SPOUSAL SUPPORT AND CONTROL TARGETING EXERCISE IN OLDER ADULTS WITH DIABETES: ROLES OF PATIENTS’ EMOTIONAL RESPONSES AND GENDER

A dissertation submitted to Kent State University in partial fulfillment of the requirements for the degree of Doctor of Philosophy

by

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December 2010
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CHAPTER 1

Introduction

The health-enhancing properties of marriage have been repeatedly documented in terms of lower mortality rates and better mental and physical health in married individuals relative to non-married individuals (Berkman & Syme, 1979; Gove, 1973; House, Landis, & Umberson, 1988). The health benefits of marriage are thought to occur in part through social support that ameliorates distress and facilitates engagement in healthy behaviors (Burman & Margolin, 1992; Kiecolt-Glaser & Newton, 2001) and through social control that discourages unhealthy behaviors (Umberson, 1992).

However, the health effects of spouses’ social support and social control appear to favor men over women (Kiecolt-Glaser & Newton, 2001; Westmaas, Ferrence, & Camden, 2002) and may be explained in part by recipients’ emotional responses to receiving support and control (Cohen & McKay, 1984; Tucker, Orlando, Elliot, & Klein, 2006).

The association between marriage and health may be especially apparent in the context of chronic illness. Nearly 90% of adults over the age of 65 live with at least one chronic illness (Centers for Disease Control and Prevention; CDC, 2008a). In order to reduce illness symptoms and offset further health deterioration, adults with chronic illnesses must often adopt and maintain lifestyle changes in health behaviors. However, older adults are generally less likely than other age groups to engage in recommended
guidelines for healthy behaviors, particularly recommendations for physical exercise (CDC, 2008a). As a result, spouses are often involved in their chronically ill partner’s illness management by providing social support and social control that target treatment adherence (Berg & Upchurch, 2007; Pierce, Hong, Franks, & Ketterer, 2002; Revenson, 1994).

In order to better understand how spouses’ involvement through social support and control influence illness management, the first aim of this study was to investigate the direct effects of spouses’ daily involvement on daily illness management. The second aim of this study was to investigate patients’ daily emotional responses to receiving spouses’ support and control as a mechanism through which spousal involvement affects illness management. Finally, the third aim of this study was to investigate patients’ gender as a moderator of both the direct associations between spouses’ involvement and illness management and the indirect associations through patients’ emotional responses.

This chapter first reviews the theoretical and empirical literature on social support and social control. Second, the theoretical and empirical literature on emotional and behavioral responses to receiving social support and social control are reviewed. Third, the theoretical and empirical literature on gender differences in social support and social control exchanges are reviewed to discuss why the health effects of social support and control may vary by the recipients’ gender. Finally, this chapter describes the present daily, diary study on older adult couples in which one partner has type 2 diabetes. Specifically, patients’ positive emotional responses to their spouses’ involvement in their diabetes management were examined as a mediator, and patients’ gender was examined.
as a moderator, of the associations between spouses’ provision of social support and control and patients’ management of their diabetes through exercise.

**Social Support and Social Control**

This section reviews the literature on social support and social control in relation to health behaviors. First, the constructs of social support and social control are each defined in terms of their historical and current descriptions. Next, social support and control are described in terms of factors that are thought to elicit social support and social control from others. Finally, the literature on the influence of social support and social control on health behaviors is reviewed. The literature review highlights the effects of support and control provided by spouses or intimate partners on recipient’s health behaviors in relation to illness management.

**Social support.** Early theory and research suggested that social support instills a sense of being loved and cared for, personal value, and belonging in recipients (Weiss, 1974) and provides recipients the emotional and tangible resources to manage difficult situations (Cobb, 1976). Across studies, however, social support has been conceptualized as either perceived support (i.e., believed to be available from others if needed) or enacted support (i.e., support actually received or provided) (Turner & Turner, 1999). Since the objective of this study is to investigate the effects of spouses’ provision of support on illness management, this study will focus exclusively on enacted social support.

Social support from others may be elicited in response to, or anticipation of, distress in the recipient due to a shared understanding of the recipients’ difficult situation.
Typical functions of social support include emotional support (i.e., expressions of affection, empathy), instrumental support (i.e., provision of material aid, assistance with carrying out activities), and informational support (i.e., provision of needed problem-solving information or advice) (Cohen, 1988, 2004). Theory and evidence suggest that social support is most beneficial to recipients when a specific function of support matches the recipients’ support needs (Cohen & Wills, 1985; Cutrona & Russell, 1990; Uchino, Cacioppo, & Kiecolt-Glaser, 1996).

Social support is posited to benefit health by improving mood, reducing physiological responses to distress, reducing perceived barriers to managing a difficult situation, and by facilitating engagement in healthy behaviors (Cohen, 1988; Cohen, Gottlieb, & Underwood, 2000). Indeed, studies on smoking cessation suggest that receiving family support that improves smokers’ problem-solving skills and family support that positively reinforces smoking reduction are effective in reducing smoking (Coppotelli & Orleans, 1985; Lawhon, Humfleet, Hall, Reus, & Muñoz, 2009). Similarly, qualitative studies on couples with one chronically ill member suggest that partners often provide social support to help patients overcome treatment-related difficulties and to positively reinforce ongoing treatment adherence (Beverly, Miller, & Wray, 2008; Trief et al., 2003; Wrubel, Stumbo, & Johnson, 2008). Further, literature reviews have found emotional support and instrumental support to be linked to better illness management (DiMatteo, 2004; Gallant, 2003).

Social control. In addition to social support, close relationships are thought to promote health by regulating behaviors via social control (Berkman, Glass, Brissette, &
Early theory and research suggested that one’s social role obligations (e.g., parent, spouse) provide a sense of meaning and purpose in life, which in turn discourage socially deviant and risky behaviors (Gove, 1973; Hughes & Gove, 1981; Umberson, 1987). More recently, social control has been conceptualized as social interactions that entail regulation, influence, and constraint of one’s health behaviors (Lewis & Rook, 1999). Social control is theorized to take the form of either indirect control (i.e., perceived expectations of others for one’s behaviors) or direct control (i.e., threatened or actual sanctions by others to discourage unhealthy behaviors and encourage healthy behaviors) (Lewis & Rook, 1999; Umberson, 1987).

Since the objective of this study is to investigate the effects of spouses’ provision of social control on illness management, this study will focus exclusively on direct social control.

Social control from others may be elicited in response to, or anticipation of, recipients’ engagement in unhealthy behaviors, irregular implementation of health-enhancing behaviors, or in response to the control provider’s own anxiety about the recipients’ health (Lewis et al., 2004; Lewis & Butterfield, 2005; Thompson, Ersser, & Webster, 1995). In studies on spouses’ control attempts in healthy couples, however, findings have been mixed. Whereas some social control strategies (e.g., engaging in a targeted behavior together, modeling healthy behavior) have been associated with greater engagement in healthy behaviors, other social control strategies (e.g., direct requests to change behavior, pressuring to change behavior, or the use of guilt or frustrated expressions) have been either unrelated to health behaviors or associated with less

In studies on spouses’ control attempts in couples living with one partner’s chronic illness, findings have been similarly mixed. A variety of spousal control strategies (e.g., nagging, motivating) have been associated with better illness management in older adults with osteoarthritis (Stephens, Fekete, Franks, Rook, Druley, & Greene, 2009). However, a study on men with prostate cancer found that wives’ treatment-specific control (i.e., urging better treatment adherence) predicted poorer contemporaneous illness management and was unrelated to illness management over time (Helgeson, Novak, Lepore, & Eton, 2004). Further, studies on adults with diabetes have found that whereas such spousal control tactics as encouraging the patient to eat a healthier diet is associated with more compliance with spouses’ control, such control tactics as nagging and warning about the negative health consequences of not following a healthier diet are associated with less compliance (Beverly et al., 2008; Stephens, Rook, Franks, Khan, & Iida, in press; Trief et al., 2003).

Independent Effects of spousal support and control on illness management.

Although spouses may provide both social support and social control to influence their partner’s illness management (Pierce et al., 2002), few studies have investigated how spouses’ support and control influence patients’ illness management independently of each other. Overall, findings from studies on older adult couples with one chronically ill member suggest that spouses’ social support may be more beneficial for illness
management than spouses’ social control, at least in the short-term. Although spouses’ social support is found to be associated with better contemporaneous illness management (Franks, Stephens, Rook, Franklin, Keteyian, & Artinian, 2006), it is found to be unrelated to illness management over time (Fekete, Stephens, Druley, & Greene, 2006; Franks et al., 2006). However, these same studies found spouses’ social control to be either unrelated to illness-management or to predict poorer illness management over time.

Summary. Social support and social control are identified as two ways by which spouses influence their partner’s health behaviors. Whereas spouses’ social support may be provided to reduce frustration or discouragement with engaging in healthy behaviors, social control may be provided to correct unhealthy behaviors. Across studies on chronically ill adults, however, social support appears to be a more consistent predictor of better illness management than social control.

Theory and evidence suggest that one reason why health behaviors may vary in response to social support and social control is recipients’ emotional responses to the providers’ involvement (Rook & Heller, 1997). Whereas social support is typically intended to address recipients’ emotional needs, the same may be less true of social control. In fact, theory and evidence suggest that social control can influence health behaviors at the expense of psychological well-being (Fekete, Geaghan, & Druley, 2009; Franks et al., 2006; Hughes & Gove, 1981; Okun et al., 2007). As such, another objective of this study was to investigate patients’ emotional responses to receiving social support and control as mechanisms through which support and control each influence illness management.
Emotional Responses to Receiving Social Support and Social Control

This section reviews the literature regarding emotional responses to receiving social support and social control. The aim of this section is to describe how emotional responses may account for the links between social support and social control and health behaviors. Theoretical reasons for differential emotional responses to support and control will be described. Next, the indirect link between support and control and recipients’ behavior through emotional responses will be described in terms of theory and empirical research suggesting how emotions can influence behavior.

