Effects of Priming Family versus Friend Support and Non-support on Subsequent Cardiovascular Reactivity to Acute Psychological Stress

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on Subsequent Cardiovascular Reactivity to Acute Psychological Stress

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Abstract

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To further understand the relationship between cognitive aspects of close relationships and health, the present study examined the effects of writing about supportive or non-supportive family and friends on blood pressure and heart rate responses to stress. In a 2 Relationship Quality x 2 Relationship Type mixed design study, 88 participants were randomly assigned to either a supportive or non-supportive priming condition (between groups) and were asked to write about friend and family relationships (within groups) in two separate sessions. After a 10 minute baseline, participants engaged in writing and thinking about a specific relationship for 4 minutes, prior to engaging a preparation and interview-style speech task. Unexpectedly, results revealed null effects of relationship quality as well as null interaction effects; however, a main effect of relationship type emerged, such that writing about family relationships significantly attenuated DBP responses to the preparation and speech tasks, relative to writing about friends. These findings suggest that writing about more familiar relationships may aid in one’s ability to cope with subsequent stress, relative to writing about less familiar relationships.

Approved: ___________________________________________________________

Christopher R. France

Professor of Psychology
To my father, Mark Warfel
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Introduction

Social relationships have been shown to benefit health and longevity (Cohen, 1988; Uchino, 2004), and further evidence supports associated improvements in cardiovascular functioning (Uchino, Cacioppo, & Kiecolt-Glaser, 1996) and improved long-term cardiovascular health outcomes (Uchino, 2006). In a recent review (Krantz & McCeney, 2002) regarding the psychosocial factors of disease it was concluded that epidemiological data provide clear support that social relationships facilitate improved prognosis for coronary heart disease, but the specific pathways underlying the social support and health link remain less clear.

Lepore (1998) suggests at least two potential pathways through which social relationships may facilitate health: the first is through direct dampening of stress responses, and the second is through cognitive reappraisal processes, or a combination of the two. The first proposed pathway emphasizes biological mediators implicated in pathology; a form of this theory is also known as the buffering hypothesis (Cohen, 2004), asserting that supportive others can provide the necessary resources to cope with and directly attenuate harmful physiological responses to acute daily stressors, thereby minimizing strain on the cardiovascular system over a lifetime (Uchino et al., 1996). Less is known about Lepore’s (1998) second suggestion that close relationships may facilitate coping through cognitive reappraisal processes. However, researchers have noted the importance of the role of perceived support (Krause, 1997) and relationship knowledge structures (Baldwin, 1992) in decoding the social-cognitive processes underlying stress coping. The objective of the current research is to elaborate on the role of relationship
knowledge structures in the coping process. Specifically, the current study’s aim is to examine the effects of cognitively priming supportive versus nonsupportive family and friend relationships on subsequent cardiovascular reactivity to acute psychological stress.

Only one published study (Smith, Ruiz, and Uchino, 2004) has directly considered the question of how cognitively priming relationship schemas affects subsequent stress responses. Their findings are intriguing: participants who wrote and thought about a supportive relationship responded with lower heart rate (HR) and blood pressure (BP) reactivity to an acute speech stressor compared those who wrote and thought about an acquaintance. This novel study suggests that the appraisal processes associated with pre-existing supportive relationships are not only powerful enough to elicit stress buffering, but that daily thoughts associated with close relationships may have a more significant overall influence on coping than transactions themselves. These appraisal processes may occur in a very similar way as when a supportive close relationship is physically present, and past studies demonstrating a friend’s presence contributes to stress coping may be enacting psychosocial resources in a similar manner as demonstrated in Smith et al.’s study.

Results of Smith et al.’s (2004) study parallels meta-analyses, demonstrating support-attenuating cardiovascular responses when compared to low support (i.e. Thorsteinsson & James, 1999; Uchino et al., 1996). However, results are inconsistent in studies that manipulate the physical presence of pre-existing relationships during an acute stressor. Two cited reasons for these inconsistencies are: (1) heightened evaluation when a friend is present during a stressor (Thorsteinsson & James, 1999) and (2) ignoring the
relative quality of specific relationships brought into the laboratory (Lepore, 1998). In addition, when participants were assigned to the “alone” condition in these studies, the friend often still accompanied them and waited in another room. This situation may have inadvertantly created a supportive environment, particularly in light of Smith et al.’s findings that mental activation of a supportive friend can contribute to stress buffering. Although priming thoughts of a supportive tie clearly differs from having a friend physically present, both thoughts and the physical presence of a close positive relationship ultimately leave participants feeling valued, comforted, and supported. These feelings of comfort and support may enact cognitive and emotional reappraisal processes to diffuse perceived demands or threats and in turn reduce physiological activation (Lepore, 1998). Likewise, some evidence shows that individuals who perceive high support from one’s network have lower cardiovascular stress responses compared to those who perceive low network support (Knox, 1993; Tardy, Thompson, & Allen, 1989). Smith et al. primed only supportive close relationships (thus controlling for quality) and isolated the cognitive component of support by eliminating their physical presence completely (thus eliminating an ally’s evaluation). The present study used a similar protocol to prime thoughts of relationships.

When considering relationship quality, it is important to note that social contact may act as a stressor rather than a support (Seeman, 2000). House, Landis, and Umberson (1988) concluded in a review that the magnitude of cardiovascular disease risk associated with negative relationships is comparable to major risk factors such as smoking, high blood pressure, and low physical activity. Support for the connection between conflict in
relationships and disease is based on substantial evidence that negative interactions are weighted more heavily in social judgment, create more intense responses, and result in stronger mental health effects than do positive interactions (Rook & Pietromonaco, 1987; Taylor, 1991). The idea that negative aspects of a relationship may be even more powerful than positive aspects in influencing psychological and physiological outcomes is known as the social negativity hypothesis (Major, Zubek, Cooper, Cozzarelli, & Richards, 1997). According to this hypothesis, perceived social conflict in an important relationship is a stronger predictor of cardiovascular disease development than perceived support in the same relationship (Major et al., 1997). Further, attachment theory (Bowlby, 1969, 1988) affirms that threats to a relationship can be a major source of distress, and the more important the relationship, the more intense the distress when the relationship is threatened (Simpson & Rholes, 1994).

Recently, findings in the laboratory have confirmed the evidence that lower quality (i.e. ambivalent) relationships are a risk factor for disease, perhaps by enhancing cardiovascular responses to behavioral demands or threats (Holt-Lunstad et al., 2003; Holt-Lunstad et al., 2007). It is clear that negative aspects of social relationships are related to negative physiological effects (Kiecolt-Glaser, Glaser, Cacioppo, MacCallum, et al, 1997), and positive aspects of relationships contribute to improved coping (Uchino, 2006), but it is unknown how cognitive appraisals associated with positive or negative close relationships impact coping with daily stressors apart from the actual relationship. Smith et al. (2004) proposed that it is possible cognitively primed relationships impacts daily stressors in the same way as their physical presence does. Similar models have
emphasized the relational schema (Baldwin, 1992), or cognitive maps which represent a pattern of interaction with a particular person. Thus, schemas of specific close relationships may be easily activated when primed, and recall of both declarative and procedural knowledge of the relationship may enact affective responses in a similar way that would occur if that person were physically present. For instance, when one is reminded of the supportive aspects of a positive relationship, associated cognitions and emotions may recreate procedural knowledge of this person, possibly enacting feelings of support and acceptance. In this way, primed relationship thoughts may evoke emotional support and thus provide coping resources in a similar way as the physical presence of a person is thought to facilitate coping. On the other hand, if one is reminded of the negative aspects of a low quality relationship, associated procedural knowledge and emotions may likewise be enacted, evoking a response in opposition to priming the supportive relationship. Appraisal processes may also vary in a similar way depending on the type of relationship primed; specifically, relationships higher in familiarity, depth and permanence (i.e. family) may evoke stronger responses than those lower in these components (i.e. friends).

Although relationship typology has not yet been considered within the reactivity literature, a meta-analysis has emphasized the importance of familial relationships on regulating blood pressure (Uchino et al., 1996), and longitudinal data has found that contact with family relationships have the most direct beneficial impact on ischemic heart disease and mortality (Barefoot, Gronbaek, Jensen, Schnohr, & Prescott, 2005). Finally, two studies have considered the differential impact of interactions with family versus
friends on ambulatory blood pressure, with the quality of family relationships exhibiting a greater impact in both directions (Holt-Lunstad, Uchino, Smith, Olson-Cerny, & Nealey-Moore, 2003; Spitzer, Llabre, Ironson, Gellman et al, 1992).

Uchino (2006) highlights research which links social support to psychological processes, including appraisals, emotions, and feelings of control. However, he points out the lack of evidence for their mediational role on health outcomes (House, 2001). Others, such as Ryff and Singer (2001), have urged researchers to uncover the deeper emotional mechanism for the established tie between social relationships and health. The direct role that affective responses may play on the link between cognitively primed relationships and stress coping were explored for the first time in the present study.

This study attempted to isolate cognitions of specific relationships using a paradigm similar to Smith et al. (2004) to determine the influence of thoughts of specific relationships on cardiovascular stress coping. To determine the effects of priming relationships of various qualities and types, thoughts of both high and low quality family and friend relationships were manipulated. Finally, to uncover the role of affective processes involved, mediation by affect was directly tested.

Prior to discussing the specific aims of the present study, a brief review on the importance of the functional quality of relationships in predicting cardiovascular health will be described. The role of acute stress reactivity on cardiovascular health will then be reviewed, followed by an evaluation of the social support literature pertaining to perceived support and pre-existing relationships. Discussion of research pertaining to the priming manipulation used in the present study will be followed by examination of
relationship typology as a potential predictor of health outcomes. Consideration of the mediational role of affect on the effects of social relationship manipulations and physiological parameters will then be the focus.

