AMBIVALENCE AND CARDIOVASCULAR FUNCTION: EXAMINING AMBULATORY BLOOD PRESSURE AND MARITAL QUALITY

by

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ABSTRACT

Prior research suggests that married adults are at lower risk for cardiovascular morbidity and mortality although being married, per se is not universally beneficial, but rather, the quality of the relationship is important. Such work has documented relationships that differ in their underlying positive and negative substrates. For instance, some close relationships are characterized by high levels of both positivity and negativity (ambivalence) which may be a significant source of stress. Couples with ambivalent relationships may not experience the same cardiovascular-protective benefits of marriage. Thus the aims of the current study were to elucidate the physiological pathways by which spousal relationship quality may ultimately influence long-term health and to examine the roles of relationship quality on daily ambulatory blood pressure (ABP), an independent predictor of cardiovascular health. Additionally, as relationships progress through multiple interactions, the behavioral styles of the spouses may be altered in ways that establish greater complimentarity. Thus an additional aim of this study was to examine relationship quality both in terms of how one perceives their spouse's underlying positive or negative behavior, and how they perceive they behave toward their spouse. We hypothesized that relationships perceived as more ambivalent would result in higher individual daily ABP and worse interpersonal processes. We also tested a meditational model based on principles of complimentarity and interpersonal processes and expected that when an individual views their spouse's behavior as ambivalent, this would significantly influence the individual's levels of ambivalence in their own behavior.

We examined ABP during the day and evening among 94 married couples aged 18 to 63 (M=29.4). For our primary analyses we used Proc Mixed and analysis revealed a significant effect of relationship quality on systolic blood pressure for spousal ambivalence (SBP) (p=.01), and a significant effect of relationship quality for own behavior on SBP (p=.0002) and on diastolic blood pressure (DBP) (p=.009) such that those individuals who viewed their relationship as more ambivalent (both positive and negative) had higher SBP and DBP during daily life. Relationship quality was also associated with worse interpersonal processes such as lower reported partner responsiveness (p=.0005), intimacy (p<.0001) and greater negative affect (p=.026) for spousal ambivalence and lower reported intimacy (p=.003) and greater negative affect (p=.0016) for own ambivalence. These findings suggest that individuals may not benefit from the positivity that exists in ambivalent marriages and this may negatively influence long-term health.

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CHAPTER I

INTRODUCTION

A growing body of research has supported the supposition that social support may lower disease risk and lack of social support is associated with impaired mental and physical health including cardiovascular disease, depression and immune function (Broadhead, 1983; House, Landis, & Umberson, 1988; Seeman, 2000; Uchino, Cacioppo & Keiscolt-Glaser 1996). A review by House et al. (1988) found evidence suggesting that the link between social relationships and health was as predictive of disease as risk factors such as smoking and lack of physical exercise. Further, the association between social relationships and cardiovascular functioning is strong and consistent: socially supportive relationships predict reductions in blood pressure and heart rate (Gallo, Smith, & Kircher, 2000), reduced odds of myocardial infarction and postmyocardial infarction survival (Berkman, Glass, Brissette, & Seeman, 2000).

The predominant focus of prior research on social relationships and health has been on the health protective influence of these networks (Berkman, 1995; Brummett et al., 2001) while ignoring the complexity of relationships that include both positive and negative aspects. Yet not all close relationships are always uniformly positive. Although social relationships can certainly be sources of support and understanding, they can also be sources of criticism, conflict and rejection. Prior research on social support and social

relationships has tended to ignore the complexity of relationships that may include both positive and negative aspects. This is important to examine because positive and negative aspects of social relationships tend to be separable dimensions which may have important conceptual implications for their joint study (Finch, Okun, Barrera, & Zautra, 1989; Fiore, Becker, & Koppel, 1983; Pierce, Sarason, & Sarason, 1991; Rook, 1984; Ruehlman & Karoly, 1991; Schuster, Kessler, & Aseltine, 1990).

As shown in Figure 1, we have proposed a model representing a more integrated view of social relationships and the way they may influence health outcomes. As shown in the model, there may be those in the social network that are mostly sources of support and pleasant interactions. These relationships are represented in the high positivity/low negativity corner and may include such contacts as a good friend in whom one can confide or a loving spouse. The relationships represented by the high negativity/low positivity corner would include social ties that are mostly a source of negative interactions such as a critical boss, or a judgmental associate. These are labeled as aversive social contacts. The low positivity/low negativity corner is labeled as indifferent social ties and would represent those in the network with whom one has little contact, or interaction. These relationships have little depth or importance and would likely be casual co-workers, or a neighbor one sees only rarely. Finally, the high positivity/high negativity corner represents the prototypical ambivalent relationship member. These relationships have elements of both positivity and negativity and may include the intrusive sibling, the wayward child or an emotionally unavailable spouse. In fact, when an individual has an impactful negative interaction with a network tie that in the past has shown positive support, the individual may in turn perceive the relationship as

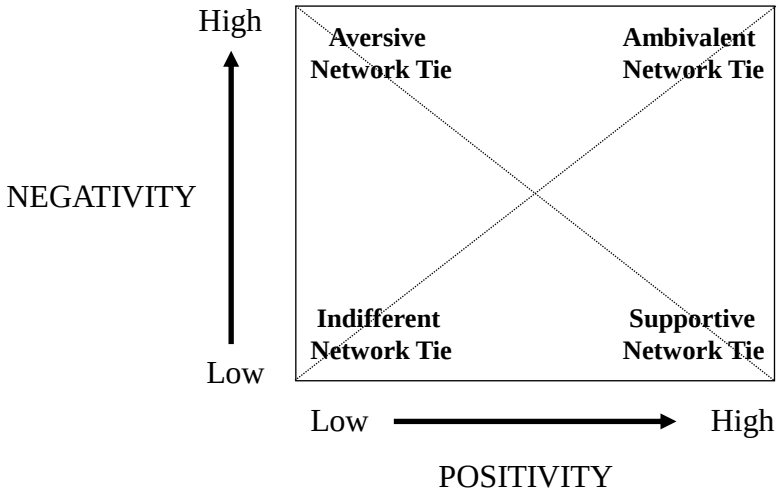

Figure 1

A General Framework for Examining Positive and Negative Aspects of Relationships on Health

ambivalent. This relationship may be viewed as a source of distress, yet there are still enough positive aspects of the relationship that the individual may be reluctant to terminate the association. But such relationships may extract a toll on the health of the individual. In fact, recent research demonstrates that while socially supportive network ties are associated with beneficial influences on health, ambivalent ties may be detrimental to health despite the positivity found in these relationships (Birmingham, Uchino, Smith, Light, & Sanbonmatsu, 2009; Holt-Lunstad, Uchino, Smith, & Hicks, 2007; Uchino, Holt-Lunstad, Uno & Flinders, 2001).

