaviors.

Inclusion of Sleep as a Non-Targeted Health Behavior

Sleep 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 (Troxel, 2010). As with waking behaviors (Craddock et al., 2015), it is likely that social control would influence sleep. First, positive control may have a positive influence on sleep. Positive control does not only facilitate health enhancing behaviors, but is also associated with greater relationship satisfaction (Craddock et al., 2015). This increased satisfaction can have a myriad of effects on sleep. For example, partners serve as social zeitgebers, such that they serve as a cue for going to bed at night and waking up in the morning (Troxel, 2010), and increased relationship satisfaction may increase the likelihood of concordant sleep behavior (Gunn, Buysse, Hasler, Begley, & Troxel, 2015). Greater satisfaction may also elicit pre-sleep comfort, buffering psychological distress and pre-sleep rumination (Troxel, 2010; Troxel, Buysse, Hall, & Matthews, 2009). This, in turn, creates an intimate, safe environment, facilitating deep and restorative sleep. The psychological backlash from negative control may also influence sleep. Previous studies have shown that interpersonal distress impairs objective sleep quality, and in a study of adults with insomnia and healthy controls, it was found that more interpersonal distress was associated with arousal in both groups (Gunn, Troxel, Hall, & Buyyse, 2014). Interpersonal distress may also increase the likelihood of avoiding your partner at bed time, thus disrupting the influence of this social zeitgeber. In fact, when compared to couples who are well adjusted, less adjusted couples have a greater discrepancy in their sleep schedule (Lange, Waterman, & Kerkhof, 1998).

The Current Study

The purpose of the current study was to test the Extended Dual Effects Model of Social Control which examined the effects of daily control on both targeted (diet and physical activity) and non-targeted (sleep) health behavior. We hypothesized that (1) positive control would significantly predict fewer calories consumed and more total minutes of activity, (2) negative control would significantly predict more calories consumed and fewer total minutes of activity, and (3) that the effects of perceived control would spread to the non-targeted behavior of sleep. Specifically, positive control would predict greater sleep duration and continuity, while negative control would predict shorter sleep duration and poorer continuity.

Method

Participants

Participants ($N = 66$) of the present study include a subset of participants enrolled in a parent study designed to examine sleep, diet, and physical activity in members of a commercially available weight loss program. This parent study was a one-week in-home assessment in which participants wore Fitbits to objectively measure physical activity and sleep, and completed diet logs each night of the study. Participants were included in the present analyses if they were currently in a cohabiting, romantic relationship, were not being treated for a sleep disorder, had a regular sleep schedule (e.g., no shift work), and were physically able to engage in physical activity. Of the 214 participants in the parent study, we examined the subsample of 66 who reported being in a romantic relationship and had adequate data to test our study hypotheses (i.e., had valid daily health behavior data). Given recommendations for multi-level modeling (Newsom, Jones, & Hofer, 2013), we were adequately powered to detect level 1 effects. Moreover, a post hoc power analysis was conducted using Monte Carlo simulation in Mplus version 8 to determine whether the current sample size provided adequate power to detect a medium effect size (d = .5). The outcome variable with fewest data points was sleep, with 66 participants averaging 4.24 days of data. Monte Carlo simulations using these data provided a power of greater than .90 to detect a medium effect size. Thus, there was adequate power to detect a medium effect of control on diet, physical activity, and sleep. Compared to the rest of the parent study participants, the 66 in the current analysis did not significantly differ by gender or education. However, participants in the current analysis were, on average, 3 years older ($t = 1.99$, $p = .04$), and had a household income of approximately $24,000 more per year ($t = 2.96$, $p < .01$). While these differences were significant, they are reasonable to expect due to the focus on people in cohabiting relationships (Zagorsky, 2005).

Procedure

All study procedures and materials were approved by both the university and hospital IRBs. 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, which contained a link to the eligibility screening assessment. After completing an online survey measuring relevant demographic and psychosocial variables, a one-week, in-home assessment to measure diet, physical activity, sleep, and receipt of partner control was conducted. Participants received a package via postal mail that included a Fitbit Charge HR, detailed instructions in the use of the device, and food logs for their food provided by the weight loss program. 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. At the end of a week, participants returned the Fitbit device in a prepaid shipping envelope. Participants completed a final questionnaire, and were mailed $50 compensation and a report of their sleep, physical activity, and diet during the in-home assessment.

Measures

Diet. Each night following completion of the sleep diary, participants reported their dietary consumption for that day with two different measures. A component of the participants' weight loss efforts was using food provided by the program, and each day participants self-reported what products they ate. These foods were recorded on hard copy food logs which were provided by the research team. Participants mailed these food logs back when returning the study materials, and nutrient information was entered by the research team. Participants also consumed foods that were not part of their program and reported these items separately using the Automated Self-Administered 24-Hour (ASA24) Dietary Recall (Subar et al., 2012). The ASA24 is an online program that guides participants through a detailed 24-hour recall of their dietary consumption and provides researchers with estimates of caloric and nutrient intake. Caloric intake was combined from these two measures, providing a single daily measure of total calories consumed.