**Supportive Social Relationships and Cardiovascular Disease**

Social relationships have the ability to improve one’s health and quality of life, and at least in terms of epidemiological data, a considerable body of evidence associates greater social integration—defined as the number, variety, or affiliation with one’s social network (House, Umberson, & Landis, 1988)—with lower risk for mortality. A number of studies have also specifically linked both structural (size, frequency, and density of contacts) and functional (instrumental or emotional) support to cardiovascular disease (CVD). A few of these studies have found higher levels of structural support to be associated with a slightly lower incidence of CVD related events (Berkman & Syme, 1979; Eng, Rimm, Fitzmaurice, & Kawachi, 2002; House, Robbins, & Metzner, 1982; Orth-Gomer & Johnson, 1987). Nevertheless, there is not a conclusive association between structural aspects of support and cardiovascular disease, as measures of either network size or frequency of contacts have often not demonstrated significant associations with lower CHD risk (Kawachi, Colditz, Ascherio, & Rimm, 1996; Reed, McGee, Yano, & Feinleib, 1983; Seeman & Syme, 1987). These mixed results are perhaps due to one of the foremost criticisms of structural support mentioned in a recent review by Lett et al. (2005): A relationship support measure based solely on quantity ignores the nature of relationships, in essence grouping non-supportive and supportive relationships. In conjunction with this possibility, Greenwood, Muir, Packham, and
Madeley (1996) conclude in a review that the emotional aspects of support are stronger predictors of CHD than network size. A few studies to follow have simultaneously measured structural and functional aspects of support and may help explain the inconsistencies present within findings of structural support.

Seeman and Syme (1987) tested 169 males and females who were referred for an angiography due to suspected coronary artery disease (CAD). Both functional (network integration, problem-based support, and feelings of being loved) and structural (network size, church attendance, marital status, group membership) aspects of support were measured the day before their cardiac assessment; two aspects of functional support (instrumental support and feelings of being loved) were both significant predictors of coronary atherosclerosis, whereas no form of structural support was related. Thus the authors conclude their findings support the hypothesis that a network’s supportive quality as opposed to its quantitative characteristics most impacts coronary atherosclerosis development.

Orth-Gomer, Rosengren, and Wilhemsen (1993) conducted a six year longitudinal study assessing the relationship between two measures of functional support (availability of network support and closeness to a significant other) as well as one measure of structural support (number of persons in household) and myocardial infarction or CHD among fifty year old Swedish men (N = 736). The researchers found that those with lower support availability had significantly higher incidences of myocardial infarction and CHD diagnosis; however, this relationship did not emerge with respect to household size. Further, in a multivariate analysis of numerous physiological, psychosocial, and
behavioral measures including occupational status, smoking, social support, physical activity, serum cholesterol, BMI, hypertension, and diabetes, the authors found that lack of support availability and closeness were most comparable to smoking: These three emerged the strongest independent predictors of CHD risk. These results indicate a robust influence of the quality of support on cardiovascular health protection; additionally, the finding that the purely quantitative measure of household size had no effect on cardiovascular disease outcomes emphasizes the critical focus of the quality of relationships in relationship support measures.

In a 15-year follow-up of the above study, Rosengren, Wilhelmsen and Orth-Gomer (2004) used the same measures of functional support, and found similar results; after adjusting for smoking, physical activity, cholesterol, SBP, BMI, diabetes and family history of CHD, lack of emotional support was a stronger predictor of cardiovascular mortality than network availability. A study by Medalie and Goldbourt (1976) may help explain the reason network availability may not always be beneficial: They found that men with high network availability who also reported higher levels of family problems were found to be more likely to develop angina pectoris. These studies support the idea that the underlying supportive quality of relationships may play a role in the inconsistencies within literature that looks solely at the structural aspects of social contacts.

One study has considered associations between various measures of social support and non-cardiovascular physiological parameters. Data from the MacArthur Studies of Successful Aging (Seeman, Berkman, Blazer, & Rowe, 1994) found the most consistent
pattern of association between levels of emotional support perceived by men and lower levels of 12-hour overnight measures of urinary cortisol, norepinephrine, and epinephrine, whereas measures that did not directly take relationship quality (emotional support) into account—including network size and marital status—demonstrated less consistent patterns of association. For women, however, there was no association between any measures of social support and any physiological parameters; a closer examination of relationship quality revealed that women who reported higher levels of negative social interactions had significantly higher levels of urinary cortisol, which may have countered any benefit received from emotional support in their network. Consistent with the social negativity hypothesis, conflict present in relationships may have overshadowed the health benefits received from social support for these women.

Overall, results of the prior studies presented suggest that relationship quality has the most direct impact on one’s cardiovascular health outcomes as well as physiological profiles, relative to quantitative or structural measures of support. As noted in a review by Berkman and Breslow (1983), the relationship between forms of functional (emotional or instrumental) support and cardiovascular disease (CVD) outcomes has been demonstrated by a number of studies. Lack of perceived functional support has been associated with worsened physiological profiles, including higher heart rate and blood pressure (Bland, Krogh, Winkelstein, & Trevisan, 1991; Broadwell & Light, 1999; Dressler, 1983; Knox, 1993; Tardy, Thompson, & Allen, 1989) and higher serum cholesterol (Thomas, Goodwin, & Goodwin, 1985).
A natural question stemming from this body of research is: through what pathway does the quality of social relationships relate to health? As stated earlier, one potential pathway through which perceptions of functional support may influence CVD risk is via buffering of physiological responses to stress. If general perceptions of support are related to lower CVD incidence, then supportive relationships when brought to mind may contribute to improved cardiovascular stress responses. Alternatively, if perceptions of low support contribute to CVD, then thoughts of non-supportive relationships may contribute to larger stress responses. The following section more specifically describes the utility of cardiovascular parameters within this context.

**Cardiovascular Reactivity to Acute Psychological Stress**

**Stability of Responses**

The term cardiovascular reactivity refers to a short-term and fairly rapid response to a stressor, causing change from a baseline measure in a cardiovascular parameter (Hugdahl, 1995). There are significant individual differences between the degree of cardiovascular reactivity, with some individuals consistently showing larger changes and others showing smaller changes in cardiovascular parameters (Turner, 1994). These individual differences are stable both across time and type of task. For example, in a review of 17 studies by Steptoe and Vogele (1991), the test-retest weighted averages across tasks for blood pressure and heart rate reactivity correlations were .62, .52, and .30 for heart rate, systolic blood pressure, and diastolic blood pressure, respectively. In addition, a meta-analysis by Swain and Suls (1996) indicated moderate temporal stability across tasks for HR reactivity ($r = .57$), SBP reactivity ($r = .46$), and DBP reactivity ($r = \ldots$).
To demonstrate inter-task consistency, a study was conducted by Turner, Sherwood and Light (1994) in which 128 participants were separated into four groups by race (African American and Caucasian) and gender. All participants completed four laboratory tasks—active speech, passive speech, reaction time and cold pressor—within the same day. Blood pressure, total peripheral resistance (TPR) and cardiac output (CO) reactivity correlations of the three psychological tasks were unanimously significant and ranged from .34 to .78, demonstrating consistency across tasks. Inter-task consistency of the psychological and cold pressor tasks was considerable, but less impressive, which the authors claim is due to the active versus passive nature of the tasks, respectively. These values are reported as being even higher in a review of five studies by Kamarck and Lovallo (2003), in which correlations for blood pressure reactivity of normotensive adults across a variety of laboratory tasks—sampled between one week and one month apart—ranged from .71 to .81. Finally, the most recent of these studies conducted by Kelsey, Ornduff, and Alpert (2007) simultaneously considered individual and inter-task reliability in a total sample of 326 (Mean age = 19.6) males and females. Within-task temporal consistency in a single session ranged from .65 to .96 (Cronbach’s alpha) for a math task, cold pressor and video game task. Inter-task reliability was lower, with coefficient’s ranging from .35 to .64 when comparing cold pressor, video game and MAT, but fell to non-significant reliability coefficients when comparing the video game and cold pressor tasks, perhaps due to their inherent differences as measures of myocardial versus vascular responses, respectively. These studies demonstrate the moderate reliability of cardiovascular reactivity as a measure, including temporal stability as well as inter-task
consistency. Both of these factors are important if cardiovascular reactivity is to be compared across studies utilizing a variety of tasks, as well as whether reactivity is a stable enough measure to predict disease. The next section describes the associated CVD risk of hyper-responses to more traditional cardiac measures such as blood pressure and heart rate.

**Predictive Utility of Cardiovascular Reactivity**

There is a longstanding hypothesis that increased and frequent blood pressure reactivity to a variety of stressors predicts accelerated development of cardiovascular disease (Barnett, Spence, Manuck, & Jennings, 1997; Light, Sherwood, & Turner, 1992; Matthews, Manuck, & Saab, 1986; Treiber et al., 2003). Moreover, the reactivity hypothesis more specifically states that persons with a reliably exaggerated cardiovascular response to stress are more likely to develop CVD than either lower or average reactors (Ming et al., 2004).