There are several reasons why a study of ambivalent relationships, separate from supportive and aversive relationships, may be important: While supportive ties ***reduce*** cardiovascular reactivity, ambivalent ties predict ***worse*** mental health outcomes such as depression, perceived stress, and lower satisfaction with life (Uchino et al., 2001; Uchino,

2004). Studies have also shown that interactions with ambivalent friends *increases* cardiovascular reactivity during laboratory stress; interactions with ambivalent friends *increases* reactivity during support-seeking and interactions with ambivalent ties are associated with *elevated* blood pressure during daily life (Holt-Lunstad, Uchino, Smith, Cerny & Nealey-Moore, 2003; Holt-Lunstad, Uchino, Smith, & Hicks, 2005; Uno, Uchino, & Smith, 2002). In fact, an ambivalent relationship may lead to significant interpersonal stress above and beyond that of aversive ties (Birmingham, 2009; Uchino, 2009; Holt-Lunstad et al., 2003; Holt-Lunstad et al., 2005; Uchino et al., 2001; Uchino, 2004). This may occur because if a relationship is primarily a source of negativity, one may habituate to the aversive relationship by using specific coping strategies such as avoidance or discounting. However, an ambivalent network tie that is a source of both positivity and negativity may be considerably less predictable and thus may be associated with greater emotional responses, and, therefore, reactivity. It is important, therefore that a multidimensional approach examining both positivity and negativity in close relationship be undertaken in order to more fully understand the complexity by which social relationships influence physiological functioning and health.

Prior research has also generally emphasized the structural features of social relationships such as the size and physical proximity of individuals' social network and for most adult's marriage is the most central relationship in their lives. A large amount of research has focused on the marital relationship and its contribution to the happiness and well-being of individuals, including the health benefits of marriage. Indeed, marriage and social support are perhaps the most studied variables in regard to relationships and health and there is much evidence demonstrating the health advantages of marriage. For

instance, studies have shown that married individuals have lower rates of morbidity and mortality than their unmarried counterparts (Johnson, Backlund, Sorlie, & Lovelass 2000), lower risk for depression and greater life satisfaction and greater happiness (Gove, Hughs, & Briggs, 1983; Mastekaasa, 1994; Robins & Reiger, 1991).

But marital relationships, like other social relationships are not always positive. Marital partners, like other social ties can be sources of support and understanding but can also be sources of criticism, conflict and jealousy. Conflicts in marriage can include aversive and ineffectual responses leading to nagging, complaining, distancing or creating a coercive atmosphere (Koerner & Jacobson, 1994). Ineffective problem solving can fuel hostility and tension (Sullivan, Pasch, Johnson, & Bradbury, 2010). Such negative social exchanges can extract a toll on individuals, leading to greater difficulty with daily life activities (Newsom, Mahan, Rook, & Krause, 2008). Additionally, individuals may expect their spouse to be a source of support during times of stress. Actions meant to be supportive by a spouse, however, can actually be viewed negatively by the individual and this can add to the individual's distress during their time of need (Newsom, Nishishiba, Morgan, & Rook, 2003; Rook & Pietromonoco, 1987).

So does the quality of the marital relationship have any bearing on the *health* benefits individuals may derive from marriage? Research indicates that it does. Previous research indicates that the quality of the marital relationship matters, not just being married, per se. In fact, research has found that marriage must be high quality to be advantageous or one is better off single (Holt-Lunstad, Birmingham & Jones, 2008). For instance**,** unhappily married couples are unlikely to experience the same health benefits as their happily married counterparts (Coyne et al., 2001; Ross, Mirowsky, & Goldsteen

1990), with women gaining benefits from marriage only when marital satisfaction is high (Gallo, Troxel, Matthews, & Kuller, 2003). Likewise, low marital quality can reduce otherwise beneficial effects marriage may provide for men on the progression of atherosclerosis (Janicki, Kamarck, Shiffman, Sutton-Tyrell, & Gwaltney, 2005). Research has also found that those couples who indicate less satisfaction with their relationship have worse cardiovascular function (Broadwell & Light, 2000; Smith et al., 2009), poorer self-rated health and more health problems (Newsom et al., 2008). Thus, research seems to support that married individuals who are satisfied with their relationship show greater benefits physiologically than do couples in unsatisfactory relationships, leading us to presume that quality of the relationship is an important aspect when looking at the benefits available to the couple through the marital relationship.

Despite the research showing the detrimental physical and mental effects unsatisfactory relationships may have, many remain intact. There are varying reasons why a marriage with high levels of negativity may remain intact and it may be that these marriages also contain high levels of positivity. Within the framework of our model, relationships that contain high levels of both positivity and negativity are classified as ambivalent and have been shown to be more detrimental to health than even aversive relationships despite the positivity in them (Birmingham et al., 2009). This is an important point as most prior research on marriage and health has implicitly conceptualized marital quality as ranging from high conflict to high support. However, as shown in Figure 1, these two dimensions can co-occur within the marriage and may provide a more accurate representation of relationships processes. Thus one aim of the

present research was to apply our model of relationship quality in order to understand the health-related consequences of marriage.

A second aim was to elucidate the physiological pathways by which spousal relationship quality may ultimately influence long-term health. One important biological pathway by which relationships may impact health is through cardiovascular functioning. While evidence links marital conflict to heart rate and blood pressure (BP) in laboratory studies (Smith et al., 2009; Broadwell & Light, 2000), much less is known about how relationship quality affects blood pressure over the course of the day. Clinical BP readings may not necessarily be representative of the individual's true cardiovascular functioning. Ambulatory blood pressure (ABP) measures, however, offer a large number of readings across the day, chronicling daily fluctuations, providing a more complete picture of cardiovascular functioning (Perloff, Sokolow, & Cowan, 1983; Pickering, Shimbo, & Haas, 2006). ABP monitoring is an essential measure in determining cardiovascular risk as ABP can predict complications of hypertension above and beyond what is possible to determine with resting or clinical BP measures alone (Marler, Jacob, Lehoczky & Shapiro 1988; Pickering, 2006). Importantly, studies suggest that elevated ambulatory blood pressure (ABP) is a stronger predictor of left ventricular hypertrophy, and overall morbidity and mortality, than are clinic BP readings (Perloff, 1983).

Our prior work on our relationship model depicted in Figure 1 suggests that whether one views their relationship partner as supportive or ambivalent can influence physiological responses (Uchino, Holt-Lunstad, Reblin, & Campo, 2007). However, relationship quality likely reflects more complex processes involving perceptions of other that influence one's interpretation and reactions to interpersonal events (Reis, Clark, &

Holmes, 2004). In addition, interpersonal theory holds that an actor's behavior invites or evokes behavior from the interacting partner that is *similar* in affiliation (warmth and hostility) and *opposite* in control (dominance and submission) (Carson, 1969; Kiesler, 1983; Sadler & Woody, 2003). For instance if a husband shows warmth by complimenting his wife's dinner, this behavior will usually evoke a warm (kind) response in return while if the husband criticizes his wife's dinner, he will likely evoke a hostile response in return. If one spouse demonstrates dominance by taking the lead in a joint project, the behavior should evoke submissiveness from the interacting spouse in the form of following the lead of the dominant partner, or allowing the spouse to take the lead on the project.

Additionally as relationships progress through multiple interactions, the behavioral styles of the spouses may be altered in ways that establish even greater complementarity in behavior (Kiesler, 1983). In other words, as the level of the relationship between two people becomes more intimate, and the number of interactions increases (as likely happens in marriage) the degree to which their behavioral styles complement each other may also increase (Markey & Kurtz, 2006). Thus, a final aim of this study was to examine relationship quality both in terms of how one perceives their spouse's underlying positive or negative behavior and how they perceive they behave towards their spouse.