Physical Activity. Physical activity was assessed using the Fitbit Charge HR. This is a commercially available wrist worn accelerometer which uses movement to infer sleep and wake states and is an acceptable tool for measuring physical activity (Diaz et al., 2015). Fitbit provided data on how many minutes participants were lightly, fairly, and very active. These variables were combined to form a variable of total minutes of activity, which was used as our measure of physical activity.

Sleep. Sleep was also assessed using the Fitbit Charge HR, which is an acceptable source of objective sleep data in healthy sleepers according to previous investigations (Montgomery-Downs, Insana, & Bond, 2012). The present analyses utilized 2 indicators of sleep: total sleep time (TST) and number of awakenings throughout the night.

Social Control. Social control attempts targeting diet and physical activity were assessed daily as part of the bedtime sleep diary with an adapted measure 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. 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), and (4) try to stop you from doing things that are not good for your health (e.g., told you not to eat dessert)?. If participants answered yes to questions 1 and/or 3, then they would receive a score of 1 for that day, indicating that they received any amount of positive control. If participants answered no to questions 1 and 3, then they would have a score of 0, indicating that there was no receipt of positive control on that day. Daily negative control was scored in the same way.

Covariates. Gender, relationship quality, and dyadic expectation (amount of desired involvement from your partner in your health behavior) of partner control may affect the influence of control on health behavior (Knoll, Burkert, Scholz, Roigas, & Gralla, 2012; Seidel, Franks, Stephens, & Rook, 2012). Relationship satisfaction was measured with the Relationship Assessment Scale (RAS) (Hendrick, Dicke, & Hendrick, 1998). Dyadic expectation of health-related partner involvement was assessed with a single item ("Your

Table 1. *Demographic and health characteristics*

Gender, *n(%)*	
Male	9(13.6%)
Female	57(86.4%)
Age, *Mean(SD), years*	46.76(11.34)
Race, *n(%)*	
Caucasian	66(100%)
Income, *Mean(SD), dollars*	107,636.36(57,593.97)
Education, *n(%)*	
High School	14(21.2%)
Associates/Professional	10(15.2%)
Bachelor's	24(36.4%)
Graduate	18(27.3%)
Marital Status, *n(%)*	66 (100%)
Relationship Duration, *Mean(SD), years*	20.23(12.08)
Positive Control, *Mean(SD), % Study*	22.73(31.44)
Negative Control, *Mean(SD), % Study*	2.57(8.25)
Calories Consumed, *Mean(SD), per day*	1130.71(237.72)
Total Minutes Active, *Mean(SD), per day*	270.36(74.57)
Total Sleep Time, *Mean(SD), minutes*	432.39(67.56)
Awakenings, *Mean(SD),*	8.16(6.79)
Dyadic Expectations, *Mean(SD)*	4.27(1.61)
Relationship Satisfaction, *Mean(SD)*	30.98(4.81)

spouse's involvement is essential for your health") which was included as a part of the RAS. Responses ranged from 1 (strongly disagree) to 6 (strongly agree). Previous research has demonstrated that control attempts are more likely to be associated with positive health behavior change when the recipient is male (Umberson, 2012; Westmaas, Wild, & Ferrence, 2002), relationship satisfaction is high (Knoll, Burkert, Scholz, Roigas, & Gralla, 2012), and dyadic expectation is high (Rook, August, Stephens, & Franks, 2011; Seidel, Franks, Stephens, & Rook, 2012).

Data Analysis

Due to the low levels of reported negative control (2.57% of days received), we were not able to test the influence of negative control on targeted and non-targeted health behaviors. Thus, only positive control was tested in our analyses. Mixed linear models were tested to examine the direct effects of perceived control on same day total minutes of activity, caloric intake, and subsequent night TST and number of awakenings. Gender, relationship satisfaction, and dyadic expectations entered as covariates in every model.

Table 2. *Mixed linear models: Influence of social control on targeted health behavior*

	Calories Consumed				Total Minutes Active			
Predictor	*B*	*SE*	*t*	*p*	*B*	*SE*	*t*	*p*
Positive Control[a]	-41.62	48.80	-.85	.39	-11.77	13.51	-.87	.39
Gender[b]	-100.94	91.80	-1.10	.28	35.40	29.57	1.20	.24
Relationship Satisfaction	-7.81	6.93	-1.13	.27	-3.55	2.25	-1.58	.12
Dyadic Expectations	-13.55	19.84	-.68	.50	-1.00	6.47	-.15	.88

Positive control[a] (0=did not receive, 1=received)
Gender[b] (0=female, 1=male)