Both case control and longitudinal studies have verified the reactivity hypothesis by demonstrating that blood pressure hyper-reactivity to a variety of psychological tasks is predictive of hypertension or carotid atherosclerosis. For example, exaggerated cardiovascular reactivity (CVR) to laboratory stress has been shown to contribute to coronary heart disease (CHD) risk factors (Davis & Matthews, 1990), and case control studies indicate that persons with CHD exhibit heightened cardiovascular responses during stress when compared to non-CHD controls (Corse, Manuck, Cantwell, Giordani, & Matthews, 1982; Dembroski, MacDougall, & Lushene, 1979). Further, a study by Wood, Sheps, Elveback and Scherger (1984) found that exaggerated responses to the
cold-pressor task predicted hypertension in a follow-up at least twenty years later.

The most recent example of these studies is the ongoing longitudinal multi-site prospective study, CARDIA (Coronary Artery Risk Development In young Adults; Matthews et al., 2004; Matthews, Zhu, Tucker, & Whooley, 2006), which involves over 5,000 black and white original participants without hypertension or diabetes. The team discovered that higher blood pressure reactivity to psychological stress predicted hypertension. In a publication two years later (Matthews et al., 2006), the CARDIA group found that SBP reactivity during a video game task predicted coronary calcification thirteen years later, and this association withstood adjustments for age, race, gender, smoking, obesity, family history of myocardial infarction, cholesterol, and physical activity. This finding is significant because carotid atherosclerosis is a predictor of coronary calcification (Barnett et al., 1997; Kamarck et al., 1997) which leads to higher rates of coronary morbidity and mortality (Arad et al., 1996; Detrano, Wong, Doherty, & Shavelle, 1997; Pletcher et al., 2004). Only approximately half of the original 5,000 participants both remained in the study by the fifteenth year and had participated in the computed tomography measures of coronary calcification, and these remaining participants were more likely to be thin, white, male, a smoker, and have no family history of heart disease; they also had slightly higher reactivity scores, but did not differ in lipid levels or alcohol consumption.
Effects of Supportive Relationships on Cardiovascular Reactivity

This section briefly overviews studies that compare those reporting higher versus lower support in their network, along with studies involving pre-existing friendships or pets. Individuals who generally hold a positive view of their social network may also respond in a positive way toward specific network members. Further, when in the presence of one of these network members, associated cognitions and emotions are automatically activated, and this priming mediates any potential psychosocial resources gained. Results in this section may provide insight as to how isolating the cognitive component of supportive processes may affect stress reactivity.

A handful of studies have considered the influence of self-reported perceptions of support on cardiovascular reactivity. In a typical design, a questionnaire is used to assess the participant’s perceived support of their relationship network, and those reporting higher levels of support are directly compared to those reporting lower levels of support. These types of studies have produced discrepant results; findings demonstrate that higher perceived support results in lower (Knox, 1993; Tardy, Thompson, & Allen, 1989) or no difference (Boyce & Chesterman, 1990; Farag, Bardwell, Nelesen, Dimsdale, & Mills, 2003; Roy, Steptoe, & Krischbaum, 1998) in HR and/or BP stress responses. Social desirability may confound results of these studies; among those who report higher levels of support, some may have a tendency to report socially desirable responses, also characterized as defensiveness. Likewise, other overlapping trait differences may be driving the effect, such as optimism. Thus, reported levels of support may not capture social reality. Despite this and other limitations associated with self-report data, there is a
trend of lower stress responses associated with higher self-reported support. The design of these studies should be improved, as causal relationships cannot be concluded from these data. The present study directly manipulated thoughts of specific relationships through a priming manipulation, and thus problems associated with self-report data is not an issue.

When the mere presence of pre-existing friendships have been considered in a laboratory context, physiological responses have also proven inconsistent (Uchino et al., 1996). These studies have shown that the cardiovascular stress response in the mere presence of a friend is buffered (Gerin et al., 1995; Kamarck et al., 1995; Kamarck et al., 1990) or unchanged (Edens et al., 1992; Sheffield & Carroll, 1994; Snydersmith & Cacioppo, 1992), when compared to being alone. Evaluative threat may have confounded the results of some of these studies; a friend’s presence during a stressful task inherently invites potential for heightened evaluation. An additional explanation for the inconsistencies is that relationship quality was not considered. In the few studies that have considered the quality of pre-established relationships within a laboratory setting, the buffering hypothesis is most robust within the context of relationships characterized by a high level of support and positivity (Holt-Lunstad et al., 2007; Uno, Uchino, & Smith, 2002).

One type of relationship that could be characterized by high support and positivity is a person’s pet dog. Two studies involving dogs demonstrated mixed results depending on whether the dog had a pre-existing bond with the participant. In one study, the presence of a pet attenuated SBP reactivity relative to a friend or the experimenter (Allen
et al., 1991), but a second study found that MAP was heightened in the presence of an unfamiliar dog relative to being alone (Craig, Lynch, & Quartner, 2000). If familiar pets buffer responses to stress, but unfamiliar dogs heighten stress reactivity, it is possible that the simple presence of a person’s pet elicits positive affective responses associated with an individual’s relationship schema of that pet. On the other hand, a novel stimulus (i.e. unfamiliar dog or experimenter) seems to elicit greater stress responses compared to being alone. Since the presence of a non-evaluative companion (i.e., pet) was found to attenuate stress, mixed results in the friend studies may be partially due to the inherent evaluative component associated with the friend’s presence; this would explain the reason Allen et al. found that a friend’s presence heightened stress responses relative to the pet’s presence. This pet study also demonstrates the potential for the sole presence of a familiar relationship to contribute to stress coping, independent of any supportive actions. Thus, cognitively primed relationship knowledge structures likely play a role in this context.

Five studies listed in Table 1 include a support manipulation that involves a pre-existing friendship. For example, Christenfeld et al. (1997) was interested in whether there was a difference between the presence of a stranger or friend. They stated the basis for their design was to consider a potential mechanism of support attenuation that had very little consideration within the reactivity literature; namely, the context of the relationship other than actual immediate behavior. Ninety females were randomly assigned to one of three social support conditions: supportive friend, supportive confederate, and non-supportive confederate. Results demonstrated significantly higher
SBP, DBP, and HR reactivity for those in the non-supportive confederate group compared to either supportive group. Further, SBP reactivity was significantly greater for those observed by a supportive confederate compared to a supportive friend, and the trend was the same for DBP and HR. The authors indicated these results suggest the effect of support on cardiovascular responses are not only a function of actual supportive behaviors, but are influenced by pre-existing knowledge or familiarity of a relationship; importantly, the frequency of supportive behaviors, determined by behavioral coding, did not differ significantly between friends versus confederates. A potential weakness of this study was that a non-supportive friend condition was not included, and thus a comparison could not be made between neutral confederate and friend behaviors. The authors indicated they left out this condition due to the potential bias in participant interpretation of aloof behavior from their friend. However, two other similar studies (Edens et al., 1992; Snydersmith & Cacioppo, 1992) indicated an attenuated influence of a neutral friend’s presence during a laboratory task relative to a neutral stranger. An additional weakness is that friendship quality was not considered; perhaps this helps explain why the effect was only significant for SBP. Overall, this study provides some support that greater relationship familiarity may ameliorate cardiovascular responses to stress.

As cited above, Edens, Larkin, and Abel (1992) conducted a similar study in which support was manipulated through five conditions: the mere presence of a friend or confederate, the physical touch of either a friend or confederate, and being alone. In order to dilute evaluative threat, friends and confederates wore headphones and flipped through magazines during the mirror tracing task and MAT. The researchers’ main findings are
that the stranger conditions elicited greater HR and DBP reactivity than friend conditions, and the touch conditions elicited greater SBP, DBP, and HR reactivity than no touch conditions. Although unmentioned by the authors, it is possible the touch conditions increased evaluative threat by making their presence more salient, while the evaluative threat controls were effective in the non-touch conditions; a form of invisible support (indirect or discrete support provision) may have been effectively induced in the non-touch conditions. This study lends support to the notion that the non-evaluative presence of a familiar pre-established relationship attenuates cardiovascular responses, at least for HR and DBP.

Craig and Deichert (2002) were interested in the affects of gender and friendship on the physiological influence of various types of support. They focused on male undergraduates, and considered pre-existing same-sex friendships in their support manipulations, creating three conditions: a friend’s emotional support, a friend’s instrumental support, and non-support. The non-support condition involved a neutral experimenter’s presence during the mental arithmetic task (MAT). The pair of researchers found that instrumental support produced the lowest DBP reactivity, compared to emotional support or non-support. Perhaps the impact of support provision was not strong enough for HR and SBP reactivity effects to reach significance because the researchers did not consider the quality of the participants’ friendships. Further, this study may be indicative of the importance of the source and context of support. The present study’s manipulation does not involve the physical presence of relationships during the actual stressor, which may control for evaluative threat. However, thinking
about familiar relationships may enact a process similar to the simple physical presence of those relationships. The history and memories associated with a given relationship—whether positive or negative—may be re-felt when activated. Thus, the present study isolated the recalled cognitive and emotional aspect of support to determine whether simply thinking about a close relationship affects subsequent responses to stress. Overall, the above findings indicate that the presence of pre-existing relationships do buffer stress responses relative to strangers, but this buffering effect does not always occur when compared to being alone. As noted above, a potential reason for the weak findings within studies that considered pre-established friendships is that the quality of relationship was not considered. Because a confederate clearly differs from a longstanding relationship in both familiarity and depth, the quality of the friendship is clearly an important consideration within studies utilizing pre-existing relationships. Allen’s (1991) study involving the presence of a pet may have enacted a type of relationship that is non-evaluative and generally supportive and positive. The manipulation of the present study aims to cognitively activate supportive as well as non-supportive relationships. In the next section, studies presented focus on the quality of pre-existing friendships. TA
Table 1.  
*Relationship Support and Non-support effects on Cardiovascular Function: Laboratory Reactivity Studies Involving Pre-existing Relationships*