Theorized differences between emotional responses to support and control. Some theoretical models (i.e., self-determination, psychological reactance) suggest that spouses’ provision of social support and social control could differentially affect their partners’ emotional responses, and in turn, their behavioral responses. Social interactions that communicate affirmation of one’s behaviors are posited to evoke positive emotions in part because such interactions communicate understanding and respect for the recipient’s autonomy (self-determination, Ryan & Solky, 1996). In turn, positive emotional responses to affirming interactions are expected to elicit less resistance to someone else’s involvement with one’s behaviors (psychological reactance, Brehm, 1966). In contrast, social interactions that are perceived to be coercive or controlling are posited to evoke negative emotions in part because such interactions communicate a lack of empathy and regard for one’s autonomy (Ryan & Solky, 1996). In turn, negative emotional responses to coercive and controlling interactions are thought to increase resistance to someone else’s involvement with one’s behaviors (Brehm, 1966).
According to theory, receiving social support that targets specific behaviors would be expected to elicit more positive emotional responses from support recipients to the extent that receiving support bolsters a sense of autonomy and affirmation (Cohen et al., 2000; Ryan & Solky, 1996; Thoits, 1986). In turn, recipients would be expected to continue or increase engagement in the targeted behaviors (Brehm, 1966). Indeed, better illness management in response to treatment-specific emotional and instrumental support has been attributed to patients’ positive emotional responses to receiving treatment-specific support (DiMatteo, 2004; Edwards, 2006; Gallant, 2003).

Conversely, theory would suggest that to the extent that receiving social control undermines autonomy and suggests a lack of affirmation from the control provider, receiving social control would be expected to elicit less positive emotional responses from control recipients (Hughes & Gove, 1981; Ryan & Solky, 1996). In turn, recipients would be expected to be less willing to engage the targeted behaviors (Brehm, 1966). Partially supporting theory, evidence suggests that social control can elicit both positive (e.g., feeling loved) and negative (e.g., feeling resentful) emotional responses (Fekete et al., 2009; Stephens et al., 2009; Tucker et al., 2006; Tucker & Anders, 2001). In fact, some evidence suggests that older adults may view social control from others as being well-intentioned and motivated by others’ concern for their welfare (Rook & Itarte, 1999; Rook, Thuras, & Lewis, 1990). In turn, positive emotional responses to control have been linked to greater compliance with the control provider’s request, whereas negative emotional responses to control have either failed to elicit behavioral change or have been
linked to greater resistance to the control provider’s request (Fekete et al., 2009; Okun et al., 2007; Tucker et al., 2006).

Summary. Overall, theory and evidence suggest that emotional responses to receiving social support and social control might explain why social support and social control could have different effects on health behaviors. More favorable emotional responses to support may explain how social support can facilitate engagement in healthy behaviors. In contrast, less favorable emotional responses to control may explain how social control can hamper engagement in healthy behaviors.

In addition to recipients’ emotional responses, however, theory and research suggest that the health effects of support and control can vary by the recipient’s gender (Aneshensel, 1992; Thoits, 1995; Umberson, 1987). Evidence suggests that women experience poorer mental health than men in couples living with one partner’s chronic illness (Hagedoorn, Sanderman, Bolks, & Wobbes, 2008; Rohrbaugh, Cranford, Shoham, Nicklas, Sonnega, & Coyne, 2002), which may be attributed in part to gender differences in social support and control exchanges (Aneshensel, 1992; Belle, 1987; Umberson, Chen, House, Hopkins, & Slaten, 1996). Accordingly, the final aim of the current study was to investigate patients’ gender differences in the direct associations between spouses’ social support and control and illness management and in the indirect associations through patients’ emotional responses.

Gender Differences in Social Interactions

This section reviews the literature regarding gender differences in social support and social control exchanges as well as gender differences in responses to receiving
social support and control. Theoretical reasons for gender differences in social support and social control exchanges will be described in terms of gender socialization and social role theory. In turn, gender socialization and social role theory will be applied to the context of couples living with one partner’s chronic illness to explain why chronically ill women may benefit less from spouses’ social support and social control than chronically ill men.

*Health disparities in married, chronically ill adults.* Studies on couples living with one partner’s chronic illness find that chronically ill women experience poorer psychological well-being than chronically ill men (Hagedoorn et al., 2008; Rohrbaugh et al., 2002). Further, a study on adults diagnosed with colorectal cancer found that whereas married men experienced better psychological well-being than unmarried men, married women experienced poorer psychological well-being than unmarried women (Goldzweig et al., 2009). Such gender differences in the health of married, chronically ill adults may be attributed in part to women being less likely than men to perceive their spouse as being sensitive to their social support needs (Neff & Karney, 2005). Evidence also suggests that compared to men, women are less likely to comply with spouse’s social control (Lewis et al., 2004; Westmaas et al., 2002). Compared to men, women may be more resistant to their spouse’s social control because they may be more emotionally sensitive to their spouses’ control strategy (Tucker et al., 2006) or because they may feel more undermined in their social role performance as a spouse (Hafstrom & Schram, 1984).
Gendered norms for social interactions. The apparent gender differences in health between married, chronically ill adults may be explained by gendered socialization processes and norms regarding social roles in close relationships. Theory and research suggest that men and women have different socialization histories in childhood that are further reinforced by social roles occupied in adulthood (e.g., parent, employee) (Cross & Madsen, 1997; Eagly, 1987; Helgeson & Fritz, 2000; Vaux, 1988). Whereas socialization histories and adult social roles are posited to encourage women’s focus on demonstrating interdependence and cohesion, socialization histories and adult social roles are posited to encourage men’s focus on demonstrating independence and strength. Indeed, evidence suggests that women often maintain a larger network of emotionally close relationships and more often provide social support and social control to others than do men (Aneshensel, 1992; Belle, 1987; Umberson et al., 1996).

Gendered social norms in the context of chronic illness. For couples living with one partner’s chronic illness, social norms typically dictate that spouses adopt a caregiving role toward their ill partner (Revenson, Abraído-Lanza, Majerovitz, & Jordan, 2005). However, since women often adopt caregiving roles (e.g., caring for ill family members, adopting professions that entail caregiving) in general (Aneshensel, 1992; Umberson et al., 1996), social norms may place a greater emphasis on wives’ caregiving than on husbands’ caregiving (Eagly, 1987). Indeed, wives of chronically ill men are found to place a greater importance on their caregiving abilities than husbands of chronically ill women (Hagedoorn, Sanderman, Buunk, & Wobbes, 2002). Moreover, gendered social norms may exacerbate social role demands for chronically ill women, as
they are more likely to maintain pre-existing social roles than chronically ill men after illness onset (Hafstrom & Schram, 1984; Revenson et al., 2005).

Summary. Overall, theory and evidence suggest that gendered social norms may place a greater emphasis on spousal caregiving in women than in men. Gender differences in social norms for caregiving may explain why chronically ill women are less likely to feel as though their health needs are being met by their spouse than are chronically ill men. Thus, chronically ill women would be expected to view their spouses’ involvement in their illness management less positively than chronically ill men.

Current Study

The overall goals of the current study were to investigate the associations between spouses’ social support and control on patients’ management of type 2 diabetes mellitus (T2DM), the mediating roles of patients’ emotional responses to receiving spouses’ support and control, and the moderating role of patient gender. T2DM is an endocrine disorder characterized by elevated blood glucose levels due to insulin resistance, inadequate insulin production, or both. Development of T2DM is attributed to genetic as well as environmental factors such as obesity and a sedentary lifestyle, and its prevalence increases with age (CDC, 2008b). An estimated 12.2 million older adults (60 years and older) in the United States are diagnosed with diabetes mellitus, most often Type 2 (CDC, 2008b). T2DM contributes to declines in health from such complications as cardiovascular disease, kidney disease, neuropathy, and blindness, and it is the seventh leading cause of death in the United States (CDC, 2008b).
Diabetes management typically entails adopting and maintaining daily dietary and exercise regimens, daily blood glucose monitoring, and may include daily insulin injections and medications to maintain healthy blood glucose levels (CDC, 2008b). However, adults with T2DM are often unable to maintain such lifestyle changes, most notably physical exercise. A national survey of adults with T2DM found that only 12.7% of adults reported engaging in moderate or vigorous levels of physical activity in the past 7 days (Green, Bazata, Fox, & Grandy, 2007). Another national survey of older adults with T2DM found that of the adults who engaged in at least some exercise at baseline, 55% of these adults had stopped engaging in that exercise by the four-year follow-up (Nothwehr & Stump, 2000).

Whereas physical activity refers to any activity produced by the skeletal muscles that results in energy expenditure (e.g., work-related activities), exercise refers to physical activity that is planned, structured, repetitive, and specifically intended to maintain or improve health (Caspersen, Powell, & Christenson, 1985). The American Diabetes Association (2010) describes exercise as formal activities that include aerobic activities (e.g., walking or bicycling), strength-building (e.g., weight-lifting), and stretching exercises as well as informal activities that can be done regularly such as household chores. Exercise reduces blood glucose levels by increasing cellular sensitivity to insulin and glucose uptake (Hayes & Kriska, 2008). Exercise can also help reduce the risk of diabetes-related complications through weight management (CDC, 2008a). However, maintaining an exercise routine may be particularly challenging for
older adults with diabetes, as they are often more physically impaired than older adults who do not have diabetes (American Diabetes Association; ADA, 2009).

Social relationships have been identified as one key factor affecting patients’ diabetes management and prognosis (Gonder-Frederick, Cox, & Ritterband, 2002). Qualitative studies on adults with T2DM and their family have shown that spouses provide social support (e.g., reassurance, affirmation) and/or social control (e.g., prompts, reminders, nagging) to facilitate or improve patients’ adherence to dietary regimens, blood glucose monitoring, and exercise (Beverly et al., 2008; Thorpe, Lewis, & Sterba, 2008; Trief et al., 2003). In light of the high relapse rates in physical exercise in adults with T2DM (Green et al., 2007; Nothwehr & Stump, 2000), the current study sought to inform prior research by investigating how spouses’ attempts to facilitate or improve patients’ exercise behaviors through social support and social control (i.e., exercise support and exercise control) affect patients’ exercise behaviors.