To address our major aims, the present study examined the ABP of married couples during daily life. General psychological processes that are influenced by relationship factors were also examined including state self-esteem, positive and negative affect, and intimacy (spousal responsiveness and spousal and self-disclosure). Consistent

with our framework, we predicted that those individuals who perceive their spouse's behavior as high in both positivity and negativity (ambivalence) would exhibit the greatest overall ambulatory blood pressure and exhibit worse daily interpersonal processes such as lower partner responsiveness, self and spousal disclosure and negative affect.

In order to examine relationship quality in terms of how one perceives a spouse's behavior and how that perception may influence the individual's behavior, we also collected data on the individual's perception of their behavior toward the spouse (i.e., positivity and negativity). We predicted that those individuals who themselves exhibit behavior that is high in both positivity and negativity (ambivalence) would exhibit greater ambulatory blood pressure and worse daily interpersonal processes.

Finally, we tested a mediational model based on principles of complementarity in interpersonal processes (Kiesler, 1983) as shown in Figure 2. Following the mediational model criteria established by Baron and Kenny, (1986) we expected that when the individual views their spouse's behavior as both highly positive and highly negative (ambivalent) it would significantly affect their own ABP (pathway c). When an individual views their spouse's behavior as ambivalent, we expected this would significantly influence the individual's levels of ambivalence in their own behavior (pathway a). We also predicted that this ambivalent behavior from the individual would then significantly affect their ABP (pathway b). And finally we predicted that the previously significant pathway between the individuals' view of the spouse's behavior and their own blood pressure would be nonsignificant (pathway c').

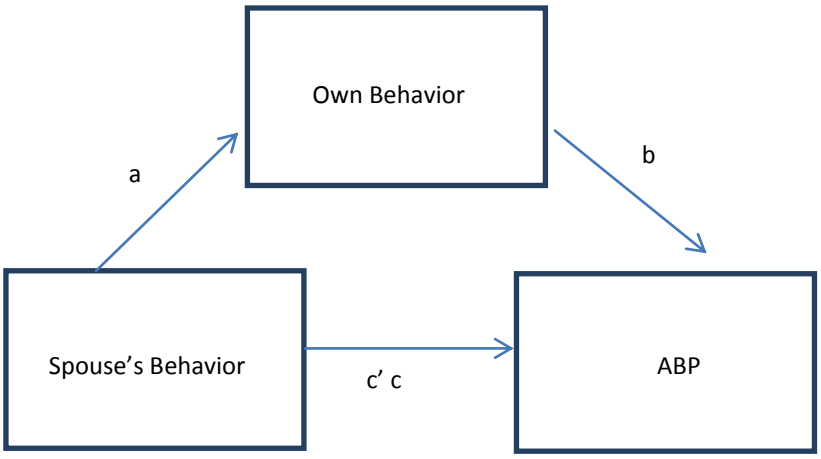

Figure 2

A Proposed Mediational Model of Spousal and
Own Ambivalence on Ambulatory Blood Pressure

CHAPTER II

METHOD

Participants

Participants were 97 healthy couples recruited from the community through newspaper ads and notices posted on campus. Participants were paid $75 (or 2 credit hours for students) for their time. Because physiological measurements were taken, exclusion criteria included those who were not generally healthy or who had medical conditions with a cardiovascular component (e.g., no hypertension or psychological problems for which they are being medically treated; see Cacioppo et al., 1995). Participants were all legally married and living together. Eligible couples were required to not have children currently living in the home, so as to focus on the ambulatory effects of a more "controlled" social context. Participants ranged in age from 18 years to 63 years with a mean age of 29.5. Most were White (83%), college educated (62.4%), attended church at least monthly or more (51%) and had an income over $40,000 per year (66%). Participants' number of ABP readings ranged from 20 to 35. Three couples did not spend time during the evening together and so were eliminated from the study. This resulted in a total of 94 couples.

Procedure

Eligible couples arrived at the laboratory on the morning of a typical work day. Morning times ranged from 4 am to 9:30 am. A trained research assistant obtained consent from each participant which included information on the nature of the study,

potential risks, potential benefits, compensation and confidentiality. All participants were also reminded before starting the procedures that they would be free to withdraw at any time without penalty. Height and weight were assessed using a Health-o-Meter scale and participants were instructed to sit quietly while three baseline blood pressure readings were obtained, each taken one minute apart. Participants were then given the Social Relationship Index-Spouse (SRI-Spouse) questionnaire and instructed to complete it without help from the other spouse. The SRI-Spouse assesses how the participants view their spouse's underlying negativity and positivity on a 1 (not at all) to 6 (extremely) scale. They rated their spouse's underlying positivity and negativity in three differing conditions: when the participant is happy, proud or excited; when the participant is in need of social support; and during daily interactions with their spouse. In addition, each spouse rated how they perceive their own behavior toward their spouse in the three differing conditions (see below). Couples were seated across the room from each other and were reminded that their answers were confidential and that the other spouse would not have access to their answers.

Consistent with our prior work, we used a scoring system of positivity and negativity categorizing participants as either viewing their spouse's behavior as supportive or ambivalent (Uchino et al., 2001). Participants who scored their spouse's behavior higher than a 1 on positivity but no higher than a 1 on upsetting were categorized as supportive. If they scored higher than a 1 on positivity and higher than a 1 on upsetting they were categorized as ambivalent. This method of scoring was also utilized when assessing the participants own behaviors. We again categorized the

participants as exhibiting ambivalent behavior or exhibiting supportive behavior based on these scores.

Once the SRI was completed, the couple was fitted with the ambulatory blood pressure monitor by a trained research assistant and given detailed instructions on how to use it, including how to remove it at the end of the day. They were also given a palm pilot to record diary entries following each blood pressure reading and detailed instructions on how to use it. Participants were instructed to initiate a palm pilot ambulatory diary reading (ADR, see below) within 5 minutes of each cuff inflation. Monitors were set to randomly obtain readings every 30 minutes from time of fitting until bedtime (approximately 10:30 pm). This random sampling procedure prevented participants from anticipating a reading and hence altering their activities. Participants were told to take off the ABP monitors just before bedtime but no earlier than 10 pm. Total readings spaced across the workday and home ranged between 20 and 35. One reading was obtained before the participants left the lab to insure that the monitors were working properly and that participants understood how to use the palm pilots and how to correctly fill out the ADR. Following these procedures, participants were given the psychosocial and demographic questionnaires to take home and instructed on how to complete them. An appointment to return the equipment and to receive compensation the following day was set and participants were debriefed at the return appointment and all questionnaires and equipment was returned.

Assessments

ABP. The Oscar 2 (Suntech Medical Instruments, Raleigh, NC) was used to estimate ambulatory SBP and DBP. The Oscar was designed specifically for ambulatory

assessments and is validated to international standards of reliability (Goodwin, Bilous, Winship, Finn, & Jones, 2007). The cuff was worn under the participants' clothing, and only a small control box (approximately 5.0 x 3.5 x 1.5 inches) attached to a lab-supplied belt was partially exposed. Outliers associated with artifactual readings were identified using the criteria by Marler, Jacobs, Lehoczky, and Shapiro (1988). These include: (a) SBP < 70 mmHg or > 250 mmHg, (b) DBP < 45 mmHg or > 150 mmHg, and (c) SBP / DBP < [1.065 + (.00125 X DBP)] or > 3.0.