<table>
<thead>
<tr>
<th>Study</th>
<th>Social Support Conditions</th>
<th>ANS Assessment</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edens et al. (1991)</td>
<td>Friend or stranger sat in room while listening to white noise and reading magazines, or they also touched participant’s wrist, or participant sat alone.</td>
<td>SBP, DBP, and HR during MAT and mirror tracing</td>
<td>Stranger conditions elicited greater HR and DBP reactivity than friend conditions. Touch conditions elicited greater SBP, DBP, and HR reactivity than no touch conditions. Alone condition elicited greater SBP reactivity than friend-touch.</td>
</tr>
<tr>
<td>Christenfeld et al. (1997)</td>
<td>Supportive confederate/friend: smiled, acted responsive and positive. Non-supportive confederate: acted reserved and neutral.</td>
<td>SBP, DBP, and HR during speech about euthanasia</td>
<td>Non-supportive confederate condition elicited greater SBP, DBP and HR reactivity than both supportive conditions. Supportive confederate condition elicited greater SBP reactivity than the supportive friend condition.</td>
</tr>
<tr>
<td>Craig et al. (2002)</td>
<td>Friend emotional support: male (same-sex) friend read instructions and provided verbal praise and supportive gestures. Friend instrumental support: provided useful information for MAT. Non-supportive experimenter: male acted neutral while reading instructions.</td>
<td>SBP, DBP, and HR during MAT</td>
<td>Experimenter non-support and friend emotional support conditions elicited greater DBP reactivity and lower DBP recovery than the friend instrumental condition. SBP also showed these trends, but none reached significance.</td>
</tr>
</tbody>
</table>
Table 1: continued

<table>
<thead>
<tr>
<th>Study</th>
<th>Conditions</th>
<th>Measurements</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uno et al. (2002)</td>
<td>Either a supportive or ambivalent friend (male or female) in an adjacent room wrote scripted emotionally supportive, instrumentally supportive or non-supportive notes during speech, which were transferred by the experimenter.</td>
<td>SBP, DBP, and HR during speech about current event topics</td>
<td>Female ambivalent friend condition exhibited the greatest DBP, TPR, and PEP reactivity. Ambivalent friends exhibited greater CO reactivity and smaller TPR reactivity than supportive friends.</td>
</tr>
<tr>
<td>Holt-Lunstad et al. (2007)</td>
<td>Either a supportive or ambivalent friend was present during the entire stress protocol, alternating speaking and listening every minute during discussions.</td>
<td>SBP, DBP, HR, RSA, PEP, TPR, and CO during discussion of either positive or negative personal event</td>
<td>Ambivalent friends elicited greater SBP reactivity during negative and neutral discussions than supportive friends.</td>
</tr>
</tbody>
</table>

Note. ANS = autonomic nervous system; DBP = diastolic blood pressure; HR = heart rate; MAP = mean arterial pressure; MAT = mental arithmetic task; PEP = pre-ejection period; RSA = respiratory sinus arrhythmia; SBP = systolic blood pressure; TPR = total peripheral resistance
Effects of Non-Supportive Relationships on Cardiovascular Reactivity

As noted, one way to improve upon studies described in the previous section is to consider the moderating effect of the quality of pre-existing relationships. Prior research has focused on the contention that some social relationships are characterized by some degree of positivity and negativity (Abbey, Abramis, & Caplan, 1985; Rook, 1984), with varying proportions of each (Uchino et al., 2001). Relationships characterized by both negativity as well as positivity—termed ambivalent—have been most consistently associated with higher cardiovascular reactivity to laboratory stress (Holt-Lunstad et al., 2007; Uchino et al., 2001), when compared to relationships characterized as purely positive—termed supportive. However, most prior research in the area of social relationships and health has only focused on a single dimension (positivity; Uchino et al., 2001). To address this limitation, recent CVR studies have directly compared high and low quality relationships.

A cross-sectional design by Uchino, Holt-Lunstad, Uno and Flinders (2001) highlighted the differences in blood pressure reactivity between the number of relationships in one’s social network perceived as supportive or ambivalent. One hundred thirty-three young and old participants underwent a stress protocol involving both a speech and MAT. Results of regression analyses revealed that individuals with fewer positive ties or more ambivalent ties demonstrated HR reactivity increases as a function of age, whereas those with a higher number of positive ties or fewer ambivalent ties did not have this HR reactivity increase; further, having a higher
number of ambivalent ties was associated with a significantly greater shortening of PEP. This study aimed to combine both structural and qualitative aspects of social ties. Although there are clear limitations of a cross-sectional design, important personal relationships are fairly stable across the lifespan, thus these findings may demonstrate the importance of the proportion of supportive and ambivalent ties in an individual’s social network and their improved and adverse impact on physiological profiles, respectively. It may also demonstrate the importance of the perception of one’s relationships, which may play a role in the present study’s manipulation. These findings are consistent with the social negativity hypothesis (Major et al., 1997), and others have noted that negative aspects of relationships exert a more powerful influence than do supportive aspects (Ingram, Jones, Fass, Neidig, & Song, 1999; Rook, 1984). However, this study did not manipulate support and as such identification of the mechanism for the suggested aging affects of negativity within one’s network could not be determined. The very next year the lab published a follow-up study addressing this pressing question.

In this follow-up study conducted by Uno, Uchino, and Smith (2002), eighty-eight undergraduate females were involved in a 3 x 2 x 2 between-subjects design. Although they were instructed to bring a female or male nonromantic friend into the laboratory, their friend’s physical presence was not part of the manipulation. While participants gave three one-minute speeches on current event topics, an experimenter handed them emotionally supportive notes, instrumentally supportive notes, or non-supportive notes copied by their friends from pre-scripted statements. Participants
were told that their friends would be listening to their speeches. Heart rate, SBP, DBP, RSA and impedance cardiography measures were recorded through a baseline period, speech preparation, and speech performance. Quality of relationship was assessed using the Social Relationships Inventory (SRI), and those who were rated greater than “1” (1-6 scale: 1=lowest rating) for helpfulness and equal to a “1” for upsetting were deemed supportive, while those who were rated greater than “1” for both helpfulness and upsetting were deemed ambivalent. Based on results from the SRI, 44% percent of the sample brought in an ambivalent friend and 56% brought a supportive friend, which is consistent with their prior study (Uchino et al., 2001), indicating that ambivalent ties make up almost half of important network members. Despite that fact that their friends were not physically present during the speech, those who brought an ambivalent friend to the lab had significantly greater TPR and marginally greater DBP reactivity compared to those who brought a supportive friend. The authors point out that this study did not replicate prior results that demonstrate a buffering effect of support provision on HR and BP reactivity (Lepore, 1998; Uchino et al., 1996); however, they further state that a comparison to other studies is difficult because their design used a less direct form of support provision and they had relatively low power. Despite the methodological weakness of the support manipulation, a small relationship quality buffering effect was found, and thus this study supports the hypothesis that the history or cognitive schema of a particular relationship can have a physiological impact. The current study focused on this powerful and ecologically valid concept: namely, the perception of quality in pre-
existing relationships. This study has at least one unique similarity to the present study: absence of physical presence; however, participants were made aware of the fact that their friends would be listening. Therefore, evaluative threat may have been a confounded the results. In the following study support is manipulated through the physical presence of a friend.

Holt-Lunstad, Uchino, Smith, and Hicks (2007) recruited one hundred and seven undergraduate women and men for their study, which was designed to assess the differences between the presence of a supportive compared to an ambivalent friend on cardiovascular reactivity. Participants with both ambivalent and supportive friendships were randomly assigned to one of the two relationship conditions: They were to bring either their supportive or ambivalent friend with them to the testing session for monetary compensation. During the experimental session, a baseline period was taken in silence with a curtain drawn between the participant and their friend. A dialogue then ensued between the participant and their friend about a moderately intense, positive or negative past experience based on instruction to alternate speaking for one-minute intervals. Cardiovascular measures including HR, impedance measures and respiratory sinus arrhythmia (RSA) were continuously recorded, and BP was taken every minute at each dialogue exchange. The authors found that resting RSA and HR were higher for those who brought an ambivalent friend to the laboratory compared to those who brought a supportive friend. Further, among participants discussing a negative event, those interacting with an ambivalent friend exhibited greater SBP reactivity than those interacting with a supportive friend.
Also, among participants interacting with an ambivalent friend, those discussing a negative event had a greater SBP reactivity than those discussing a positive event, whereas participants interacting with a supportive friend demonstrated no significant differences in SBP reactivity between those discussing negative compared to positive events. The authors suggest that the supportive friend served as a buffer to cope with the negative event. Overall, the authors concluded their results indicate that compared to supportive relationships, ambivalent friendships may be general sources of stress during social interaction; particularly, they note, during disclosure of past negative events (or when support is sought in times of stress); these data suggest ambivalent friendships are unhelpful for coping. Given their subsequent analyses revealing that past upsetting feelings mediated the main effect of SBP reactivity relationship quality differences, as well as that coded behaviors during interactions were no different for supportive compared to ambivalent friends, they further conclude that the overall perception of the relationship is more important than actual behavior during a particular interaction. Unfortunately, however, the ecological validity of the study is somewhat questionable because the flow of the discussions was unnatural due to the required alternation of speaking roles. This study differs from the present study in several ways; however, it is possible that priming specific relationship thoughts may enact the same mechanism creating this effect. One potential extension to this study is to examine how relationship type (i.e., sibling, mother, father, friend) might interact with quality to affect cardiovascular response during stress.
The research described above indicates that relationship quality is an important consideration for future studies that consider the effect of pre-established relationships on physiological parameters. Furthermore, these studies suggest that relationship quality may serve as a moderator of the relationship between support from a friend and CVR. As such, lack of control for quality is a key explanation for the inconsistencies in the body of literature manipulating presence of a friend. When quality has been considered, findings are more consistent. The present study isolated thoughts rather than physical presence associated with one’s pre-existing relationships. Cognitions and emotions associated with established relationship schemas may be playing a role in the support and CVR link. The basis for this concept will follow.