Prior studies on adults diagnosed with T2DM have found social support to be linked to better diabetes management (Garay-Sevilla et al., 1995; Nicklett & Liang, 2010; Rosland et al., 2008). Prior studies have also found social support to predict better diabetes management in men but not women (Connell, Fisher, & Houston, 1992) and satisfaction with support to be more influential to diabetes management for women than for men (Heitzman & Kaplan, 1984). However, each of these studies only assessed perceived social support, which tends to remain relatively stable across assessments (Turner & Turner, 1999) and may be less amenable for understanding how day-to-day differences in social support provision influence health behaviors. These earlier studies
also assessed patients’ perceived support from their general social network. This limited conclusions about the influence of spouses, who are most often closely involved in, and affected by, patients’ diabetes management on a daily basis (Beverly et al., 2008; Trief et al., 2003). The current study addressed limitations in prior research by investigating spouses’ enacted support and control as predictors of patients’ exercise behaviors.

Little is known about the daily impact of spouses’ support and control on patients’ illness management (Helgeson et al., 2004; Revenson, 2003). Although spouses’ attempts to improve their partner’s health behaviors may be an ongoing experience of couples (Lewis et al., 2004), prior research on married couples suggests that such attempts do not occur every day (Tucker & Anders, 2001). The current investigation uses a 7-day computer diary to investigate how spouses’ provision of exercise support and exercise control on a given day influences patients’ exercise behaviors relative to days in which spouses do not provide support and/or control. The use of daily diaries enables 1) the investigation of associations between day-to-day variability in spousal involvement and day-to-day variability in patients’ responses within couples, and 2) the investigation of differences in these daily associations between couples (Bolger, Davis, & Rafaeli, 2003). In addition to associations between spousal involvement and patient responses that same day, the potential carry over effects of spousal involvement on patients’ exercise behaviors the following day were explored.

Finally, the current study extends prior research by using an activity monitoring device worn on the patients’ wrist for 24 hours each day during the 7-day diary period to objectively measure physical activity. Activity monitoring devices measure minutes of
low, moderate, and vigorous physical activity and calculate energy expenditure over varying lengths of time (Murphy, 2009). Importantly, the availability of physical activity data for 24 hours each diary day allows for the measurement of brief bouts of physical activity that can occur throughout the day (Pate et al., 1995) but could otherwise be missed by self-report.

**Aim 1**

The first aim of this study was to investigate the direct effects of spouses’ exercise support and control on patients’ exercise behaviors (on the same day and next day). The hypothesized associations between spouses’ support and control and patients’ exercise are depicted as dashed lines in Figure 1. With previous research suggesting that spouses’ support is associated with better illness management and that spouses’ control is either unrelated to, or is associated with poorer, illness management (Helgeson et al., 2004; Franks et al., 2006), the following hypothesis for the associations between spouses’ exercise support and control and patients’ exercise was derived:

*Hypothesis 1*: On days in which spouses provided exercise support, patients would engage in more exercise (greater minutes of self-reported low, moderate, and vigorous levels of exercise; greater energy expenditure) that same day and the next day than on days in which spouses did not provide support. However, on days in which spouses provided exercise control, patients would engage in less exercise that same day and the next day than on days in which spouses did not provide control.

**Aim 2**
Figure 1. Hypothesized mediational model of patients’ positive emotional responses for daily associations between spouses’ exercise support and control and patients’ exercise.
The second aim of this study was to investigate patients’ same day positive emotional responses to spouses’ involvement in diabetes management as mediators of the associations between spouses’ exercise support and control and patients’ same day and next day exercise behaviors. Only positive emotional responses were investigated as mediators because older adults are found to respond more positively than negatively to their family members’ involvement in their health behaviors (Rook et al., 1990; Scheibe & Carstensen, 2010). Because the sample in the current study would consist of older adult couples, patients were expected to respond more or less positively to their spouses’ exercise support or exercise control as opposed to more or less negatively.

The hypothesized indirect associations through patients’ positive emotional responses are depicted as solid lines in Figure 1. Based on theory and evidence that receiving social support can improve health behaviors by eliciting more favorable emotional responses and that receiving social control can worsen health behaviors by eliciting less favorable emotional responses (Brehm, 1966; Ryan & Solky, 1996; Cohen et al., 2000; Tucker et al., 2006), the following hypothesis was derived:

*Hypothesis 2*: On days in which spouses provided exercise support, patients would have more positive emotional responses, and in turn, engage in more exercise (greater minutes of self-reported low, moderate, and vigorous levels of exercise; greater energy expenditure) that same day and the next day than on days in which spouses did not provide support. However, on days in which spouses provided exercise control, patients would have less positive emotional responses,
and in turn, engage in less exercise that day and the next day than on days in which spouses did not provide control.

Aim 3

The final aim of this study was to investigate patients’ gender as a moderator of the direct associations between spouses’ exercise support and control and patients’ exercise (same day and next day). Additionally, patients’ gender was investigated as a moderator of the mediated effects of spouses’ exercise support and control through patients’ emotional responses to spousal involvement in diabetes management. Based on gender role theory (Eagly, 1987) and evidence that chronically ill women are less likely to have their health needs met by their spouses than chronically ill men (e.g., Hagedoorn et al., 2001), the following hypotheses were generated:

Hypothesis 3: The associations between spouses’ exercise support and patients’ exercise (minutes of self-reported low, moderate, and vigorous levels of exercise; greater energy expenditure) that same day and the next day were expected to be positive and stronger for male patients than for female patients. Conversely, the associations between spouses’ exercise control and patients’ exercise that same day and the next day were expected to be negative and stronger for female patients than for male patients.

Hypothesis 4: The indirect associations between spouses’ exercise support and patients’ exercise and between spouses’ exercise control that same day and next day through patients’ positive emotional responses were expected to be stronger for female patients than for male patients. That is, the
strength of the direct associations between spousal involvement and patients’ exercise was hypothesized to be attenuated for female patients when their emotional responses are taken into account. By comparison, the strength of the direct associations between spouses’ support and control and patients’ exercise for male patients was hypothesized to be less affected by having their emotional responses taken into account.
CHAPTER 2

Method

Participants

Older adult couples were recruited through newspaper advertisements, radio announcements, physicians’ offices, diabetes education centers, and senior citizen organizations. Couples who participated in the present study were drawn from a subsample of couples who had participated in prior studies conducted by our lab and who agreed to have their names placed in a registry for possible participation in future studies. Couples from the registry were not approached to participate in the present study until at least one month after completing a prior study.

To be eligible for the current study, adults had to be at least 55 years of age, diagnosed with T2DM, be in a heterosexual marriage or marriage-like relationship, and reside in the community with their partner (hereafter referred to as “spouse”). Spouses had to be the primary source of assistance for the patient regarding diabetes management, and they could not be diagnosed with either type 1 diabetes or type 2 diabetes themselves.

Ninety couples were screened for eligibility. Of these couples, 8 were ineligible. Couples were most frequently ineligible because both partners had diabetes (N = 2) or because the spouse was deceased (N = 2). Among the eligible couples, 9 declined to
participate, and the most frequent reasons were illness (N = 4), lack of interest (N = 2), or lack of time (N = 2). Two couples withdrew at the start of the study because of patient illness, and one couple was excluded due to incomplete data on sociodemographic variables. The final study sample had 70 couples (140 individuals), yielding a response rate of 77.7% for eligible couples. Characteristics of couples who participated in the study are shown in Table 1.

Procedures

Patients and spouses completed daily diaries on laptop computers (Toshiba Techra8000 and IBM ThinkPad A21m). The diary software, ATH Solutions, was designed for easy access by older adults (e.g., large font size) and for individuals with limited computer experience (e.g., multiple options for registering responses). Laptop computers were brought to the couples’ home by trained staff who instructed couples on how to use the laptop and enter information in the diary program. Couples were instructed to complete one electronic diary record in the evening between 7:00 pm and 9:59 pm for 7 days. Each diary record was electronically stamped by date and time, and couples could only access the diaries within the specified 3-hour evening window. Patients and spouses were given separate passwords to access their diaries to encourage independent responding. Couples were also provided paper diaries in case of technical difficulties. Additionally, couples were instructed to independently complete paper questionnaires regarding sociodemographic information, general health, and mood.
Table 1.

*Sociodemographic Characteristics of Couples in Study (N = 70).*

<table>
<thead>
<tr>
<th>Participant Information</th>
<th>Patients</th>
<th>Spouses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>68.9 (6.6)</td>
<td>69.0 (8.1)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>50.00%</td>
<td>50.00%</td>
</tr>
<tr>
<td>Female</td>
<td>50.00%</td>
<td>50.00%</td>
</tr>
<tr>
<td>Years of Education</td>
<td>13.9 (2.3)</td>
<td>13.8 (2.3)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>87.10%</td>
<td>87.10%</td>
</tr>
<tr>
<td>African American</td>
<td>11.40%</td>
<td>10.10%</td>
</tr>
<tr>
<td>Asian American</td>
<td>1.40%</td>
<td>1.40%</td>
</tr>
<tr>
<td>Employment Status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Working full-time</td>
<td>7.10%</td>
<td>8.60%</td>
</tr>
<tr>
<td>Working part-time</td>
<td>11.40%</td>
<td>8.60%</td>
</tr>
<tr>
<td>Retired</td>
<td>70.00%</td>
<td>67.10%</td>
</tr>
<tr>
<td>Years Diagnosed with T2DM</td>
<td>13.0 (9.5)</td>
<td>---</td>
</tr>
<tr>
<td>Years Married</td>
<td></td>
<td>42.1 (11.4)</td>
</tr>
<tr>
<td>Median Household Income</td>
<td></td>
<td>$40,000-59,000</td>
</tr>
</tbody>
</table>
Diary compliance was tracked using the date and time stamps of the diary software. Out of the potential 490 diary records for patients (70 patients x 7 days), 97.3% (477 diary records) were completed. Of the diary records completed by patients, 6.1% (29) were filled out on paper, and 20.0% of patients (14) used paper diaries at any time. The maximum number of paper diaries used by a patient was 7 (one patient). Out of the potential 490 diary records for spouses, 97.9% (480 diary records) were completed. Of the diary records completed by spouses, 5.6% (27) were filled out on paper, and 21.4% of spouses (15) used paper diaries at any time. The maximum number of paper diaries used by a spouse was 7 (one spouse, who was in the same couple as the one patient who used 7 paper diaries).