Table 3. *Mixed linear models: Influence of social control on non-targeted health behavior*

	Total Sleep Time				Awakenings			
Predictor	*B*	*SE*	*t*	*p*	*B*	*SE*	*t*	*p*
Positive Control[a]	9.55	12.68	.74	.45	.42	.74	.56	.58
Gender[b]	13.27	24.06	.55	.58	-3.30	2.52	-1.31	.20
Relationship Satisfaction	.13	1.83	.07	.94	-.20	.20	-1.04	.30
Dyadic Expectations	-3.62	5.22	5.22	.49	1.14	.57	2.01	.05

Positive control[a] (0=did not receive, 1=received)
Gender[b] (0=female, 1=male)

Results

Sample characteristics are displayed in Table 1. Participants were mostly female (86.4%), were on average 46.76 years old, were all Caucasian, slept a little over 7 hours per night, woke up approximately 8 times per night, consumed 1130.71 calories per day, and spent 270 minutes active per day.

Influence of Control on Targeted Health Behaviors

Mixed linear models revealed (see table 2) that daily reports of positive control did not significantly predict same-day calories consumed ($B = -41.62(48.80)$, $t = -.85$, $p = .40$) or total minutes of activity ($B = -11.77(13.51)$, $t = -.87$, $p = .39$).

Influence of Control on Non-Targeted Health Behaviors

Mixed linear models revealed (see table 3) that daily measures of control did not significantly predict that night's TST ($B = 9.55(12.68)$, $t = .74$, $p = .45$) or nighttime awakenings ($B = .42(.74)$, $t = .56$, $p = .58$).

Discussion

Taken together, these data do not support either the Dual Effects Model of Social Control or the Extended Dual Effects Model of Social Control. However, there are methodological and participant factors that could have led to these null results, and these interpretations must be considered with caution. First, control did not influence the targeted health behaviors (diet or exercise), which contradicts previous research on control and health behavior (Craddock et al., 2015). A methodological factor that could explain this failure to reject our null hypotheses is that this study used a daily diary approach to study the impact of perceived control on health behavior. While other studies have demonstrated significant, daily effects of control on health behavior (Novak & Webster, 2011; Stephens, Franks, Rook, Iida, Hemphill, & Salem, 2013), it is possible that, in this sample, the impact of control was 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).

Another factor that could have contributed to our results is that participants reported very low levels of negative control, and we were unable to test its influence on targeted and non-targeted health behaviors. One potential explanation for the low levels of received control is that the gender distribution of the sample was less balanced than expected with 86.4% of it female. Evidence suggests that control may have a greater influence on the health-related behavior of men compared to women (Seidel, Franks, Stephens, & Rook, 2012) and women are more likely than men to provide, rather than receive, control (Umberson, 1992). 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.

While our study only measured the perception of received control by the participant, an alternative approach might be to 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 (Franks et al., 2006) and is more effective than direct control (Lüscher et al., 2014). This parallels 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 invisible social control may drive the relationship between social control and health-related behaviors present in the extant literature. However, this was not assessed in the present study and it is possible that the null results were a consequence of this measurement limitation.

Several directions for future research are recommended. First, more studies testing the daily impact of control are necessary. While other daily studies have demonstrated significant effects of control on health behavior (see Novak & Webster, 2011; Stephens, Franks, Rook, Iida, Hemphill, & Salem, 2013), this literature is scant and it is possible that the effects of daily control on targeted health behaviors are not robust. Therefore, replication and extension of daily frameworks are needed to better understand these relationships. Second, future studies should collect both subjective and objective reports of the health behaviors being studied. The current literature mainly relies on subjective reports of health behavior, but we assessed physical activity and sleep with an objective measurement tool (e.g., Fitbit), and diet with an intensive, 24-hour dietary recall (e.g., ASA-24 and food log). This is a key difference because self-reports of diet (Shim, Oh, & Kim, 2014), physical activity (Sallis & Saelens, 2000), and sleep (Lauderdale, Knutson, Yan, Liu, & Rathouz, 2008) often significantly differ from objective measurement, and this may have contributed to our findings contradicting previous research. Lastly, future studies should test the Extended Dual Effects Model of Social control, as testing the impact of control on non-targeted behavior can provide a more comprehensive framework when studying health promotion efforts.

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. We present a novel extension to the Dual Effects Model of Social Control, in that no study to date has considered the effects of control on non-targeted behaviors. This extended model provides an important framework to consider social influence on health, given how change in one health behavior is often associated with change in another (Johnson et al., 2008; Prochaska, Spring, & Nigg, 2008). Our methodology and results draw attention to the possibility that the ability to measure the true effect of social control on health-related behavior may be dependent on the type of control (e.g., cumulative, invisible). This extended model provides a new theoretical framework in which to study the effects of control on health behavior, and future research efforts should consider the influence of control on non-targeted health behavior.

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