Mental Activation of Relationship Schemas

While supportive transactions themselves are important factors in evaluating social support, the general expectation that support is available—or cognitions associated with positive support—may have the most direct influence on health (Krause, 1997). Likewise, cognitions associated with a longstanding, non-supportive relationship—or a lack of support—may have an equally direct and adverse effect on health. The development of relationship knowledge structures through repeated exposure to experiences of social interaction is demonstrated through both attachment theory (Bowlby, 1969) and social-cognitive perspectives (Baldwin, 1992). Mental activation of relationship schemas manipulated through subliminal priming, structured writing, or recall exercises has been shown to reduce negative affect
(Pierce, Baldwin, & Lydon, 1997). Thus simply priming these well-established knowledge structures may activate a function similar to the effect of physical presence of those companions. Conversely, activating knowledge structures of negative or non-supportive relationships may create a cognitive response associated with social isolation and social conflict.

A few studies regarding marital quality and communication styles have demonstrated the significance of generalized relationship schemas in the role of physiology. One such study by Heffner, Kiecolt-Glaser, Loving, Glaser, and Malarkey (2004) recruited both newlywed and older couples who indicated by self-report their spousal support satisfaction and then engaged in a conflict discussion while measures of blood pressure and cortisol were taken. They found that for newlywed wives, the perception of higher levels of spousal support predicted lower cortisol responses during the conflict interaction. After the conflict, both husbands and wives who indicated higher levels of spousal support had lower blood pressure. Finally, among older husbands only, when general spousal support was perceived as being lower the conflict interaction produced greater cortisol responses. The authors concluded that general relationship satisfaction levels predict physiological responses during a conflict interaction.

In a follow-up study (Heffner et al., 2006) of the same older married couples (mean age = 66.75 ± 4.96), the researchers determined how the long-term perceptions of their communication pattern affected their cortisol responses compared to an actual conflict interaction. The study focused on a communication pattern termed
demand/withdraw, which is associated with relationship dissatisfaction as well as divorce (Caughlin & Huston, 2002). Results demonstrated that coding of actual wife demand/husband withdraw communication patterns during a conflict interaction did not correspond with cortisol levels; however, long-term perceptions of this negative interaction pattern were significantly related to cortisol responses. In their discussion of these results, Heffner and colleagues postulated that a long-term relationship perception has a greater impact on physiological responses than a third party perception of a single interaction. They refer to the concept of general relationship sentiment (Baucom, Sayers, & Duhe, 1989), which has sometimes been shown to override interactions themselves in terms of interpretation of their spouses reactions and, in turn, physiological responses (Ewart et al., 1991). The results of these two studies by Heffner and colleagues suggest that general knowledge structures of a relationship may be at least as important as social interactions in terms of predicting physiological responses.

Similarly, in a study by Carels, Szczepanski, Blumenthal, and Sherwood (1998), fifty married women between ages 25-45 were asked to engage in a conflict recall task after being categorized as either distressed or non-distressed in their marriage. Wives who reported being in a distressed marriage had higher blood pressure than wives in a non-distressed marriage when asked to activate thoughts of an instance of marital conflict. This study (unlike the two previously described) relied solely on recall and not engagement in an actual discussion, lending support to the
prospect that simply mentally priming relationships that vary in quality is sufficient to significantly impact BP responses.

Mental activation of relationship schemas has some similarity to the concept of invisible support, or the receipt of support without direct awareness by the recipient (Bolger, Zuckerman, & Kessler, 2000). It establishes an underlying provision of support that is more powerful for stress buffering than receipt of actual supportive transactions. Bolger et al. (2000) postulated three reasons why blatant support receipt has not been found to be beneficial for coping: (1) confounding effects of receiving more support during times of stress, (2) well-intended provision of support is sometimes detrimental and (3) making support receipt salient may increase anxiety and lower self-esteem if the support itself acts as a reminder of one’s difficulty with coping. In a study by Bolger and colleagues (2000) the phenomenon of invisible support was demonstrated via a daily diary study. Participants included cohabitating heterosexual couples in which one member was facing an upcoming exam. Results indicated that support reported by the recipient worsened their adjustment to the stressor, whereas support reported by the provider but unnoticed by the recipient promoted adjustment. Perhaps an illustration of invisible support is an instance during which the cognitive priming of supportive relationship schemas—unbeknownst to the receiver—activates a coping response.

A study conducted by Smith, Ruiz and Uchino (2004) was the first to incorporate a paradigm within an actual laboratory context, in which pre-existing relationship schemas were primed via mental activation. They were interested in how
supportive relationships primed in this manner would interact with hostility to influence stress reactivity. In addition, the researchers examined mediation of negative affect, to evaluate whether changes in anxiety and anger during the speech accounted for effects of priming supportive relationships on stress cardiovascular reactivity. Eighty-two male and female college students were primed to think of either a supportive tie or an acquaintance via writing exercises immediately prior to a preparation and speech task regarding one of two topics: (1) requiring uniforms in public schools to discourage gang participation or (2) raising the social security age of retirement. HR and BP reactivity to the speech was significantly reduced in those who wrote about a supportive tie compared to those who wrote about an acquaintance. Among women, low-hostile participants experienced a significant reduction in DBP response in the supportive tie condition compared with the acquaintance condition. For high-hostile women, however, there were no differences in reactivity between the supportive and acquaintance tie conditions, but state affect was slightly reduced in the acquaintance condition. To reiterate, the novel cognitive priming manipulation of supportive versus acquaintance relationship structures demonstrated a significant main effect, and some evidence for an interaction with hostility. Further, a change in state anxiety during the speech (but not state anger) was found to mediate (indirectly) the effects of the support manipulation on cardiovascular responses. Because state anxiety change was measured from post-baseline to post-speech, temporally speaking it is difficult to conclude true mediation. One point raised by the researchers of this study was that their support priming
manipulation may have simply worked as a mood induction rather than an effect specific to the supportive relationship schemas. However, if this was true, mediation should have been found from the change in state anxiety or state anger immediately following the priming manipulation. Indeed, it is difficult to know exactly what mechanism is operating without the possibility of direct observation of perceptual states, and thus the researchers suggest that future studies include measures of other plausible mediators of this effect. Positive affect has been posited as a likely mediator of supportive relationships’ effects on health (Uchino, 2006). Accordingly, affect was explicitly measured in the current study to test the possibility that activating thoughts about specific relationships effects cardiovascular stress responses through changes in affect. The section following will elaborate on the basis for this prediction.

Studies presented thus far have mainly focused on support from a friend. The focus on friendships alone, however, may be too narrow, and one little explored question is whether there is a difference between the impact of friendships and non-spousal familial relationships on cardiovascular reactivity. In other words, are various relationship typologies (i.e., exogenously established versus voluntary relationships) differentiated in their stress buffering capacity? The potential impact of both quality and typology of relationships on health will be elaborated upon in the following sections.

Relationship Typology

One way VanLear, Koerner, and Allen (2006) have distinguished relationships is to divide those that are exogenously established (i.e., family, work
relationships) from those that are discretionary or voluntary (i.e., friends, romantic partner). They divide these two typologies even further into either personal or social, in which personal relationships are more intimate and interdependent while social relationships more impersonal and superficial. Among relationships that are voluntary, best friends, married or cohabiting couples would be considered personal, whereas acquaintances or casual friends would be considered social. Likewise, among exogenously established relationships, immediate family would be considered personal, whereas distant relatives and work relationships would be considered social.

Another way to categorize relationships is by their social function. The basic function of a friend is companionship (Fischer, 1982), whereas when companionship is not present, a friendship is usually broken. On the other hand, family relations—while they can provide companionship—do not exist solely for this purpose because they originate from an exogenously established genetic tie, which cannot be broken even if companionship is absent (Rook, 1987). Furthermore, Rook (1987) stated that reciprocity is more common in friendships than family relationships, and people are in fact more likely to turn to family during times of financial crisis. By a similar vein, Wellman and Wortley (1989) noted that the same amount of emotional support is provided between parents and adult children, regardless of the self-described closeness of the relationship. Hence, at a basic level, family relationships are characterized as having a higher expectation of support (or at least a lower expectation of reciprocity through companionship), as well as a much higher difficulty of termination compared to friendships.
There are inherent differences in the social function of family and friend relationships. Is it possible that these functional differences between family and friends interact with relationship quality? For example, would a non-supportive family relationship influence coping ability to daily stressors differently than a non-supportive friendship? Would these functional differences further translate into emotional responsivity differences? This investigation of sources of support has been cited by Thoits (1995) as an unanswered question with regard to the body of research on stress and coping. As a relatively unexplored topic, the current study considered how priming specific relationship typologies impacts mood and in turn the acute stress response of cardiovascular parameters during a specific phase of the lifespan (young adults).