For a measure of physical activity (through energy expenditure), patients wore an activity monitoring device (Actical, Mini Mitter Corporation) on the wrist for 24 hours each day during the 7-day diary period. Because activity monitoring devices were not available until after data collection began, only a subset of patients \( n = 53 \) wore the activity monitoring device. The activity monitoring device detects the occurrence and intensity of motion and stores this information as activity counts. Patients were instructed to wear the device on their wrist in order to better capture upper body physical activity that is characteristic of many light activities (e.g., household chores) (Chen et al., 2003; Swartz, Strath, Bassett, O’Brien, King, & Ainsworth, 2000), as such activities are common for older adults (Westerterp, 2008). Using patients’ weight, age, height, and activity counts, software programmed within the Actical device calculates energy expenditure in kilocalories per kilogram per minute (Crouter & Bassett, 2008; Heil,
2006). Although patients wore the activity monitoring device for 24 hours each diary day, only energy expenditure calculations that reflect a diary day (i.e., starting at wake time and ending at the start of the diary) were used in study analyses.

Chi-square analyses and independent samples $t$ tests indicated that there were no significant ($p < .05$) differences between the patients who had worn the activity monitoring device ($n = 53$) and patients who had not worn the activity monitoring device ($n = 17$) in race/ethnicity, age, level of education, income, employment status, years diagnosed with T2DM, level of activity restriction, or overall physical health. However, female patients were more likely to have not worn an activity monitoring device than male patients, $\chi^2(1) = 6.29$, $p < .05$.

**Measure Descriptions**

To conduct factor analyses for spouse’ exercise support and control ratings, scale items were first aggregated across the 7 days to yield a mean score for each person. Cronbach’s alphas for scales are based on squared deviation scores of people’s daily item ratings from their own mean rating across the 7 days to account for the variability in item ratings across days.

**Spouse Measures**

*Exercise support and exercise control.* In 14 items of the diary, spouses indicated the extent to which they engaged in exercise support (e.g., Listened to my [husband’s / wife’s] concerns about maintaining an exercise routine) and exercise control (e.g., Prompted or reminded my [husband / wife] to exercise more) that day (see Appendix A). Exercise support and exercise control items were created based on previous studies on
spousal interactions regarding one partner’s chronic illness (Franks et al., 2006; Trief et al., 2003). Each item was rated on a scale from 1 (Not at All) to 4 (Very Much).

Factor analyses (Maximum Likelihood, varimax rotation) of the 14 items indicated a three factor solution (i.e., eigenvalues > 1.0) that accounted for 73.0% of the variance: exercise control (7 items), exercise-specific emotional support (5 items), and exercise-specific instrumental support (2 items). All item loadings were at least .40. For the purpose of the current study, exercise-specific emotional support and exercise-specific instrumental support were combined into one 7-item exercise support scale.

Spouses in the current study rarely provided exercise support or exercise control during the 7-day diary period, which is consistent with prior research on healthy couples (Tucker & Anders, 2001). The mean exercise support score across spouses was 1.79 (SD = .59; range = 1.00 - 3.21; \( \alpha = .72 \)), and the mean exercise control score across spouses was 1.28 (SD = .40; range = 1.00 - 2.74; \( \alpha = .67 \)). Due to the rarity with which spouses provided either exercise support or exercise control on a given day, measures of spouses’ exercise support and exercise control were dichotomized. Exercise support and exercise control were each dummy coded (e.g., 0 = No support provided that day, 1 = At least some support provided that day). As a result of dummy coding, patients’ exercise and positive emotional responses on days in which spouses provided exercise support or exercise control could be compared to patients’ exercise behaviors and positive emotional responses on days in which spouses did not provide support or control.

---

1 Similar results were found for factor analyses of exercise support and control conducted separately by spouse gender (Male spouses: three factor solution accounting for 76.9% of the variance, item loadings at least .40; Female spouses: three factor solution accounting for 74.3% of the variance, item loadings at least .40).
**Patient Measures**

*Minutes of exercise.* In diaries, patients reported the number of minutes in which they engaged in light (e.g., grocery shopping, playing golf), moderate (e.g., yard work, brisk walking), and vigorous (e.g., running, bicycling) levels of exercise on that day (see Appendix B). Exercise items were adapted from items of the Yale Physical Activity Survey, which assesses older adults’ physical activity (DiPietro, Caspersen, Ostfeld, & Nadel, 1993). The mean number of minutes of light exercise across patients was 36.74 (SD = 25.54; range = 0 – 102.86), the mean number of minutes of moderate exercise across patients was 28.19 (SD = 25.82; range = 0 – 105.00), and the mean number of minutes of vigorous exercise across patients was 9.80 (SD = 17.43; range = 0 – 79.29).

*Daily energy expenditure.* The measure of interest from the activity monitoring device was the average metabolic equivalents (METs) calculated by the Actical program for each diary day. METs refer to the ratio of energy expenditure during physical activity to energy expenditure during rest (Pate et al., 1995). Averaging METs by the length of a diary day (in minutes) provides an average energy expenditure that is expressed as kilocalories/kg/minute. Light physical activity (e.g., household cleaning, slow walking) is defined as energy expenditure that is less than 3 METs, moderate physical activity (e.g., brisk walking) is defined as energy expenditure that is between 3 and 6 METs, and vigorous physical activity (e.g., fast cycling, moving furniture) is defined as energy expenditure that is greater than 6 METs (Pate et al., 1995). For the subset of 53 patients who wore an activity monitoring device, the mean METs across patients was 3.20 kcal/kg/min (SD = .81; range = 0.73 – 5.21).
**Positive emotional responses.** In diaries, patients rated the extent to which they experienced three positive emotional responses (i.e., loved/cared for, appreciative/grateful, hopeful/optimistic) and three negative emotions (i.e., guilty/ashamed, resentful/bitter, irritated/angry) to their spouses’ attempts to influence their diet or exercise that day (see Appendix C). Scale items were created based on previous studies on emotional responses to health-related interactions from social network members (Lewis & Rook, 1999) and spouses (Stephens et al., 2009). Items were rated on a scale from 1 (Not at all) to 4 (Very much). For the purpose of the current study, only positive emotional responses (items 2, 4, and 6 in Appendix C) were used in the present study. The mean positive emotional response score across patients was 2.46 (SD = .93; range = 1.00 - 4.00; α = .65).

**Covariates**

Patients’ age, gender, education level, and BMI were included as covariates because they can affect the degree to which adults engage in physical exercise and their magnitude of energy expenditure (Cerin & Leslie, 2008; Krug et al., 1991; Lee, 2005; Lührmann, Bender, Edelmann-Schäfer, & Neuhäuser-Berthold, 2009; Sternfeld, Ainsworth, & Quesenberry, 1999). Patients’ marital satisfaction (Quality of Marriage Index, Norton, 1983) and number of years diagnosed with T2DM were also included as covariates because of their potential influence on the strength or direction of associations between spouses’ involvement and patients’ emotional and behavioral responses (Berg & Upchurch, 2007; Peyrot, McMurry, & Hedges, 1988).

**Analysis Plan**
Analyses. Hierarchical linear modeling analyses (HLM; Bryk & Raudenbush, 1987) were used to test all research hypotheses. HLM accounts for within-person (Level 1) and between-person (Level 2) dependencies in responses that are associated with repeated measures and dyadic designs. As a result, HLM provides more precise estimates of associations between variables than the estimates of associations derived from ordinary least squares (OLS) (Bolger et al., 2003; Pollack, 1998). Because daily measures were nested within patients and spouses (who in turn were nested within couples), the direct and mediated associations were investigated at Level 1 (cf., Bolger et al., 2003). Since patient gender varies between couples, patient gender was examined as a Level 2 variable that influences the strength or direction of the direct and mediated associations at Level 1. Statistically, moderation by gender is denoted by cross-level interactions between Level 1 (direct and mediated associations) and Level 2 (patient gender) models (cf., Raudenbush & Bryk, 2002).

All study covariates were added at Level 2. Patients’ age, education, BMI, and gender were included to control for between-couple differences in patients’ average minutes of exercise and energy expenditure. Patients’ marital satisfaction and years diagnosed with T2DM were included to control for between-couple differences in the magnitude and/or direction of associations between either spouse’s exercise support or exercise control and either patients’ positive emotional responses or exercise. Additionally, the mean scores of spouses’ exercise support and exercise control across the diary 7 days were included as Level 2 predictors in order to partial out the effects of spouses’ general tendencies to be more or less involved in their partner’s diabetes
management from the effects of daily fluctuations in spouses’ involvement on patients’ mean positive emotional responses and exercise (cf., Skaff et al., 2009).

Predictor variables at Level 2 (i.e., covariates, moderator, and mean support and control scores) were grand-mean centered, and predictor variables at Level 1 (i.e., daily exercise support and control) were group-mean centered to ease the interpretation of Level 1 associations by reducing the overlap between Level 1 variance and Level 2 variance (Enders & Tofighi, 2007; Nezleck, 2003). Group-mean centering of the dichotomous exercise support and control variables enabled the interpretation of differences in patients’ minutes of exercise and energy expenditure between days in which spouses had and had not provided support or control within a given couple (cf., Raudenbush & Bryk, 2002). Errors for Level 1 associations were estimated as random effects (i.e., deviations of observed outcomes from predicted outcomes were assumed to vary by couple) in order to investigate between-couple differences (at Level 2) in the direct and mediated associations by patient gender (Nezleck, 2003).