Ambulatory Diary Record (ADR). The Ambulatory Diary record (ADR) was programmed into a Palm Pilot device that allowed for easy downloading for data reduction and analyses. The time / date stamp also allowed us to verify that the ADR was completed soon after each programmed ambulatory cardiovascular reading. The ADR was relatively easy to complete (about 2 minutes) in order to maximize cooperation, and was divided into three general sections. The first part of the diary assessed information on basic variables that might influence cardiovascular function (Guyll & Contrada, 1998; Kamarck et al., 1998). These include items such as posture (lying down, sitting, standing), activity level (1 = no activity, 4 = strenuous activity), location (work, home, other), talking (no, yes), temperature (too cold, comfortable, too hot); prior consumption of nicotine, caffeine, alcohol, or a meal; and prior exercise (no, yes). The second part of the ADR assessed within-participant factors such as whether or not participants were directly interacting with their spouse, state positive affect, state negative affect, perceived control, state self-esteem, and the third part assessed such factors as perceived partner responsiveness, intimacy, disclosure, and influence (Laurenceau, Feldman-Barrett, &

Rovine, 2005; Reis & Wheeler, 1991). Readings were examined to ensure compliance and were discarded if not instigated within 5 minutes of a blood pressure reading.

Demographic assessment. A demographic sheet utilized in our laboratory was used to assess standard control variables including age, income, education, and occupational status (Hollingshead classification). Height and weight were measured using a health-o-meter scale in order to calculate body mass index to be used as an additional covariate.

Health behavior assessments. A standardized health behavior questionnaire provided information on the following potential health-related variables: medication use, exercise habits, smoking habits, alcohol consumption, and caffeine intake. Participants also completed the Pittsburgh Sleep Quality Index which provides a valid and reliable assessment of sleep quality (Buysse, Reynolds, Monk, Berman, & Kupfer 1989).

Social Relationship Index (SRI). The SRI was initially developed as a self-report version of the social support interview (Kiecolt-Glaser, Dura, Speichr, Trask, & Glaser, 1991; Pagel, Erdly, & Becker, 1987; Uchino, Kiecolt-Glaser, & Cacioppo, 1992). Participants rated how generally helpful and how upsetting their spouse typically was on a 1 (not at all) to 6 (extremely) point scale in three areas: "when they needed support such as advice, understanding or a favor" (Support-Seeking), "when they were really excited, happy or proud" (Happy), and "during routine daily interactions, conversations and activities" (Daily Interactions). Participants who scored higher than a 1 on positivity (mean of positivity in all three areas) but no higher than a 1 on upsetting (mean of negativity in all three areas) were categorized as supportive. If they scored higher than a 1 on positivity and higher than a 1 on upsetting they were categorized as ambivalent. We

did not use a continuous scale for measuring relationship quality as we do not normally see aversive or indifferent couples; thus using a continuous scale would not have been a test of our model as it would have forced individuals into those categories. We also had participants provide information about how they behaved toward their spouse during the same type of interactions (i.e. "when your spouse needs support such as advice, understanding or a favor"). We again then categorized the participants as exhibiting ambivalent behavior or exhibiting supportive behavior based on these scores. In our prior work, these measures of positivity and negativity were temporally stable with significant 2-week test-retest correlations of $r = .81$ ($p < .001$) for positivity and $r = .83$ ($p < .001$) for negativity (data reported in Uchino et al., 2001). . We examined internal consistencies across our three interaction measures "happy, proud or excited," "during daily interactions," and "when you need support such as advice, understanding or a favor." Cronbach's alpha for measures of positivity in spousal behavior was .79; negativity in spousal behavior was .82; positivity in own behavior was .75 and negativity in own behavior was .77. Exploratory measures of positivity and negativity across two other contexts (sharing positive events, everyday interactions) were also examined. A criterion measure of subjectively felt ambivalence was utilized by asking participants how mixed/conflicted they feel towards the spouse (Priester & Petty, 1996) and how mixed/conflicted they rated their own behavior. The SRI also contains questions on other relationship variables that can be examined or statistically controlled if necessary including relationship length, and relationship importance. Prior studies suggest that the SRI is psychometrically sound, with good internal consistency and test-retest reliability (Campo et al., 2009).

CHAPTER III

RESULTS

Statistical Analysis

For our analysis, we used proc mixed (SAS institute) in order to examine ABP and the diary ratings. In the present study, we modeled the covariance structure for the two repeated measures factors of dyad (i.e., husband, wife) and measurement occasion (i.e., reading number) using the direct (Kronecker) product (Park & Lee, 2002). This was modeled using the "type=un@ar(1)" option that specifies a decreasing covariance structure between measurement occasions further apart in time for each member of the dyad. As recommended by Campbell and Kashy (2002), we also used the Satterthwaite approximation to determine the appropriate degrees of freedom. As noted previously, consistent with our prior work, we used a scoring system of positivity and negativity where we categorized participants as either viewing their spouse's behavior as supportive or ambivalent.

Preliminary Analyses

In preliminary analysis, we first examined potential covariates that might need to be controlled in studies of ABP (Guyll & Contrada, 1998; Kamarck et al., 1998). Importantly, we replicated prior work indicating factors such as age, posture and activity level influenced blood pressure (Guyll & Contrada, 1998; Holt-Lunstad et al., 2003; Steptoe et al., 2000; Kamarck et al., 1998). Our analysis also indicated that temperature,

alcohol, recent meals, exercise, talking, and body mass index influenced blood pressure and thus were statistically controlled for in analysis.

Relationship Quality and Daily Life Interactions

We began our analysis by first looking at relationship processes such as partner responsiveness, intimacy, disclosure, relationship quality and psychological processes such as state affect and state esteem. Partner responsiveness included feelings of being understood, valued and accepted. As indicated in Table 1, we found that individuals who viewed their spouse's behavior as ambivalent had lower ratings of partner responsiveness [b=-.1679, SE=.047, t(308) = -3.51, , p=.0005] and lower ratings of intimacy [b=-.3316, SE=.067, t(278)=-4.93, p<.0001]. Individuals who viewed their spouse's behavior as ambivalent also perceived less spousal disclosure [b=-.122, SE=.056, t(341)= -2.17, p=.03] and less self-disclosure [b=.12, SE=.058, t(326)=-2.07, p=.038]. We also looked at measures of state affect which included measures of sad, frustrated, stressed and upset. Individuals who viewed their spouse's behavior as ambivalent had significantly higher negative affect [b= .038, SE=.017, t(586)=2.23, p=.02] (see Table 1). We then looked at state self-esteem measured as mean values of momentary experiences of social-evaluative threat, concerns about appearance, and perceived ability and examined how such processes were affected by relationship quality. We found no significant differences between supportive couples and ambivalent couples on measures of state self-esteem.