There is a differential importance of various types of relationships across the lifespan. For young adults, friendships are of extreme importance (Brown, 1981). Generally, McLaughlin and colleagues (2002) assert that young adults are at a stage during which they characteristically have a need to exert independence from their family, while also usually remaining dependent on their support. In addition to this, family may be an important and expected source of support for young adults who are more likely to undergo new experiences and drastic life transitions. Because the study focused on young adults (ages 18-25), generalization to a population in a different life stage should be made with caution.
Relationship Type, Coping, and Well-being

A few studies have considered the influence of relationship type on various measures of well-being and coping. Those relevant to the current study include the impact of friend and family relationships on anxiety (Bolger & Eckenrode, 1991; Cutrona, Cole, Colangelo, Assouline, & Russell, 1994), mental health (McLaughlin, Horwitz, & White, 2002; Schrimshaw, 2003) and loneliness (Pinquart & Sorensen, 2001). These measures of coping and well-being are relevant to the physiological dependent variables of the current study due to their shared association with heightened cardiovascular disease development.

A study by Bolger and Eckenrode (1991) distinguished between friendship and kin social integration effects of buffering pre-examination anxiety. Among 56 students preparing for the MCAT, social integration with voluntary relationships (i.e., friends and neighbors) significantly decreased pre-examination anxiety, whereas integration with obligatory (family, work, and school) relationships did not. As the authors mention, a major weakness of this study is that the entire sample is composed of a very specific population of students studying for the MCAT. This possibility is clarified by anecdotal evidence obtained that the students felt a tremendous amount of pressure from parents, and thus interaction with family surrounding this anticipated acute stressor may have been particularly detrimental. Nevertheless, this study provides potential evidence that network type interaction is an important consideration when investigating anxiety surrounding context-specific stressors.
On the other hand, Cutrona, Cole, Colangelo, Assouline, and Russel (1994) found that perceived parental support predicted a higher college GPA in 131 first and second year students, while friends and romantic partners did not. Utilizing causal modeling regression analyses, Cutrona and colleagues discovered supportive parents had a greater influence on their child’s grade point average relative to supportive friends or romantic partners. Also, contrary to findings by Bolger and Eckenrode (1991), parental support was found to lower anxiety, at least with respect to a long-term achievement goal such as GPA. Thus, combined findings of these two studies point to the possibility that parental support fares better than friends’ support in general, but within the context of certain short-term stressors the reverse may be true.

McLaughlin, Horwitz, and White (2002) considered the differential impact of voluntary versus involuntary relationships on young adult’s mental health. They compared the impact of supportive and problematic relationships between family, friendships, and heterosexual relationships on depression for 1257 adults between ages 25-31. Results generally supported hypotheses that non-supportive relationships that are more involuntary (characterized by a higher expectation of support and those with a higher difficulty of termination) would have a worsening impact on depression, whereas supportive relationships would have a greater impact on lowering depression the more voluntary they are. Results indeed demonstrated that problematic family relationships had the strongest impact on worsening depression, while supportive friends were the most protective against depression. Overall, the authors believe the results of this study indicate that relationship typology is an
important factor when investigating supportive relationship effects on mental health. Empirical evidence exists which links depression with morbidity and mortality in CHD patients (Frasure-Smith, Lesperance, & Talajic, 1993). Because of this, the study lends support to the possibility that an interaction between the effects of quality and typology on physiological parameters also exists. The authors further point out that the studies’ longitudinal design was not sensitive to the dynamic nature of relationships, especially during a typically transitional period of the lifespan. Given that the studies’ age range (25-31) differs from that of the current study (18-25), the results of this study may not fully generalize to the population of interest.

In a similar study, Schrimshaw (2003) considered the impact of negative interactions of various relationship sources on the depression and coping of 146 women with HIV. After controlling for demographic characteristics (race, SES, and education) and disease stage and symptoms, a hierarchical regression analysis demonstrated that higher levels of negative interactions with a lover/spouse as well as non-spousal family members was significantly associated with depression; however, unsupportive interactions with friends was not significantly associated with greater depression. Combined, negative interactions uniquely accounted for 17% of the variance in depression, over and above demographic characteristics and disease state.

The last two studies presented not only reemphasize the importance of negative aspects of relationships on well-being and health, but they are unique in their attempt to differentiate the impact of negative interaction by relationship source. Schrimshaw summarizes findings in his discussion, stating that while all three sources
of negative interaction worsened depression in these HIV patients, they did so in different ways. He highlights that regardless of interactions with other sources, negative interactions with a lover/spouse and especially non-spousal family relationships had a direct effect on depression, whereas interactions with friends and a lover/spouse were found to interact, such that high levels of negative interactions in either relationship predicted higher levels of depression. He believes this subsequent finding indicates that negative interactions result in poorer mental health— independent of quantity or relationship source—as either negativity from friends or negativity from a lover/spouse is sufficient to increase levels of depression, and negativity from both sources resulted in a similar level of increase in depression. These results suggest that support from all types of close relationships is a required factor to promote the mental health of women, which is in line with the social negativity hypothesis (Major, Zubek, Cooper, Cozzarelli, & Richards, 1997). Overall, this study highlights the differences between non-spousal family relationships and friends, such that negative interactions with family relationships are likely to have a more direct impact on well-being, perhaps due to the higher difficulty of avoidance and/or elimination of family relationships relative to friendships. The current study considered these potential typology differences in the context of acute stress reactivity.

In a meta-analysis of loneliness in the elderly, Pinquart and Sorensen (2001) found that friendships had a more powerful influence of lowering feelings of loneliness compared to family relationships. The authors validate these findings with
mention to Cantor (1979), who found that older adults are more likely to turn to their friends than their family when they are feeling lonely or need advice. Pinquart and Sorensen attribute this to the fact that voluntary relationships may lessen feelings of loneliness in the elderly better than structurally determined family relationships. They further state that unsatisfactory friendships are likely to be terminated, whereas even very low-quality family ties are far less likely to be terminated. It seems logical that contact with friends would be particularly more beneficial in reducing feelings of loneliness compared with family relationships within the context of older adults, as family relationships among the elderly are more likely to be younger and in need of their support. Further, as stated earlier, family relationships are less likely to be companionate. However, this does not speak to the association of family versus friend relationships on physiological parameters. As with the prior study, results of this study should also be generalized to the current study with caution, because the population of interest differs from that of the current study (young adults). None of the research presented thus far speaks directly to the association of family versus friend relationships on physiological parameters. The next two sections will elaborate on this concept.

Relationship Type and CVD

The longitudinal Copenhagen City Heart Study by Barefoot, Gronbaek, Jensen, Schnohr and Prescott (2005) examined the predictive impact of contacts with various relationship sources on ischemic heart disease and mortality. An age-stratified random sample of 9,573 (ages 21 to 93; mean age = 57.5) adults were tested at a
baseline examination and then at follow-up 3 to 6 years later. Results, based on hazard ratios ranging from .48 to .83, revealed that contacts with parents, other family, friends, and spouses were all independently associated with lower risk of ischemic heart disease as well as mortality, with parents and other family being the most protective and friends being relatively less protective, overall. However, when data was broken down further into frequency of contact, an interesting difference emerged between parents and friends: compared with weekly and monthly contact, daily contact with parents was most protective, whereas monthly contact with friends was the most protective. As was indicated in the previous section, the function of friend versus family relationships differ, and it can be argued that a very close, dependent relationship with family is expected and natural, whereas a dependency and extreme closeness with a friend may be indicative of an unbalanced (i.e., needy) relationship or compensation for a lack of family support. To conclude, this study demonstrates that regular, interval contact with friends has a unique protective impact on cardiovascular health and mortality; further, contact with family—a deeper and more familiar relationship—has the potential to be even more protective, and the more contact the better. The age range of this study is far greater than that of the current study, and thus frequency of contact needs between family and friends may differ for college-aged individuals.
Relationship Type and Ambulatory Blood Pressure

While the study in the previous section considered the impact of various relationship typologies on well-being and CVD, no known studies have considered the effect of relationship type on physiological responses to stress. However, a few studies have considered the impact of relationship type on ambulatory blood pressure.

Spitzer, Llabre, Ironson, Gellman and Schneiderman (1992) considered the differential effects of family versus friend presence on ambulatory blood pressure. They distinguished various relationships by level of “familiarity” (i.e., strangers vs. friends vs. family), a relationship dimension borrowed by Levinger (1972), which is classified by the amount of one’s lifetime that has been spent with a person and interchangeable with the level of deepness within a relationship. Seventy-nine males and 52 females wore an ambulatory BP monitor for 14 hours, and their BP was taken in 20 minute intervals; participants indicated their body position (standing or sitting) and whether they were alone or in the presence of a family member, friend, or stranger. Findings indicated that both SBP and DBP varied significantly as a function of familiarity; overall, BP was lowest in the presence of a family member and highest in the presence of a stranger. Further, BP in the presence of a family member was significantly lower than in the presence of a friend. In their discussion of the results, Spitzer and colleagues mention the importance of the ecological validity of their study, but suggest the possibility of confounding factors, including level of talking and setting (i.e., work vs. home). Nevertheless, relationship type accounted for a significant amount (23-37%) of the variance in BP, and these results suggest that the
type of relationship is an important consideration for studies in which cardiovascular measures such as blood pressure are involved.