Same day and next day (i.e., lagged) analyses were conducted for direct, mediated, and moderated associations. For same day analyses, patient outcomes on a given day were modeled as a function of exercise support and control (and for mediation, positive emotional responses) on that same day. For lagged analyses, patient outcomes on a given day were modeled as a function of exercise support and control (and for mediation, positive emotional responses) and the respective patient outcome from the previous day. For illustrative purposes, analyses for each hypothesis are described below in terms of same day associations, absent covariates. In all models, t refers to a given
diary day \((t = 1 \text{ to } 7)\). An example of a lagged analysis would be modeling patients’ minutes of moderate exercise for day \(t\) (i.e., today) as a function of their spouses’ support, spouses control and their minutes of moderate exercise at day \(t - 1\) (i.e., yesterday).

First hypothesis. Patients’ exercise and energy expenditure were modeled as a function of spouses’ exercise support and exercise control in Level 1.

**Level 1:**

\[
\text{Exercise}_t = b_0 + b_1(\text{exercise support}_t) + b_2(\text{exercise control})_t + e_t
\]

Since predictors in Level 1 are group-mean centered, the intercept, \(b_0\), refers to each patients’ own average minutes of exercise or average energy expenditure on days in which their spouses did not provide exercise support or control (i.e., when support and control is 0). On days in which spouses provided some amount of exercise support and/or control (i.e., when support or control is 1) the association between exercise support and patients’ exercise is represented by \(b_1\), and the association between exercise control and patients’ exercise is represented by \(b_2\). The error term, or deviation of the patients’ amount of exercise from his/her predicted amount of exercise for a given day, is represented by \(e_t\). For Level 1, \(b_0, b_1, \text{ and } b_2\) represent fixed parameters that are interpreted similarly to regression coefficients in OLS (Nezlek & Zyzniewski, 1998).

However, unlike OLS, the HLM parameters at Level 1 are outcome variables at Level 2 (Nezlek & Zyzniewski, 1998). The intercept was modeled as a function of the average amount of exercise across all patients on days in which their spouses did not exercise support or control, \(b_{00}\), the mean score for exercise support provided by spouses
across the 7 days, $b_{01}$, the mean score for exercise control provided by spouses across the 7 days, $b_{02}$, and the deviation of a given patient’s average outcome score from the average outcome score across all patients on a given day, $r_{0t}$. The inclusion of mean scores for exercise support and control at the intercept represents the influences of spouses’ average level support and control on the average level of patients’ physical exercise and energy expenditure on days in which spouses did not provide exercise support or control. All study covariates were also included in the intercept equation to control for mean differences across patients in their average minutes of physical exercise, energy expenditure, and positive emotional responses (for mediation analyses) on days in which spouses did not provide either exercise support or control.

The associations between support and exercise and control and exercise, $b_1$ and $b_2$, respectively, were modeled as a function of the average degree of association between spouses’ support or control and patient exercise across all patients on days in which spouses provided some level of exercise support and/or control, $b_{10}$ and $b_{20}$, respectively, and the deviation of a given patient’s association from the average association across all patients, $r_1$ and $r_2$, respectively for a given day. Patients’ marital satisfaction and number of years diagnosed with T2DM were also included as covariates in Level 2 equations for $b_1$ and $b_2$ to control for between-couple differences in the associations between spouses’ exercise support or control and patients’ physical exercise, energy expenditure, and positive emotional responses (for mediation analyses) on days in which spouses provided either exercise support or control.

**Level 2:**
Second hypothesis. Analyses for the mediational model were conducted in 2 steps according to Krull and MacKinnon (2003). In the first step, patients’ positive emotional responses were modeled as a function of spouses’ exercise support and control at Level 1.

Level 1:

Positive emotional responses, $r = b_0 + b_1(\text{exercise support})_t + b_2(\text{exercise control})_t + e_t$

For Level 2 analyses in the first step of the mediation analyses, Level 1 parameters were modeled the same as what was previously described for the first hypothesis:

Level 2:

$\begin{align*}
\theta_0 &= \theta_{00} + \theta_{01}(\text{mean exercise support}) + \theta_{02}(\text{mean exercise control}) + r_{0t} \\
\theta_1(\text{exercise support})_t &= \theta_{10} + r_{1t} \\
\theta_2(\text{exercise control})_t &= \theta_{20} + r_{2t}
\end{align*}$

In the second step of mediation analyses, patients’ exercise and energy expenditure were modeled as a function of spouses’ exercise support and control and patients’ positive emotional responses at Level 1. The mediated effects of spouses’
support and control are denoted by $b_1'$ and $b_2'$, respectively. The association between positive emotional responses and exercise is denoted by $b_3$.

**Level 1:**

$$\text{Exercise}_t = b_0 + b_1'(\text{exercise support}_{jt}) + b_2'(\text{exercise control})_t + b_3(\text{positive emotional responses})_t + e_t$$

*Note:* In Level 2 analyses in the second step of the mediation analyses, Level 1 parameters were modeled similarly to what was previously described for the first hypothesis.

**Level 2:**

$$b_0 = b_{00} + b_{01}(\text{mean exercise support}) + b_{02}(\text{mean exercise control}) + r_{0t}$$

$$b_1'(\text{exercise support}_{jt}) = b_{10} + r_{1t}$$

$$b_2'(\text{exercise control})_t = b_{20} + r_{2t}$$

$$b_3(\text{positive emotional responses})_t = b_{30} + r_{3t}$$

*Third hypothesis.* Analyses for the hypothesized moderation of the associations between spouses’ exercise support and control and patients’ exercise and energy expenditure by patient gender entailed the investigation of cross-level interactions. Like Level 1 analyses for the first hypothesis, patients’ exercise and METs were modeled as a function of spouses’ exercise support and control.

At Level 2, however, Level 1 parameters were modeled as a function of gender in addition to spouses’ average provision of exercise support and control across the 7 days
and other study covariates. In the illustrations of study analyses below, the influence of patient gender on the average exercise levels and energy expenditure on a given day across patients is denoted by $b_{03}$, the influence of patient gender on the average associations between exercise support and exercise and energy expenditure across couples is denoted by $b_{11}$, and the average associations between exercise control and exercise and energy expenditure across couples is denoted by $b_{21}$. Effect coding, -1 and 1, was used to denote male patients and female patients, respectively, in order to determine differences in the average minutes of exercise and energy expenditure and associations between spouses’ support and control and patients’ exercise and energy expenditure as a function of patient gender (cf., Kenny, Kashy, & Cook, 2006). Because of effect coding, patient gender as a predictor of the Level 1 intercept parameter would show gender differences in the average level of exercise on days in which spouses did not provide exercise support and control.

**Level 2:**

$$b_0 = b_{00} + b_{01}(\text{mean exercise support}) + b_{02}(\text{mean exercise control}) + b_{03}(\text{patient gender}) + r_{0t}$$

$$b_1(\text{exercise support})t = b_{10} + b_{11}(\text{patient gender}) + r_{1t}$$

$$b_2(\text{exercise control})t = b_{20} + b_{21}(\text{patient gender}) + r_{2t}$$

**Hypothesis 4.** Analyses for the hypothesized gender moderation of the mediation by patients’ positive emotional responses also entailed the investigation of cross-level interactions. Like Level 1 mediational analyses for the second hypothesis, patients’
positive emotional responses were modeled as a function of spouses’ exercise support and control at Level 1. Next, patients’ exercise and energy expenditure were modeled as a function of exercise support and control and patients’ positive emotional responses in order to investigate mediation by patients’ emotional responses at Level 1.

At Level 2, Level 1 parameters were modeled as a function of gender in addition to spouses’ average provision of exercise support and control across the 7 days and other study covariates. For the analyses for hypothesis 4, the inclusion of patient gender at Level 2 allowed for the investigation of how it alters 1) the associations between spouses’ exercise support and exercise control and patients’ positive emotional responses and 2) the associations between patients’ positive emotional responses and patients’ exercise and METs after controlling for exercise support and control. In the second set of Level 2 analyses illustrated below, the moderating effect of gender on the association between patients’ positive emotional responses and patients’ exercise and energy expenditure is denoted by $b_{31}$.

**Level 2 for Level 1 analyses for positive emotional responses:**

\[ b_0 = b_{00} + b_{01}(\text{mean exercise support}) + b_{02}(\text{mean exercise control}) + b_{03}(\text{gender}) + r_{0t} \]

\[ b_1(\text{exercise support}_t) = b_{10} + b_{11}(\text{gender}) + r_{1t} \]

\[ b_2(\text{exercise control}_t) = b_{20} + b_{21}(\text{gender}) + r_{2t} \]

**Level 2 for Level 1 mediation analyses for exercise (after controlling for exercise support and control):**

\[ b_0 = b_{00} + b_{01}(\text{mean exercise support}) + b_{02}(\text{mean exercise control}) + b_{03}(\text{gender}) + r_{0t} \]
Testing Assumptions for HLM

Nonindependence of responses. The degree of dependency in patients’ measures as a function of couple membership was assessed using intraclass correlations for patients’ exercise, energy expenditure, and positive emotional responses in Level 1 models without predictors and Level 2 models with couple identification as a predictor. Intraclass correlations for patient measures (self-reported minutes of exercise, energy expenditure, positive emotional responses) ranged from .39 to .86 (median = .49). The intraclass correlations found in this study indicate that patients’ measures were not independent of their couple membership, which would justify the use of HLM (Kenny, Kashy, & Cook, 2006; Singer & Willet, 2003).

Sample size. In general, the number of groups at Level 2 (i.e., number of couples in this study) has been shown to be more influential to statistical power than the number of group members at Level 1 (Maas & Hox, 2005; Raudenbush, 1997; Raudenbush & Liu, 2000; Snijders, 2005; Snijders & Bosker, 1993). Some evidence suggests that having more than 50 groups for multilevel analyses with one predictor at Level 1 and at Level 2 can provide enough power to detect cross-level interactions if they do exist (Maas & Hox, 2005). For repeated measures, at least three time points of data are recommended in order to assess the nature of change (i.e., linear vs. nonlinear) in
participants’ responses and to more easily differentiate between true change and measurement error (Singer & Willett, 2003). Because the study had 70 couples who were assessed for 7 diary days, the sample size was expected to yield enough power for the study analyses.