Table 1

Spousal Behavior on Interpersonal and Psychological Processes

Variable	Estimate	*SE*	*df*	*t* value	*p* value
Responsiveness	**-.1679**	**.047**	**308**	**-3.51**	**.0005**
Intimacy	**-.3316**	**.067**	**278**	**-4.93**	**<.0001**
Self-disclosure	**-.1220**	**.058**	**326**	**-2.07**	**.03**
Spouse disclosure	**-.1222**	**.05**	**341**	**-2.17**	**.03**
Negative affect	**.037**	**.017**	**586**	**2.23**	**.026**
Positive affect	.004	.017	678	.24	.809
State esteem	.013	.024	378	.53	.599

We next examined how the participants' own behavior affected relationship processes during daily life. Individuals who reported they behaved in a more ambivalent manner towards their spouse had significantly lower reported intimacy [*b*=-.249, *SE*=.083, *t*(271)=-2.99, *p*=.003] but were not lower in self-disclosure [*b*=.006, *SE*=.071, *t*(330)=.09, *p*=.92], spouse disclosure [*b*=.001, *SE*=.068, *t*(345)=.02, *p*=.98], partner responsiveness [*b*=-.033, *SE*=.058, *t*(303)=-.057, *p*=.57], or self esteem [*b*=-.04, *SE*=.02, *t*(379)=-1.09, *p*=.166]. However, individuals who reported they behaved in a more ambivalent manner toward their spouse evidenced significantly higher negative affect [*b*=.06, *t*(588)=3.17, *p*=.0016] and higher positive affect [*b*=.07, *t*(688)=3.39, *p*=.0007] (see Table 2).

Table 2

Own Behavior on Interpersonal and Psychological Processes

Variable	Estimate	*SE*	*df*	*t* value	*p* value
Responsiveness	-.033	.058	303	-.57	.57
Intimacy	**-.249**	**.08**	**271**	**-2.99**	**.003**
Self-disclosure	.006	.07	330	.09	.92
Spouse disclosure	.001	.06	345	.02	.98
Negative affect	**.06**	**.02**	**588**	**3.17**	**.0016**
Positive affect	**.07**	**.02**	**688**	**3.39**	**.0007**
State esteem	-.04	.02	379	-1.39	.166

It is possible that the links between relationship quality and psychological processes may be moderated by the context in which those readings were assessed. Specifically, participants were assessed in differing contexts: while they were at work and also when they were at home. We thus examined whether being at home versus being at work would have an effect on psychological processes and found an interaction such that those individuals who viewed their spouse's behavior as ambivalent were associated with significantly lower perceived self-esteem when they were home. We found no interaction effects for negative or positive affect.

Relationship Quality and Daily Life ABP

To better understand how relationship quality may affect blood pressure in daily life, we examined ABP and relationship quality as noted earlier. Consistent with our

Table 3

Spousal and Own Behavior on Ambulatory Blood Pressure

Variable	Behavior	Estimate	*SE*	*df*	*t* value	*p* value
SBP	**Spouse**	**1.19**	**.5**	**680**	**2.37**	**.01**
DPB	Spouse	.45	.31	831	1.42	.15
SBP	**Own**	**2.2**	**.585**	**696**	**3.77**	**.0002**
DPB	**Own**	**.968**	**.37**	**844**	**2.61**	**.009**

prediction we found those individuals who viewed their spouses' behavior as ambivalent exhibited significantly higher SBP [b=1.19, SE=.501, t(680)=2.37, p=.018] (see Figure 3). Additionally, individuals who rated their own behavior as ambivalent also exhibited significantly higher SBP [b=2.21, SE=.585, t(696)=3.77, p=.0002] (see Figure 4) and significantly higher DBP [b=.968, SE= t(844)=2.61, p=.009] (see Figure 5) (Table 3).

Mediational Analysis

We were interested in examining whether one's own ambivalent behavior operated as a pathway linking spouse's ambivalent behavior with ABP based on the principles of complimentarity from the interpersonal circumplex. For one's own behavior to be considered a mediator it must correlate with ABP and account for variations with spouse's ambivalent behavior, and when controlled for, it must be significantly reduced (Baron & Kenny, 1986). To do so, we examined the association between spouses'

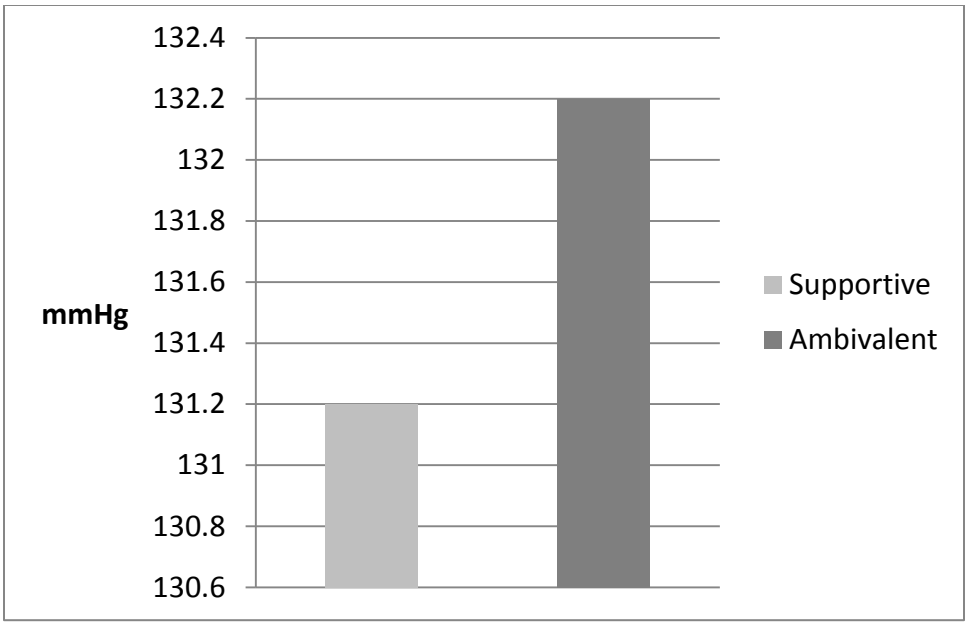

Figure 3

The Effect of Relationship Quality in Spousal Behavior
on Systolic Blood Pressure