Only one known study by Holt-Lunstad, Uchino, Smith, Olson-Cerny, and Nealey-Moore (2003) has simultaneously considered the effects of both the quality as well as typology of relationships on ambulatory blood pressure. One hundred and two college students (Mean age = 24) underwent event-contingent blood pressure monitoring for three days, during which they were to take a BP reading five minutes into each every social interaction they were involved in. After each interaction, participants completed a short questionnaire that included items from a revised Social Relationship Index (SRI; Uchino et al., 2001) regarding relationship categorization (i.e., friend, mother, brother, roommate, boss, etc.) and relationship quality (i.e., positive, negative). Results indicated a main effect of both relationship type and quality. First, discussions with family members were associated with significantly lower ambulatory SBP and DBP than non-familial network members. The explanation given by the authors for this finding is that the higher level of familiarity associated with family relationships—developed after perhaps a lifetime of contact—may create a calming effect. Second, Holt-Lunstad and colleagues (2003) discovered that, independent of typology, discussions with ambivalent network members were associated with significantly higher ambulatory SBP compared to both supportive and aversive (negative) ties. The author’s consider this finding, when combined with their previously mentioned research (Uchino, et al. 2001), as evidence of the particular importance of ambivalent ties and their potential association with poor cardiovascular
outcomes. Unfortunately, the category of non-familial network members was very broad, and included friendships, romantic relationships, roommates and work relationships, and thus more specific comparisons could not be made in order to most directly relate these results to the current study. In addition, the authors did not make use of their data to compare obligatory (i.e., family, coworker, roommate, boss) versus voluntary relationships (i.e., romantic relationships, friendships). More specific aspects of typology was addressed in the current study through a comparison of family and friend relationships, encompassing dimensions of both familiarity as well as obligation associated with these significant relationship types.

Holt-Lunstad and colleagues (2003) also considered whether the quality and type of relationships influence cardiovascular responses via independent pathways, or if they are overlapping. To address this question, they simultaneously entered perceived positivity and negativity of the relationship as well as family versus non-family relationships into a regression equation. Both relationships remained significant, and thus it was concluded that the two constructs are independent. The researchers considered this finding further evidence of their hypothesis that the familiarity of family relationships may have a calming effect on the cardiovascular system, occurring independent of the perceived quality of the relationship. This explanation is also in line with previously mentioned results from a meta-analysis (Uchino et al., 1996), which found that family relationships have a particularly strong buffering capacity on cardiovascular parameters. Overall, this study indicates that both ambivalent relationships as well as familial ties are important considerations to
be made in future studies investigating the physiological impact of social relationships.

The use of event-contingent (Wheeler & Reis, 1991) ambulatory blood pressure sampling to capture physiological responses to daily events is a valuable ecologically-valid and under-utilized medium. However, the study only speaks to the effect of coping within actual relationship transactions, whereas an ongoing relationship may influence coping with daily stressors occurring apart from actual relationship transactions. It is, nevertheless, more similar to the current study than any other known to date. One particularly unique factor of the present study is the use of a mental activation paradigm (Smith et al., 2004) such that the physiological impact of aversive, ambivalent or supportive ties to a psychological stressor can be captured, independent of actual relationship transactions.

Much of the research presented thus far regarding influences of relationship ties on psychological and physiological dependent variables has largely focused on the physical presence of relationships. In addition to actual interactions with others, however, long-standing relationships that are perceived as non-supportive may be a significant source of stress that can possibly take a toll on one’s coping resources simply via mental activation of the general knowledge structure of the relationship. In fact, thoughts about a relationship may occur more frequently in daily life than physical interactions, and these thoughts may directly activate psychosocial resources. The influence of these thoughts on affect and stress coping may have important implications for the mechanism through which relationships impact one’s
daily mood and health. Following, evidence that affect may serve as a mediator of the relationship between cognitions of a supportive or non-supportive relationship and subsequent stress reactivity will be considered.

**Potential Mediating Role of Affect**

In 1992, Baldwin proposed that priming relational schemas is an ideal way to begin a social-cognitive focus on how information about one’s relationships are perceived, interpreted, stored and recalled. He discusses various models of how affect plays a role in the process of decoding relationship schemas. Some have proposed that emotion is represented by “tags or nodes” within a cognitive structure, and in this way specific memories can be activated when primed (Bower, 1981; Fiske, 1982). Others have suggested that emotional memories are always felt, activating procedural knowledge of feelings from a specific time (Safran, 1990a). Along these lines, research by Fredrickson (2000) indicates the peak-end heuristic can be used as a reliable predictor of how past affective experiences will be encoded and recalled. The peak-end rule posits that past affective events—including in the context of close relationships—is largely interpreted based on its peak (the most extreme emotion) and ending (the most recent emotion). Cognitive priming of relationship schemas relies on recall of past affective experiences, which may work to induce emotion through a peak-end heuristic.

While support for the mediational effect of emotions on health is lacking (House, 2001), much evidence has linked social support to various psychological processes—including appraisals, emotions, and control. For instance, one study has
considered the impact of social events on one’s daily mood (Gable, Reis & Elliot, 2000). Hierarchical linear modeling demonstrated that positive social events significantly predicted positive mood at the day’s end, and negative social events predicted negative mood at the day’s end. This study demonstrates that social relationships can predict affective changes, and this effect is strong enough to predict mood potentially several hours after a social event has occurred. This evidence supports at least the first half of affective mediation on the relationship-health link. Extrapolating this to the priming manipulation used in the current study, it is possible that priming relationship schemas parallels mood induction paradigms.

Unfortunately, research is very limited with respect to the direct effects of mood induction on subsequent cardiovascular reactivity, or stressors in general. Feldman et al. (1999) conducted a meta-analysis of nine cardiovascular reactivity studies which assessed negative affect both before and after an acute stressor. They found that across different types of stressors, negative affect was reliably related to increases in heart rate and blood pressure, with small to moderate effects. Taylor et al. (2003b) has found indirect evidence that self-enhancement effects on cardiovascular reactivity occur through psychosocial resources such as optimism, mastery, self-esteem, extraversion, and social support. She has demonstrated similar findings with respect to cortisol and neurological stress responses (Taylor, 2008). Taylor has referenced two potential pathways through which psychosocial resources may contribute to an adaptive stress response: (1) through an increased threat-detection
threshold (or lower likelihood of perceiving an event as threatening) and (2) through a greater effectiveness of managing the threat once detected.

Other than Taylor’s work, a few studies have considered how mood induction, specifically, influences physiological responses unrelated to stress (i.e., Smith, 2005). Priming of positive affect through film has been shown to effectively reduce cardiovascular activation after successful induction of negative affect (Fredrickson & Levenson, 1998). Similarly, Smith (2005) compared heart rate responses to neutral, pleasant, and unpleasant images, which increased after sustained exposure to unpleasant pictures, decreased after neutral picture exposure, and remained the same after pleasant images. A study by Etzel et al. (2006) found that music-induced sadness led to heart rate deceleration, while induced fear resulted in heart rate acceleration. Similarly, slower respiration resulted from induced sadness compared to fear and happiness.

If priming social relationships does induce either positive or negative affect, then what makes this paradigm any different from other factors that influence affect, such as a music-induced mood change? Is there any unique factor about social relationships that influences health, separate from affect? As Ralph Adophs (2004) argues, social information is complex, unpredictable, and interactive, and stimulates the brain in a unique way. Presumably a relationship priming protocol, therefore, is not the most reliable way to achieve a specific affective state. On the other hand, priming may reliably induce social affective memories through the peak-end heuristic described earlier (Fredrickson, 2000). Long-standing relationship schemas identified
as negative or positive may reliably induce corresponding affective changes and, in turn, affect cardiovascular reactivity to stress. Indeed, a number of researchers have pointed out the lack of evidence for potential cognitive and emotional mediators of the social support-reactivity hypothesis (Lepore, 1998; Uchino, Cacioppo, & Kiecolt-Glaser, 1996). The current study was the first to directly explore this question.
The Current Study

Purpose

Findings in the social support-reactivity literature have been mixed, and recent examination of the distinction between supportive and ambivalent friendships has provided at least one avenue through which some of these inconsistencies may be understood. Furthermore, although the concept of relationship typology has been explored, its contribution to understanding links between supportive social relationships and CVR is greatly needed (Thoits, 1995) and has yet to be investigated. Only one study (Holt-Lunstad et al., 2003) has simultaneously considered relationship quality and typology on ambulatory cardiovascular parameters. In addition, only one published work (Smith et al., 2004) has used the present study’s cognitive priming paradigm to isolate thoughts of specific relationships. The purpose of the current study was to expand this body of research to consider the impact that cognitive priming of relationships of various quality and type would have on cardiovascular responses to psychological stress. It was the first to consider both the physiological and affective impact of something we do daily: think about our closest relationships.

Specific Aims

This study expanded Smith et al.’s (2004) work to examine how thoughts of personal relationships with opposing supportive qualities (supportive versus non-supportive) of various types (involuntary family ties versus voluntary friendships) impact cardiovascular reactivity. The first aim was to determine whether the supportive quality of close relationship ties would influence cardiovascular reactivity
to acute stress. The second aim was to determine whether there would be an
interaction between the quality and typology of relationship ties. The expectation with
the interaction term was that less voluntary relationships (i.e. family) imply a more
permanent tie (Fischer, 1982) that is deeper and thus may have served as a potentially
greater influence either as a source of support or non-support. The third aim was to
explore whether potential effects of relationship priming on cardiovascular reactivity
are mediated by affect. Thus, if either a main effect of relationship quality (supportive
and non-supportive) or relationship type (friend and family) was found, the possibility
that these effects can be mediated by affect would be explored.

Hypotheses

Hypothesis I: Relationship Quality. Mental activation of relationships
characterized as non-supportive were expected to be associated with significantly
greater cardiovascular reactivity, which would include larger increases in HR, SBP,
and DBP, compared to supportive relationships. This hypothesis was supported by
meta-analyses (Thorsteinsson & James, 1999; Uchino et al., 1996) which indicate a
trend in past literature of a support-attenuating cardiovascular impact when compared
to a lack of support.