*Normal distribution of variables and outliers.* The distributions of continuous variables (i.e., minutes of light, moderate, and vigorous exercise, energy expenditure, positive emotional responses) were fairly normal (i.e., skew ≤ 2 and kurtosis < 7), with only mild skew and kurtosis seen for patients’ self-reported minutes of vigorous exercise. Thus, no continuous variables were transformed. Few scores were greater than 3 SD for any of the continuous variables. Further, when multivariate outliers were removed, findings from preliminary analyses did not differ appreciably from when outliers were included. Accordingly, neither univariate nor multivariate outliers were removed.
CHAPTER 3

Results

Patterns of Spouses’ Involvement and Patients’ Physical Exercise

Spouses’ Involvement. Most spouses (95.7%) reported some level of involvement through support or control in their partner’s exercise on at least one diary day. Across the 7 days, 3 spouses did not provide any exercise support or control, 12 spouses only provided exercise support, and 1 spouse only provided exercise control. Spouses did not provide any exercise support on 22.9% of the days and any exercise control on 51.7% of the days. Spouses were more likely to provide exercise control on days in which they provided exercise support than on days in which they had not provided exercise support, \( \chi(1) = 47.78, p < .001 \).

Of the spouses who provided exercise support (\( n = 66 \)), female spouses were no more likely to provide exercise support than male spouses on a given day, \( \chi(1) = .66, ns \). Of the spouses who had provided exercise control (\( n = 55 \)), however, male spouses were more likely to provide exercise control than female spouses on a given day, \( \chi(1) = 5.50, p < .05 \). According to independent samples \( t \) tests and chi-square analyses, spouses who had not provided any exercise control did not significantly differ (\( p > .05 \)) from spouses who had provided exercise control in age, gender, education level, marital satisfaction, number of years the patient had been diagnosed with T2DM, or the number of years married to the patient.
Patient physical exercise. Almost all patients (98.6%) reported engaging in some level of exercise on at least one diary day. Across the 7 diary days, 1 patient did not engage in any exercise, 5 patients only engaged in light exercise, and 1 patient only engaged in moderate exercise. Patients did not engage in any light exercise on 19.2% of the days, moderate exercise on 35.2% of the days, and any vigorous exercise on 74.7% of the days.

For patients who engaged in light exercise \((n = 68)\), the mean minutes of light exercise on a given day was 37.50 \((SD = 37.00; \text{range} = 0 – 240)\). Results of an independent samples \(t\) test indicated that there were no significant differences \((p = .10)\) in the minutes of light exercise reported on a given day between male patients and female patients.

For patients who engaged in moderate exercise \((n = 61)\), the mean minutes of moderate exercise on a given day was 32.00 \((SD = 35.10; \text{range} = 0 – 120)\). Results of an independent samples \(t\) test indicated that male patients reported significantly more minutes of moderate exercise than female patients \((M = 32.87 \text{ vs. } M = 22.30; p < .01)\) on a given day. Results from independent samples \(t\) tests indicated that patients who engaged in moderate exercise were significantly more educated \((M = 14.14 \text{ vs. } M = 12.11; p < .05)\) and had a significantly lower BMI \((M = 35.01 \text{ vs. } M = 29.39; p < .05)\) than patients who had not engaged in any moderate exercise. However, results from independent samples \(t\) tests and a chi-square analysis indicated that patients who engaged in moderate exercise did not significantly differ \((p > .05)\) from patients who had not
engaged in moderate exercise in age, the number of years diagnosed with T2DM, or gender, respectively.

For patients who engaged in vigorous exercise \((n = 42)\), the mean minutes of vigorous exercise on a given day was 16.40 \((SD = 30.40; \text{range} = 0 – 120)\). Results of an independent samples \(t\) test indicated that male patients reported significantly more minutes of vigorous exercise than female patients \((M = 12.43 \text{ vs. } M = 7.01; p < .05)\) on a given day. Based on results from independent samples \(t\) tests and a chi-square analysis, patients who had engaged in vigorous exercise did not significantly differ \((p > .05)\) from patients who had not engaged in any vigorous exercise in age, education level, BMI, the number of years diagnosed with T2DM, or gender, respectively.

For patients who wore the activity monitoring device \((n = 53)\), energy expenditures ranged from sedentary-to-light levels of physical activity to moderate-to-vigorous levels of physical activity \((M = 3.20; \text{range} = 0.62 – 6.08)\) on a given day. Results of an independent samples \(t\) test indicated that daily METs were significantly greater for male patients than for female patients \((M = 3.41 \text{ vs. } M = 2.84; p < .001)\).

*Direct Associations between Spouses’ Exercise Support and Control and Patients’ Physical Exercise*

*Same day associations.* Results for the direct associations between spouses’ support and control and patients’ self-reported minutes of light, moderate, and vigorous exercise on the same day are displayed in Table 2. The fixed effects are depicted on the top, and the random effects are depicted on the bottom of the table. Results without
Table 2

Fixed Effects Estimates for Same Day Associations Between Spouses’ Exercise Support and Exercise Control and Patients’ Minutes of Exercise (N = 70 couples)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Light Exercise</th>
<th>Moderate Exercise</th>
<th>Vigorous Exercise</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model 1</td>
<td>Model 2</td>
<td>Model 1</td>
</tr>
<tr>
<td></td>
<td>Fixed Effects</td>
<td>Fixed Effects</td>
<td>Fixed Effects</td>
</tr>
<tr>
<td>Intercept</td>
<td>35.48*** (3.03)</td>
<td>35.46*** (2.97)</td>
<td>25.99*** (2.82)</td>
</tr>
<tr>
<td>Level 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>-7.16 (4.71)</td>
<td>-7.01 (4.74)</td>
<td>-2.92 (4.25)</td>
</tr>
<tr>
<td>Level 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean Support</td>
<td>10.88† (5.90)</td>
<td>6.04 (6.34)</td>
<td>18.56*** (5.43)</td>
</tr>
<tr>
<td>Mean Control</td>
<td>-18.63* (9.15)</td>
<td>-15.99† (9.25)</td>
<td>-24.26** (8.38)</td>
</tr>
<tr>
<td>Age</td>
<td>-.71 (.49)</td>
<td>-.106* (.43)</td>
<td>-.2.42 (2.67)</td>
</tr>
<tr>
<td>Gender</td>
<td>3.03 (3.04)</td>
<td>-2.24 (2.67)</td>
<td>-2.32 (2.00)</td>
</tr>
<tr>
<td>Education</td>
<td>1.81 (1.36)</td>
<td>1.03 (1.19)</td>
<td>1.10 (.89)</td>
</tr>
<tr>
<td>BMI</td>
<td>-.86 (.52)</td>
<td>-1.01* (.46)</td>
<td>-.47 (.34)</td>
</tr>
<tr>
<td>Yrs w/ T2DM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>.15 (.35)</td>
<td>.25 (.31)</td>
<td>.17 (.25)</td>
</tr>
<tr>
<td>Support Slope</td>
<td>.32 (.92)</td>
<td>-.56 (.83)</td>
<td>.13 (.63)</td>
</tr>
<tr>
<td>Control Slope</td>
<td>.30 (.43)</td>
<td>.82* (.38)</td>
<td>-.06 (.29)</td>
</tr>
<tr>
<td>Marital Satisf.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>.27 (.67)</td>
<td>.69 (.59)</td>
<td>-.02 (.50)</td>
</tr>
<tr>
<td>Support Slope</td>
<td>2.31 (1.65)</td>
<td>.67 (1.50)</td>
<td>.87 (1.13)</td>
</tr>
<tr>
<td>Control Slope</td>
<td>-.79 (1.17)</td>
<td>-.24 (1.01)</td>
<td>-.21 (.78)</td>
</tr>
</tbody>
</table>

Random Effects (Variance)

<table>
<thead>
<tr>
<th></th>
<th>Intercept</th>
<th>Support</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed Effects</td>
<td>482.50***</td>
<td>458.56***</td>
<td>436.44***</td>
</tr>
<tr>
<td></td>
<td>436.44***</td>
<td>392.94</td>
<td>471.92***</td>
</tr>
<tr>
<td></td>
<td>189.76</td>
<td>188.62</td>
<td>231.94**</td>
</tr>
</tbody>
</table>

Note. †p < .10. *p < .05. **p < .01. ***p < .001
covariates are shown under Model 1, and results with covariates are shown under Model 2 for each level of exercise. Since the patterns of findings did not differ appreciably between Models 1 and 2, the description of results is based on findings from Model 2 for each level of physical exercise.

As predicted, on days in which spouses provided exercise support, patients engaged in more minutes of light exercise (estimate = 17.35, $p < .05$), moderate exercise (estimate = 13.53, $p < .05$), and vigorous exercise (estimate = 10.39, $p < .05$) relative to days in which spouses had not provided support. By contrast, on days in which spouses provided exercise control, patients engaged in fewer minutes of vigorous exercise (estimate = -6.70, $p < .05$) relative to days in which spouses had not provided control. Spouses’ control was not significantly associated with patients’ engagement in light or moderate exercise. Further, as shown on the bottom of Table 2, the significant random effects for the associations between either spouses’ exercise support ($\tau = 478.93, p < .01$) or exercise control ($\tau = 177.06, p < .01$) and patients’ minutes of moderate exercise suggest that the strength of these associations varied between couples.

Contrary to expectations, neither exercise support nor exercise control was significantly associated with patients’ energy expenditure that same day (with or without sociodemographic, health, and relationship covariates). However, the random effect for spouses’ exercise control was significant ($\tau = 0.02, p < .01$), suggesting that the effects of spouses’ exercise control on patients’ daily energy expenditure varied between couples.