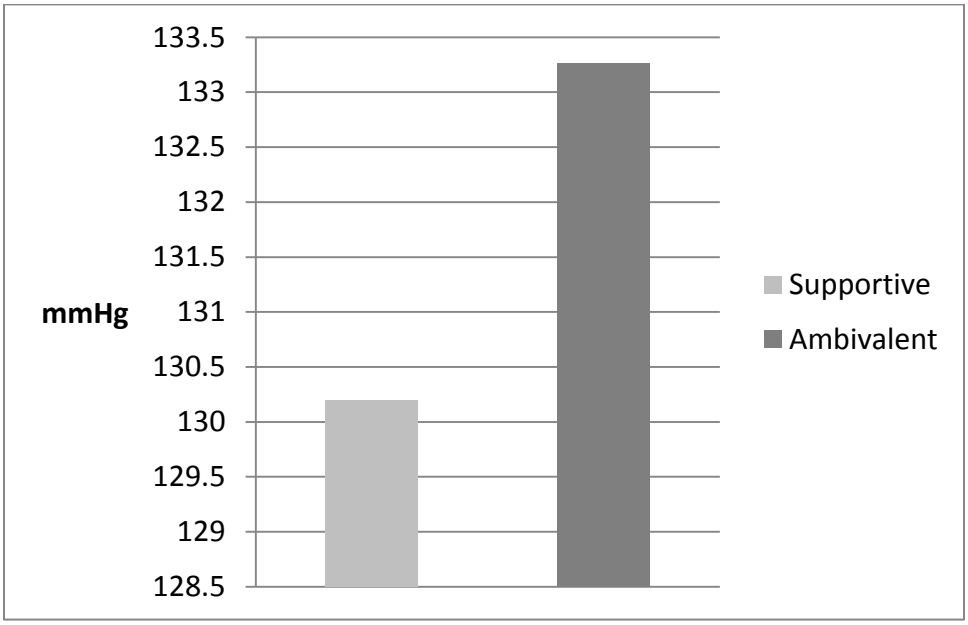

Figure 4

The Effect of Relationship Quality in Own Behavior
on Systolic Blood Pressure

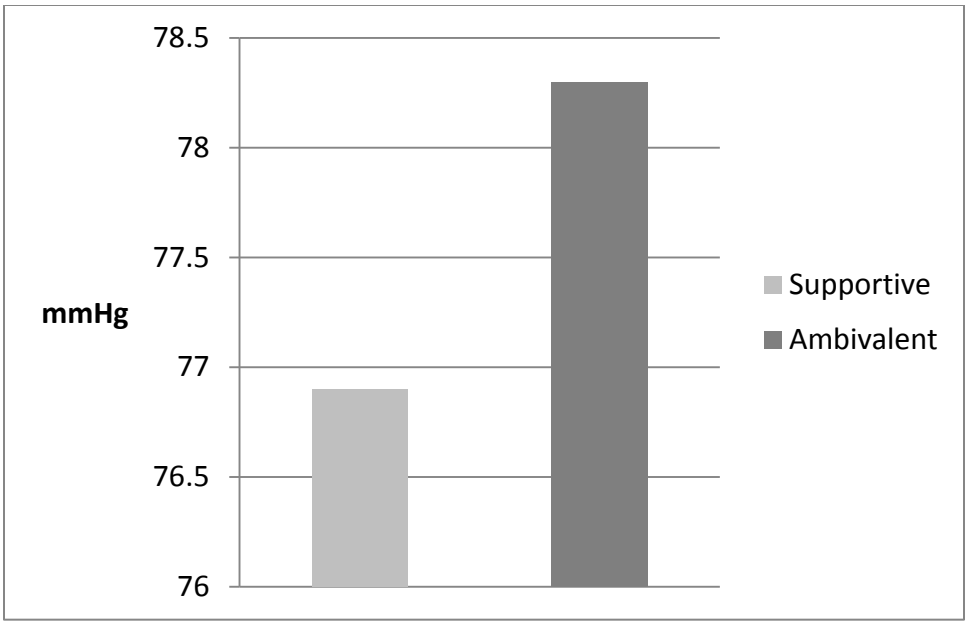

Figure 5

The Effect of Relationship Quality in Own Behavior
on Diastolic Blood Pressure

behavior and SBP. As reported earlier, we found this association to be significant [*b*=1.19, *SE*= *t*(680)=2.37, *p*=.018] (pathway c') such that individuals who viewed their spouse's behavior as ambivalent had higher SBP. We then tested the association between the individuals' own behavior and SBP and as also reported earlier, we found that individuals who themselves behaved ambivalently had higher SBP [*b*=2.21, *SE*=.585, *t*(696)=3.77, *p*=.0002] (pathway b). We then tested whether spouse behavior was associated with the individual's own behavior and found that it was significantly associated [*b*=.2.365, *SE*=.514, *Z*=4.60, *p*<.0001] (pathway a), and finally, when considering participants own behavior in the model, the previously significant link between participants views of their spouse's behavior and ABP was rendered non-significant [*b*=454, *SE*=.554, *t*(695)=.82, *p*=.413] (pathway c). A sobel test of the mediator effect was significant [Sobel=2.9, *p*=<.0001] (see Figure 6).

Ancillary Analyses

It is also possible that the links between relationship quality and ABP may be moderated by the context in which those readings were assessed as participants' ABP was assessed while they were at work and also when they were at home. A beneficial cardiovascular profile following work would be a reduction in blood pressure as individuals recover from the work day (McEwen, 1998; Steptoe, Lundwall & Cropley, 2000) although this may depend on their relationship quality. We thus examined whether being at home versus being at work would have an effect on ABP and found that being home versus being at work was significantly associated with lower DBP [*b*=-1.26, *SE*= .606, *t*(2760)=-2.08, *p*=.037] (see Table 4). We also examined whether this association was moderated by relationship quality, but did not find a significant interaction between

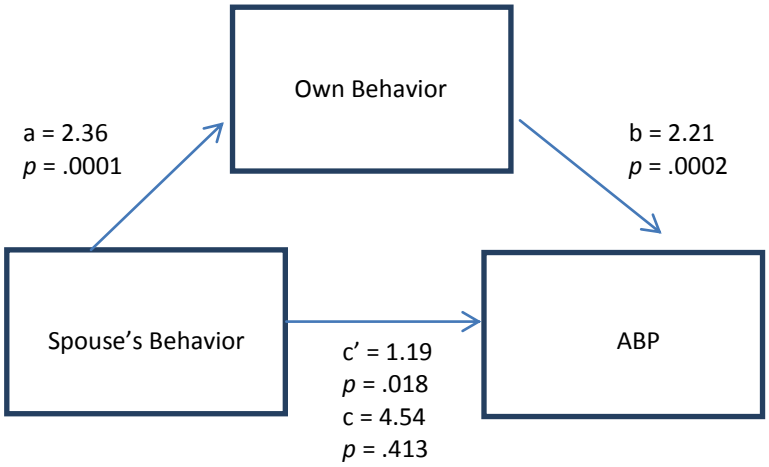

Figure 6

Mediational Model

home and relationship quality on either SBP [*b*=-0.445, *SE*= 0.816, *t*(2775)= -0.54, *p*=0.585] or DBP [*b*=-0.5092, *SE*=0.5868, *t*(2247)=-0.87, *p*=0.3856].

Another important question of interest concerns the more specific context by which ambivalent ties may be linked to ABP. That is, examining ABP when relationship quality is accessed via specific interaction contexts. We thus examined ABP and relationship quality in the three areas, "when they were really excited, happy or proud," "when they needed support such as advice understanding or a favor," and "during routine daily interactions, conversations and activities." We used the same criteria for categorizing couples as supportive or ambivalent as previously used, but positivity and negativity were assessed only within the interaction area rather than averaged across all three areas. When we examined relationship category on ABP in each context area individually we found no effects for spouses' behavior on either SBP or DBP (there was

a trend in daily contexts, p=.06) (see Table 5), however we found that individuals' own ambivalent behavior was significantly associated with greater SBP when their spouse was excited, happy or proud [t(694)=2.38, p=.017] and when their spouse needed support such as advice understanding or a favor [t(694)=3.64, p= .0003]. Individuals whose own behavior was ambivalent also were significantly associated with higher DBP when the spouse needed support such as advice understanding or a favor [t(850)=2.20, p=.02] and marginally significant when the spouse was happy [t(853)=1.78, p= .07] (see Table 6).