Lagged associations. Neither spouses’ exercise support nor exercise control from the previous day was significantly associated with patients’ self-reported minutes of
exercise (not shown in table). The pattern of findings for all lagged analyses for patients’ self-reported physical exercise did not appreciably change with the inclusion of sociodemographic, health, and relationship covariates. However, significant random effects were found for the associations between either spouses’ exercise support ($\tau = 917.57, p < .01$) or spouses’ exercise control ($\tau = 242.75, p < .01$) from the previous day and patients’ minutes of light exercise. Similarly, significant random effects were found for the associations between either spouses exercise support ($\tau = 164.68, p < .001$) or exercise control ($\tau = 219.93, p < .001$) from the previous day and patients’ minutes of moderate exercise. Finally, significant random effects were found for the association between spouses’ exercise support and patients’ minutes of vigorous exercise ($\tau = 17.67, p < .05$). Thus, although the fixed effects for the lagged associations between spouses’ exercise support and control and patients’ self-reported minutes of exercise were not statistically significant, the significant random effects suggest that the strength of these associations varied between couples.

Neither exercise support nor exercise control from the previous day was significantly associated with patients’ energy expenditure (with or without sociodemographic, health, and relationship covariates) (not shown in table). However, significant random effects for spouses exercise control ($\tau = 0.08, p < .001$) suggests that the strength of the lagged association between spouses’ exercise control and patients’ energy expenditure varied between couples.

*Mediation by Patients’ Positive Emotional Responses*
Contrary to predictions, patients’ positive emotional responses did not mediate the associations between spouses’ exercise support or control and patients’ physical exercise or energy expenditure that same day or the next day. Although spouses’ exercise support was marginally associated with patients experiencing more positive emotional responses (estimate = .22, S.E. = .12, p = .07) that same day relative to days in which spouses had not provided exercise support, the strength of the association was reduced with the addition of sociodemographic, health, and relationship covariates. Exercise control was not significantly associated with patients’ positive emotional responses (with or without sociodemographic, health, and relationship covariates). However, the significant random effects for spouses’ exercise control (τ = 0.52, p < .001) suggests that the association between spouses’ control and patients’ positive emotional responses varied between couples.

*Moderation by Patients’ Gender (Cross-Level Interactions)*

The lagged (but not same day) association between spouses’ provision of exercise support from the previous day and patients’ minutes of moderate exercise was found to vary by patient gender. The moderated association is depicted in Figure 2 (cross-level interaction estimate = -10.43, S.E. = 4.52, p < .05, with sociodemographic, health, and relationship covariates). In Figure 2, each bar represents patients’ minutes of moderate exercise on a given day after controlling for their minutes of moderate exercise from the previous day. Minutes of moderate exercise for male patients is depicted by the gray bars, and minutes of moderate exercise for female patients is depicted by black bars.
Figure 2. Lagged Association between Spouses’ Exercise Support and Patients’ Minutes of Moderate Exercise as a Function of Patient Gender

Note. Asterisks denote significant differences \((p < .05)\) in minutes of moderate exercise between days on which spouses did not provide exercise support and days on which spouses did provide exercise support.
Although male patients showed an increase in minutes of moderate exercise on days in which their wife provided exercise support relative to days in which their wife had not, the increase in minutes of moderate exercise was not significant (estimate = 13.79, \( S.E. = 8.87, p = .131 \)). By contrast, female patients showed a significant decline in minutes of moderate exercise (estimate = -14.33, \( S.E. = 5.33, p = .012 \)) on days in which their husband provided exercise support relative to days in which their husband had not provided exercise support.

On the other hand, the same day associations and lagged associations between spouses’ exercise control and patients’ minutes of physical exercise (light, moderate, or vigorous) did not significantly vary by patient gender. Further, the same day and lagged associations between spouses’ exercise support and control and patients’ energy expenditure did not significantly vary by patient gender. The pattern of findings did not appreciably change with the inclusion of sociodemographic, health, and relationship covariates.

Contrary to predictions, the pattern of mediated same day and lagged associations through patients’ positive emotional responses did not significantly vary by patient gender. Further, the associations between spouses’ exercise support and control and patients’ positive emotional responses were not found to significantly vary by patient gender. Again, the pattern of findings did not appreciably change with the inclusion of sociodemographic, health, and relationship covariates.
CHAPTER 4

Discussion

Findings from this study extend prior research on spouses’ involvement in patients’ illness management (Beverly et al., 2008; Fekete et al., 2006; Franks et al., 2006) by showing day-to-day influences of spouses’ exercise support and exercise control on patients’ diabetes management through physical exercise. Whereas spouses’ support appeared to facilitate patients’ engagement in physical exercise, spouses’ control appeared to hinder patients’ engagement in exercise. The divergent effects of spouses’ support and control on patients’ exercise were not explained by patients’ positive emotional responses to their spouses’ involvement. However, spouses’ exercise support appeared to be less beneficial for female patients’ exercise than for male patients’ exercise on a daily basis.

Direct Associations Between Spouses’ Involvement and Patients’ Physical Exercise

In line with theory (Rook & Pietromonaco, 1987) and prior research (Fekete et al., 2006; Franks et al., 2006), findings in the current study indicate that spouses’ social support and social control operate independently of each other to influence illness management. In the current study, spouses were likely to provide exercise support, exercise control, or both, to help their partner manage their diabetes through physical exercise on a given day. However, it was only spouses’ attempts to support their partner’s physical exercise that had the intended effects of increasing patients’ exercise
that same day. Despite spouses’ intentions, their attempts to increase their partner’s physical exercise through control appeared to backfire.

It should be noted that although spouses attempted to support as well as control their partner’s physical exercise, these attempts did not occur every day. On days in which spouses did provide support and/or control, however, the effects on patients’ physical exercise appeared to be immediate (i.e., same day) as opposed to delayed (i.e., next day). Moreover, spouses’ support and control on a given day predicted patients’ physical exercise above and beyond patients’ sociodemographic, health, and relationship factors and spouses’ average frequencies of support provision and control provision across the 7 diary days. Thus, findings from the current study suggest that regardless of the greater social and health contexts, spouses’ frequency of social support and social control on a given day can be consequential for patients’ engagement in physical exercise.

Although spouses’ involvement was linked to patients’ self-reported minutes of physical exercise, it was unrelated to patients’ energy expenditure. One potential explanation for the absence of significant associations between either spouses’ exercise support or exercise control and patients’ energy expenditure is that calculations for energy expenditure were based on any form of physical movement (e.g., walking from the kitchen table to the refrigerator, sorting the mail). However, not all forms of physical movement would necessarily be targeted by spouses’ exercise support or exercise control. Instead, patients’ self-reported minutes of exercise may have better reflected the kind of physical movement that would be targeted by the spouse (e.g., going for a walk, doing
household chores). As a result, spouses’ exercise support and exercise control may have been more meaningful for patients’ self-reported minutes of daily light, moderate, and vigorous exercise than for their daily energy expenditure.

Another potential problem with linking spouses’ daily exercise support and exercise control to patients’ daily energy expenditure is that patients’ energy expenditure may have been underestimated in the current study. Wearing the activity monitor on the wrist (as opposed to the hip or ankle) may have limited the range of physical movement that was measured (Chen et al., 2003; Murphy, 2009). Although wearing the activity monitoring device on the wrist would have captured upper body movements associated with such activities as washing dishes or gardening, it may have underestimated lower body movements associated with such activities as mowing the lawn with a push mower or walking. As a result, true day-to-day variation in physical exercise may not have fully corresponded with the day-to-day measurement of energy expenditure.

Mediation of Associations Between Spouses’ Involvement and Patients’ Physical Exercise by Patients’ Positive Emotional Responses

Contrary to theory (Brehm, 1966; Ryan & Solky, 1996) and prior research (Cohen et al., 2000; Tucker et al., 2006), patients’ positive emotional responses to their spouses’ involvement in their diabetes management were not significantly associated with either spouses’ exercise support or exercise control. One reason for the lack of significant findings may be that the measure of patients’ positive emotional responses to their spouses’ involvement assessed positive emotions that stemmed from factors other than spouses’ overt support and control provisions. For example, patients may have felt
positively about their spouses’ attempts to incorporate their diabetes regimens into the couple’s daily living. Spouses often try to accommodate their partner’s dietary needs by purchasing healthier foods and preparing healthier meals and low-sugar desserts (Beverly et al., 2008; Trief et al., 2003; Stephens et al., in press). Spouses may have also accommodated for patients’ exercise routine by engaging in recreational activities with the patient (e.g., going for walks together). In response to their spouse’s attempts to incorporate exercise into the couple’s daily activities, patients may have felt appreciative of their spouses’ involvement in their diabetes management independently of their spouses’ explicit support or control of their exercise behaviors.

In addition, the measure of patients’ emotional responses used in the current study may have hampered associations between either exercise support or exercise control and emotional responses because it assessed patients’ emotional responses to their spouse’s attempts “…to influence your diet or exercise routines…”. Because patients more frequently need to monitor their dietary behaviors (i.e., for meals and snacks) than their exercise behaviors each day, spouses may have more opportunities to support and/or control their partner’s diet than their partner’s exercise on a given day. As a result, when patients were asked to recall their emotional responses to their spouse’s influence, they may have been recalling their spouse’s attempts to influence their diet more than their spouse’s attempts to influence their exercise.

The lack of significant associations between spouses’ involvement and patients’ emotional responses could also be attributed to emotion regulation processes in patients. Some evidence suggests that older adults are more adept at maintaining positive emotions
than younger adults, in part, because they are better at optimizing the significance of positive events and downplaying the significance of negative events (Scheibe & Carstensen, 2010). This may explain why compared to younger adults, older adults are more likely to describe their close relationships as supportive (Windsor & Butterworth, 2010) and why older adults are likely to make benevolent attributions for social control from loved ones (Rook et al., 1990; Rook & Itarte, 1999). Patients in the current study may have largely attributed their spouses’ involvement in their diabetes management to their spouses’ affection and concern for their welfare. As a result, patients may have felt loved, appreciative, and hopeful in response to their spouse’s support and/or control of their diabetes management without distinguishing between the two forms of involvement.

Moderation of Associations Between Spouses’ Involvement and Patients’ Physical Exercise by Patients’ Gender

Findings from the present study suggest that spouses’ exercise support did not benefit female patients’ engagement in moderate physical exercise and had mildly beneficial effects on male patients’ physical exercise, which is partially in line with theory (Eagly, 1987) and prior research (e.g., Hagedoorn et al., 2000; Kiecolt-Glaser & Newton, 2001). One potential explanation for the findings for female patients is that compared to women, men provide less social support to their partners when their partner’s emotional needs are greatest (Neff & Karney, 2005). Male spouses in the current study may have failed to support their wife’s attempts to exercise on days in which she found engagement in physical exercise most challenging. As a result, exercise
support from male spouses may not have met their wife’s immediate health needs or pre-empted potential barriers to their wife’s exercise the next day.

Another potential explanation for the apparent detrimental effects of male spouses’ support on female patients’ exercise is that male spouses may have provided support on days in which their partners were already motivated to exercise. On days in which female patients were already motivated to exercise, Self-Determination Theory would suggest that receiving exercise support from their husbands undermined their intrinsic motivation to exercise (cf., Ryan & Deci, 2000). By providing exercise support on days in which female patients did not need such support, male spouses may have undermined their wife’s sense of autonomy by elevating external rewards (i.e., social recognition) from exercising over internal rewards (e.g., self-satisfaction). Thus, male spouses’ attempts to support their wife’s exercise behaviors may have paradoxically reduced their wife’s motivation to exercise and their subsequent engagement in physical exercise the next day.

Contradicting prior evidence that compared to women, men are more likely to comply with social control (Tucker et al., 2006; Westmaas et al., 2002), spouses’ daily attempts to control their partner’s exercise behaviors in the present study appeared to have no more effect on male patients’ physical exercise than on female patients’ physical exercise. Since male patients in the current study were more likely to have engaged in moderate and even vigorous physical exercise on a given day than female patients, wives’ control attempts may have been less relevant for male patients’ exercise than husbands’ control attempts for female patients’ exercise. At the same time, however, husbands’
control attempts may have failed to meet their wife’s needs for their involvement (cf., Hagedoorn et al., 2001). Future studies will need to clarify why and when social control is ineffective at improving health behaviors and whether these circumstances vary by the gender of either the control provider or the control recipient.

**Study Limitations and Conclusions**

Although the current study sought to build on prior research on spouses’ involvement in their partner’s illness management, several limitations remain. First, the 7-day diary design does not permit the investigation of how daily associations between spouses’ involvement and patients’ diabetes management change within couples over time. Spouses may be especially influential to patients’ diabetes management during the initial diagnosis period, which is marked by patients grappling with the reality of having diabetes and learning to adopt lifestyle changes in health behaviors (Peel, Parry, Douglas, & Lawton, 2004). Over time, however, the daily influence of spouses’ involvement on patients’ diabetes management may wane as patients and spouses adapt to living with diabetes (Miller & Brown, 2005).

The daily diary design does not overcome the limitation that findings in the present study are correlational. As a consequence, it is also possible that patients’ physical exercise on a given day influenced spouses’ provisions of exercise support and exercise control (cf., Lewis et al., 2004; Trief et al., 2003). However, theory and evidence suggest that spouses’ social support and social control is not always contingent on their partner’s health behaviors. Spouses may become involved in their partner’s illness management because of perceived social norms related to caring for an ill spouse.
(Revenson et al., 2005). Spouses’ attempts to support or control their partner’s illness management could also be motivated by their own anxiety about their partner’s illness (Coyne, Ellard, & Smith, 1990; Thompson et al., 1995) or by their desire to maintain a certain role within the marital relationship (e.g., as care provider) (Stryker, 2007).

Another limitation of the current study is that the spouses’ own exercise behaviors were not assessed. If spouses did not regularly exercise themselves, their attempts to support patients’ exercise may have been less meaningful to patients, and their attempts to control patients’ exercise may have been ignored or even resisted by patients (cf., Lewis & Butterfield, 2007; Trief et al. 2003). For couples in which both partners followed an exercise routine, a resulting social norm that favored exercise could have facilitated patients’ engagement in exercise (Gabrielle, Walker, Gill, Harber, & Fisher, 2005) and reduced spouses’ reliance on the explicit support and control strategies assessed in the current study.

The present study may not have included variables that could potentially explain the between-couples differences (i.e., significant random effects) found for associations between either spouses’ exercise support or exercise control and either patients’ positive emotional responses or physical exercise. One possible source of between-couple differences in these associations may be the degree to which patients were experiencing other chronic stressors (e.g., death of a loved one, conflict with a family member) around the same time they took part in the study. Evidence suggests that older adults are more emotionally reactive to daily events than younger adults when they are generally experiencing high levels of stress (Sliwinski, Almeida, Smyth, & Stawski, 2009). As
such, it is possible that the daily influences of spouses’ support and control on patients’ emotional responses and physical exercise may have been more pronounced for couples who were generally experiencing high levels of stress than for couples who were experiencing low levels of stress.

Individual factors such as attachment style (i.e., secure, anxious, avoidant) could have also accounted for between-couple differences in associations between either spouses’ exercise support or exercise control and either patients’ emotional responses or physical exercise. Prior research has shown that for couples in which one or both partners do not have a secure attachment style, social support exchanges may occur less often, and that when they do occur, they may be perceived less positively by both members of the couple (Collins & Feeney, 2000; Coughlin, Huston, & Houts, 2000). As such, it is possible that the daily influences of spouses’ exercise support and exercise control on patients’ emotional responses and exercise varied by the attachment style of patients and their spouses.

Finally, findings in the study may not generalize to couples who are in distressed marriages. In the current study, patients on average reported high levels of marital satisfaction. Since couples who are in distressed marriages may be less willing to participate in a multiple-day, diary study than couples who are in non-distressed marriages, the conclusions about the roles of spouses’ social support and social control on patients’ daily diabetes management from the current study may be limited to non-distressed couples. Given the multiple challenges that couples face when living with a partner’s chronic illness (e.g., Berg & Upchurch, 2007), future studies need to consider
how spouses’ behaviors influence patients’ daily diabetes management in distressed couples as well (cf., Fincham, 2003).

In spite of its limitations, however, the current study informs prior research by showing how two common sources of social influence in marriage--social support and social control--each affect patients’ daily management of diabetes through physical exercise. Although regular physical exercise can reduce the likelihood of diabetes-related complications through better blood glucose management and weight control (CDC, 2008a, Hayes & Kriska, 2008), the poor physical health of many older adults with diabetes (ADA, 2009) as well as an entrenched sedentary lifestyle may hamper patients’ daily engagement in exercise. Findings from the current study suggest that spouses’ attempts to support or control their partner’s exercise can influence how much patients exercise, and by extension, how well they manage their blood glucose levels on a given day.

Findings from this study may have implications for interventions for couples in which patients experience considerable difficulty with managing their diabetes through physical exercise. Psychosocial interventions that target couples have been found to improve health outcomes in chronically ill adults by helping couples mitigate barriers to illness management (see Martire, Lustig, Schulz, Miller & Helgeson, 2004 for review; T2DM, Wing, Marcus, Epstein, & Jawad, 1991). Psychosocial interventions that help spouses learn how and when to use support and control to facilitate their partner’s exercise on a daily basis may reduce patients’ relapse rates in physical exercise, and as a result, help offset age-related functional declines and diabetes-related complications.
BIOBIOGRAPHY


Appendix A

Spousal Involvement in Patient Exercise
Spousal Involvement in Patient Exercise

How much did **YOU** do each of the following regarding your husband's exercise routine:

**TODAY, I…**

<table>
<thead>
<tr>
<th></th>
<th>Not At All</th>
<th>A Little</th>
<th>Somewhat</th>
<th>Very Much</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Listened to my husband’s concerns about maintaining an exercise routine</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2. Tried to influence my husband to do more physical exercise</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>3. Congratulated my husband for participating in physical exercise</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4. Watched my husband to make sure that he participated in physical exercise</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5. Agreed with my husband's decisions about participating in physical exercise</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>6. Told my husband to exercise more because others are depending on him</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>7. Assisted my husband in carrying out his exercise routine</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>8. Prompted or reminded my husband to exercise more</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>9. Helped my husband maintain his exercise routine</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>10. Gave my husband advice about improving his exercise routine that he did not ask for</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>11. Encouraged my husband to continue participating in physical exercise</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Not At All</td>
<td>A Little</td>
<td>Somewhat</td>
</tr>
<tr>
<td>---</td>
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<td>------------</td>
<td>---------</td>
<td>----------</td>
</tr>
<tr>
<td>12. Criticized my husband for not exercising more</td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>13. Told my husband that he was doing a good job maintaining an exercise routine</td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>14. Tried to make decisions for my husband regarding his exercise routine</td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

Items 1, 3, 5, 7, 9, 11, and 13 reflect Exercise-related support.

Items 2, 4, 6, 8, 10, 12, and 14 reflect Exercise-related control.
Appendix B

Patient Self-Reported Exercise
Patient Self-Reported Exercise

How many minutes did you engage in light exercise TODAY? (Light exercise includes activities such as grocery shopping and playing golf.)

How many minutes did you engage in moderate exercise TODAY? (Moderate exercise includes activities such as yard work and brisk walking.)

How many minutes did you engage in vigorous exercise TODAY? (Vigorous exercise includes activities such as running and bicycling.)
Appendix C

Patient Self-Reported Emotional Responses
Patient Self-Reported Emotional Responses

How did you feel when your husband tried to influence your diet or exercise routines?

TODAY, I…

<table>
<thead>
<tr>
<th></th>
<th>Not At All</th>
<th>A Little</th>
<th>Somewhat</th>
<th>Very Much</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Felt Guilty / Ashamed</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2. Felt Loved / Care For</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>3. Felt Resentful / Bitter</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4. Felt Appreciative / Grateful</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5. Felt Irritated / Angry</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>6. Felt Hopeful / Optimistic</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>