Table 4

Effect on Blood Pressure of Being at Home Versus Being at Work

Variable	Estimate	*SE*	*df*	*t* value	*p* value
SBP	-.206	.82	3378	-.25	.8
DPB	**-1.26**	**.6**	**2760**	**-2.08**	**.037**

Table 5

Spousal Behavior on Ambulatory Blood Pressure as Measured in Specific Interaction Contexts

Variable	Context	Estimate	*SE*	*df*	*t* value	*p* value
SBP	Happy	.08	.43	683	.2	.84
DBP	Happy	-.15	.27	840	-.56	.57
SBP	**Daily**	**.86**	**.45**	**662**	**1.92**	**.055**
DBP	Daily	.43	.28	817	1.55	.121
SBP	Support	.4	.43	672	.93	.35
DBP	Support	.16	.27	827	.62	.53

Table 6

Own Behavior on Ambulatory Blood Pressure as Measured in Specific Interaction Contexts

Variable	Context	Estimate	*SE*	*df*	*t* value	*p* value
SBP	Happy	1.006	.42	694	2.38	.017
DBP	Happy	.47	.267	853	1.78	.07
SBP	Daily	.26	.47	685	.55	.58
DBP	Daily	-.13	.29	833	-.44	.66
SBP	**Support**	**1.58**	**.43**	**694**	**3.64**	**.0003**
DBP	**Support**	**.61**	**.27**	**850**	**2.2**	**.02**

CHAPTER IV

DISCUSSION

A main aim of this study was to examine marriage within our relationship model, examining how relationship processes may affect benefits previously seen in marriage. A second aim was to elucidate the physiological pathways by which marriage impacts health. Hypertension is a known major risk factor for coronary artery disease and a common cause of heart failure, kidney failure, stroke and blindness (Smith & Kampine, 1990). Because ambulatory blood pressure has been shown to predict cardiovascular risk above and beyond clinical blood pressure readings alone (Perloff, 1983; Pickering et al., 2006), we examined relationship processes and ABP across a typical work day in a sample of married couples. Our results not only replicated prior research on the importance of the conceptual framework depicted in Figure 1, but also extended previous findings on the importance of relationship quality in marital benefits on both physiological health and psychological well-being. Physiologically, we found that ambivalent relationships resulted in greater SBP across the day when an individual's spouse is ambivalent and greater SBP and DBP when the individual's own behavior is ambivalent. Psychologically, results showed that relationship processes were affected by relationship quality such that perceiving a spouse's behavior as ambivalent resulted in lower partner responsiveness, lower partner disclosure, lower self-disclosure, lower perceived intimacy and greater negative affect. An individual's own ambivalent behavior also affected relationship processes such that ambivalent behavior also resulted in lower

intimacy and greater negative affect. When we examined a mediational model of spouses' ambivalent behavior and individual's own ambivalent behavior based on principles of complimentarity from the interpersonal circumplex we found that that the individual's own behavior mediated the link between spouse's ambivalent behavior and ABP. Further, in our ancillary analysis of relationship quality in specific interaction contexts we found that individual's own behavior led to increased SBP when their spouse was happy, excited or proud and also when their spouse was seeking support. Individuals also exhibited greater DBP when their spouse was seeking support. However, these results regarding the relationship context are exploratory and require replication before firm conclusions can be drawn. Overall our findings indicate it is important to distinguish positivity and negativity in marital relationships as these appear to be separable dimensions and may impact health processes in unique ways.

Prior research has purported that being married is beneficial and health protective (Gove et al., 1983; Johnson et al., 2000) and several mechanisms have been proposed that may account for these benefits including the social support available within the relationship. But not all marital relationships consistently offer positive social support and most research has not separated positive and negative aspects of relationships. Marriages that are high in both positivity and negativity may not offer the same benefits seen in supportive marriages. Further, much of the physiological work on the health benefits of marriage has focused on laboratory paradigms. When we examined relationship processes in a naturalistic setting we found that those who viewed their spouse as ambivalent were in fact associated with worse relationship processes and individuals who themselves behaved ambivalently were associated with worse

relationship processes. Such lower evaluations of relationship processes can have a detrimental effect on the marriage itself. Marital interaction research emphasizes the importance of perceiving that a spouse is responsive and supportive (Gottman, 1994; Reis et al., 2004) and responsive listening has been shown to distinguish distressed from nondistressed couples (Gottman, 1994). Reis and Shaver's (1988) Intimacy Model also proposes that the partner's response to self-disclosure allows the individual to feel understood, validated and cared for. In fact, research shows that perceived invalidation is more detrimental than perceived validation is beneficial (Reis & Gable, 2003). Further, researchers have demonstrated that marriages where one spouse views their partner as less responsive may be more likely to dissolve (Huston & Vangelisti 2001). Thus, despite the positivity found in ambivalent relationships, these marriages may be at greater risk for dissolution.

A second aim of this study was to examine the physiological pathways by which relationship quality could impact health. We tested whether the positivity in ambivalent marital relationships was enough to provide beneficial cardiovascular protection to the individual or whether the negativity in the relationship negated the beneficial cardiovascular effects of marriage. Our data showed that couples who viewed their spouses' behavior as ambivalent did indeed exhibit greater SBP over the course of the day than those couples whose spouse and own behavior were supportive. These findings compliment and build upon prior research showing relationship quality is linked to lower ABP and extend such findings by directly examining ambivalent marital relationships in naturalistic conditions. ABP appears to be a strong predictor of future cardiovascular disorders (Perloff et al., 1983) and even minor elevations in BP may place strain on the

cardiovascular system and lead to greater cardiovascular risk (MacMahon et al., 1990; Verdecchia, Schillaci & Borioni, 1996). Thus, marriages that are ambivalent may not be as beneficial as supportive marriages and in fact may be more harmful to cardiovascular health although longitudinal studies among both normotensive and hypertensive couples are needed to clarify what long-term effects these relationships may have on cardiovascular health.

Based on work showing BP changes after the work day we expected to see blood pressure decrease as our participants came home. Consistent with prior research, when we looked at specific contexts in which ABP was assessed (work vs home) we found DBP to be significantly lower when individuals were at home (Blumenthal, Thyrum, & Siegel, 1994; Pickering, Harshfield, Kleeinert, Blank, & Larach, 1982) although we found no differences between ambivalent and supportive couples. This suggests that the effects of ambivalent ties may have a cumulative influence on ABP over the course of the day and not simply restricted to being in the mere presence of the spouse. Longitudinal studies (e.g., young newlyweds) will be necessary to evaluate this possibility.

We also examined specific interactions in which relationship quality was assessed and found no differences between contexts for spouse's behavior. However we did find an association between the individuals' own ambivalent behavior and ABP when their spouse was seeking support. This is interesting as most research on providing support finds positive effects of giving support on well-being (Simmons, 1991; Switzer, Simmons, Dew, & Regalski, 1995; Williams, Haber, Weaver, & Freeman, 1998) and lower ABP has been associated with giving social support (Piferi & Lawler, 2006;). However, being a*sked* to provide support to a spouse that one is feeling ambivalent

toward may carry additional stress not accounted for when providing support (1) voluntarily and (2) to a spouse one views as supportive. In fact research has shown that the effect of helping others depends on the nature of the relationship between the helper and the help recipient: Poulin et al. (2010) found relationship factors to be more important than whether the support provided was voluntary. When support providers in the Poulin et al. study felt the relationship with their spouse was highly interdependent, helping was associated with positive emotion; support providers who did not feel the relationship was interdependent experienced greater negative emotion. Ambivalent couples may feel less interdependence and thus may experience greater stress when asked to provide support. Additionally ambivalence itself is associated with unpredictability and providing support to an unpredictable spouse may lead to increases in stress not seen when providing support to a supportive spouse. Certainly further work is required to determine if ambivalence affects the benefits on well-being usually seen in support provision. Overall, ambivalent relationships appear to not offer the physiological protection that supportive relationships offer and may even, in the long run, be detrimental to cardiovascular health.

A third aim of this study was to examine relationship quality in terms of the individual's own behavior toward the spouse based on principles of complementarity from the interpersonal circumplex. Interpersonal complementarity is said to exist when the behavior or one person is a function of the behavior of another person (Leary, 1957). Past research examining complementarity has often utilized laboratory paradigms with confederates rather than naturally occurring contexts and relationships. In contrast, we examined an important existing relationship and sampled ABP in daily life. We

predicted that ambivalent behavior from the spouse would lead to the individual's own ambivalent behavior and results from our data did show that an ambivalently viewed spouse was associated with significantly greater "own" ambivalent behavior. More importantly, we tested if the individual's own ambivalent behavior mediated the associations we found between spousal ambivalence and ABP. Following the mediational model criteria established by Baron and Kenny (1986) we tested a mediational pathway and found that the individuals' own behavior did indeed mediate the association between spousal ambivalence and ABP. When two individuals interact with each other their behaviors are often intertwined and the more interactions one has with another (as can be seen with married couples) the more intertwined those behaviors become. Often, after years of interactions, partners know each other well enough to anticipate and expect certain behaviors and thus alter their own behaviors to match those of their partner. However, while anticipating a partner's behavior and altering one's own behavior can have a positive impact on relationship functioning, the individual may pay a price physiologically. Rusbult, Verette, Whitney, Slovik, and Lipkus (1991) found that when an individual is engaged in negative or destructive behaviors, relationship distress can be reduced if the partner inhibits their inclination to react in a similar fashion. Rusbult termed this kind of response "accommodation." However, while accommodation clearly is in the best interest of the relationship, it is often experienced as costly or effortful by the individual. Instead of reacting to a negative interaction with an equally nasty remark, the individual needs to exert effort and bite his or her tongue. Research has shown that exerting effort to maintain relationship quality can have a detrimental effect on cardiovascular functioning (Smith et al., 2011). Efforts to manage or avoid negative

interactions can drain or deplete self-regulatory capacity with evidence seen in parasympathetic mediated heart rate variability, which has been associated with an increased risk for morbidity and mortality (Thayer & Lane, 2007). If such recurring patterns continue over the course of the relationship, they may contribute to long term negative cardiovascular health effects. We should note that although these data are statistically consistent with a hypothesized mediational model, these theoretical pathways are likely recursive and laboratory manipulations will be needed to examine direct causal processes.

When we examined ABP in ambivalent couples we found effects across both home and work, suggesting long-term changes in ABP. Thus, high negativity in the relationship could contribute to increased ABP over the relationship and subsequently, increased cardiovascular risk.

The limitations in this study are worth noting. We sampled over only one day and our sample was predominantly White, educated, fairly young and healthy. Although blood pressure can be a predictor of future cardiovascular disease, whether the blood pressure differences we saw are indicative of actual cardiovascular risk is something that will require further study. Additionally our sample contained only legally married heterosexual couples. It is unclear to what extent these data apply to other relationships (e.g., same-sex, cohabitating and/or dating couples). In addition, because our study was correlational in nature we cannot say for certain that ambivalent relationships cause higher blood pressure. Despite these limitations this study demonstrates the value of examining relationship positivity and negativity in naturalistic settings in order to more fully understand how relationships affect cardiovascular health. Ambivalent relationships

appear to contribute negatively to relationship processes and do not offer the protection that other, more supportive relationships offer. More broadly, our findings should encourage researchers interested in relationships and health to view positivity and negativity in relationships as separable dimensions which may affect cardiovascular health and martial quality in differing ways.

APPENDIX

AMBULATORY DIARY RECORD

Ambulatory Diary Record (Hard Copy)

Date: _____ Time of cuff inflation: _____ a.m. / p.m

At the time of cuff inflation

1. Posture: ____Lying down ____ Sitting ____ Standing
2. Activity level: ____No activity _____ Some movement ____ Moderate ____ Strenuous
3. Talking: ____No ____Yes
4. Temperature: ____Too Cold ____Comfortable ____Too Hot
5. Since the last reading did you consume: ____ Nicotine ____ Caffeine ____ Alcohol ____ Meal ____ None
6. Since the last reading did you exercise: ____ No ____ Yes
7. Location: ____Work ____Home ____In transit ____ Misc.

How do you feel right now?

Sad	Not at all	1	2	3	4	Very Much
Excited	Not at all	1	2	3	4	Very Much
Interested	Not at all	1	2	3	4	Very Much
Frustrated	Not at all	1	2	3	4	Very Much
Stressed	Not at all	1	2	3	4	Very Much
Active	Not at all	1	2	3	4	Very Much
Upset	Not at all	1	2	3	4	Very Much
Alert	Not at all	1	2	3	4	Very Much
In control	Not at all	1	2	3	4	Very Much

Using the scale (1=not at all, 2=a little, 3=somewhat, 4=very much, 5=extremely), how do you feel right now?

Confident about my abilities. _____
Worried about what others think about me. _____
Feel satisfied with the way my body looks right now. _____
Feel as smart as others. _____
Concerned about the impression I am making. _____
Pleased about my appearance right now. _____

Would you say you were dealing with an everyday problem or hassle at the time of cuff inflation?
_____ No _____Yes
Are you at home?
_____No _____Yes

Circle the number that best describes your interactions with your spouse since the last cuff inflation

Intimacy:	Superficial	1	2	3	4	5	Meaningful
I disclosed:	Very little	1	2	3	4	5	A great deal
Spouse disclosed:	Very little	1	2	3	4	5	A great deal
Influence	I influenced more	1	2	3	4	5	Other influenced more
Made me feel understood	Very little	1	2	3	4	5	A great deal

Made me feel validated Very little 1 2 3 4 5 A great deal
Made me feel accepted Very little 1 2 3 4 5 A great deal
How positive: Not at all positive 1 2 3 4 5 Extremely positive
How negative: Not at all negative 1 2 3 4 5 Extremely negative
Resulted in Mixed feelings: Not at all mixed 1 2 3 4 5 Extremely mixed

Were you interacting with your spouse at time of cuff inflation? YES NO (Circle one)

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