Hypothesis II: Interaction of Quality and Type. A significant interaction
between relationship quality and typology was expected to emerge (see Figure 1).
Specifically, it was predicted there would be a greater difference between supportive
and non-supportive family relationships in cardiovascular reactivity, including larger
increases in HR, SBP, and DBP, from baseline to the speech task, relative to this
difference within friendships. This hypothesis was based on two prior studies (Holt-Lunstad et al., 2003; Spitzer et al., 1992) that have considered the impact of relationship typology on cardiovascular parameters; both findings indicate family relationships attenuate responses more than non-familial relationships within supportive relationships. The expectation that the opposite effect would occur in the context of non-supportive relationships was based on findings that indicate that non-supportive family relationships may have a more negative impact on mental health (i.e., anxiety and depression) than friendships (Bolger & Eckenrode, 1991; McLaughlin et al., 2002).

Figure 1. Pictoral description of Hypothesis II: The expected interaction between relationship type and quality on cardiovascular reactivity (i.e., SBP change scores).

*Exploratory Hypothesis: Mediation of Affect.* Changes in affect were expected to mediate the effect of cognitive priming on cardiovascular responses (see Figure 2). Specifically, it was expected that increases in negative affect would mediate non-supportive priming effects that result in larger increases in HR, SBP, and
DBP, while increases in positive affect would mediate supportive priming effects that result in relatively smaller increases in HR, SBP and DBP. If Hypothesis I was disconfirmed but Hypothesis II was confirmed, then mediation of affect would be considered solely within family relationships and/or friend relationships.

Alternatively, if both Hypothesis I and II were disconfirmed, but there was a significant main effect of relationship type, then mediation of affect would be tested to explain this effect. This hypothesis was formed as an attempt to add to the paucity of direct evidence for the potential mediational role of emotional processes in the link between social relationships and health (House, 2001).

*Figure 2*. Illustration of Exploratory Hypothesis: Affect change from baseline to immediately after the cognitive priming manipulation was expected to directly explain any emerging effects of supportive versus non-supportive priming on cardiovascular responses to the speech task.
Methods

Overview

The study employed a 2 (family versus friends) x 2 (supportive versus non-supportive) within-between subjects mixed design; relationship type served as the within factor and quality as the between factor. Multiple physiological dependent variables were measured.

Females and males who were eligible based on a pretest screening were invited to participate; sign-ups were restricted to those who met the pretest criteria (see below). Once recruited, participants signed-up for two 90-minute testing sessions where they were randomly assigned to either a supportive or non-supportive relationship condition, and all participants took part in a repeated measures protocol in which both friend and family relationships were primed, in counterbalanced order; thus, there were a total of four conditions. During each session, participants completed multiple questionnaires as well as a stress protocol. The stress protocol included a baseline period, writing period, speech stressor, and recovery period, in that order. Figure 3 provides a flowchart of the study design.

Participants

A total of 84 male and female undergraduate volunteers who passed the initial screening were able to sign-up for the study via the psychology experiment sign-up page. Inclusion criteria for participation in the testing session were (1) aged 18-25 and (2) self-report the following: (a) no hypertension, (b) no history of heart problems, (c) good health, (d) not taking cardiovascular, anti-depressive, or anxiety medication, (e)
not excessively overweight (obese), (f) not married, (g) not a smoker, (h) not currently pregnant or nursing, and (i) had at least one family and at least one friend relationship who are at times not supportive (see Appendix A). Further, as listed preparation for the study on the experimental sign-up page, participants were asked to refrain from caffeine, alcohol, and physical exercise for at least 2 hours prior to the study session time. In addition, they were asked to wear a thin shirt, and advised not to wear a dress, turtle neck, sweatshirt, or have sunburned skin.

The needed sample size for the current study was determined based on the effect sizes of a related prior study (Smith et al., 2004; $\eta^2 = .06-.08$) utilizing a similar writing manipulation and cardiovascular reactivity. Specifically, a total of 84 participants were recruited based on the computed power analysis for a mixed-design study, using (1) an alpha level of .05, (2) 80% power, and (3) a moderate effect size ($f = .3$) based on Cohen’s (1988) standards and Smith et al.’s (2004) reported effect sizes.

**Height/Weight and Physiological Measures**

**Height, Weight, and Body Mass Index**

A standard hospital balance beam scale and stadiometer (Detecto, Webb City, Missouri) was used to take measurements of height and weight. After the participant’s shoes were removed, height was recorded to the nearest centimeter and weight was recorded to the nearest pound. The weight measurement was then converted to kilograms (lbs x .454), and from this and their height in meters (cm x 100), the participant’s body mass index (BMI) was computed ($\text{BMI} = \frac{\text{kg}}{\text{m}^2}$).
Cardiovascular Measures

Cardiovascular measures were obtained for a 10-minute baseline period, a 4-minute writing task, a 3-minute preparation period, a 3-minute interview style speech task, and a 5-minute recovery period. Heart rate (HR) was determined from the measurement of the EKG signal obtained from an HIC-2000 impedance cardiograph (Bio-Impedance Technology, Inc). A Colin Press-mate 8800 was used to measure systolic blood pressure (SBP) and diastolic blood pressure (DBP) through the oscillometric method. BP measurements were taken every 1.5 minutes and recorded on a Blood Pressure Log Sheet. HR was measured continuously throughout the stress protocol.

The electrocardiography (ECG) signal was measured using a standard 3-lead triangular spot electrode formation based on guidelines from the HIC-2000 Bio-electric Impedance Cardiograph manual. Two spot electrodes were placed in the right and left clavicles (between shoulder and collar bone), and the third electrode was placed on the participant’s left side, two fingers below the fifth inter-costal space. The left clavicle electrode served as the ground. The ECG analog signal was converted to digital through the BIOPAC MP100 system, and this signal was then recorded on a Windows XP operating system through the Acknowledge program (Biopac Instruments, Inc.). Essentially, an alternating current was transmitted across the chest cavity, which looks for the path of least resistance in the aorta.
Figure 3. Flowchart of the study protocol.
Psychosocial Measures

Social Relationships Inventory (SRI; modified)

A total of nine questions regarding the person the participant chose to write about during the writing task are included in the modified SRI (Appendix B). After the recovery period, these questions assessed the participants’ perceived nature of the relationship, including the amount of contact, importance, supportiveness, and whether the person is perceived as upsetting or unpredictable. Internal consistency of the original scale was found to range from 0.76-0.87, and temporal reliability ranges from 0.51-0.75 (Uchino et al., 2001).

The Inventory of Socially Supportive Behavior—The Emotional Support Scale (ISSB; Barrera, Sandler, & Ramsay, 1981)

The 10-item emotional support scale (Appendix C) was used to assess how often participants receive emotionally supportive assistance during a typical month. The full 40-item scale and abbreviated versions have shown high internal consistency (0.84 to 0.90), test-retest reliability (0.63 to 0.80), and convergent validity through significant correlations with similar measures. This measure was used in conjunction with the SRI, as an additional measure of support.

Demographics and Health—Personal Data and Health Questionnaire

Basic demographic and health information was obtained via the Personal Data and Health Questionnaire (Appendix D). This form assessed demographic and health-related variables, some of which may affect physiological parameters during the study: the participants’ age, race, relationship status, cardiovascular symptoms or
medication, disease, illness, birth control or other prescription medication in use, recent food and caffeine consumption, and exercise activity.

State-Trait Anxiety Inventory—state (STAI; Spielberger, 1983)

The 20-item original scale (Appendix E) was used as a self-report measure of anxiety, or subjective stress, at baseline and immediately after the speech task. The STAI has shown good reliability and validity in a multitude of studies.

Positive and Negative Affect Schedule (PANAS; Watson, Clark, and Tellegen, 1988)

The PANAS (Appendix F) was used as a measure of state affect at baseline and immediately after the relationship priming manipulation. PANAS-Short form (PANAS) is composed of 20-items while the PANAS-Expanded form (PANAS-X) contains 60 (including the 20 from the short form). In both forms, a series of single-word items measure positive affect or negative affect; the PANAS-X also measures more specific emotions. The Short form was used for the first 26 participants and the remaining participants were given the Expanded version. Reliability and validity of the PANAS has been well established, and is even stronger for the Expanded form.

Stress Appraisals (Pre and Post-task)

Ten questions (Appendix G) assessed participants’ perceived threat, coping ability, and performance immediately before and after the speech task. Participants completed five items prior to the speech and five parallel items after the speech; ratings were obtained using a scale from 1 (Not at all) to 7 (Extremely). An example item given prior to the speech was: “How stressful do you expect the upcoming task
to be?” The parallel item given after the speech was: “How stressful was the task you just performed?”

Procedures

Initial Contact and Scheduling

Ohio University undergraduate students who answered “TRUE” to every question on the Pre-test Eligibility Form through the psychology department’s online pre-test had the opportunity to participate in the study. These individuals were able to voluntarily sign-up for the study on-line, which included a brief description, restrictions, and preparation for the study.

Setting

All study sessions took place in the Social Psychophysiology lab located in Porter Hall. Participants sat in a recliner in the participant room throughout the experiment. In this room, a small inconspicuous surveillance camera was attached near the ceiling to monitor participants, and another video camera was in a corner of the room, its lens facing the wall until the start of the speech stressor (see Study Session below). The control room was adjacent to the participant room, where physiological measurement and observation monitoring took place. Each testing session required the presence of two experimenters: one male or female experimenter monitored the physiological equipment and E-prime program (Psychology Software Tools, Inc) while a second female experimenter used scripted instructions to interact with the participant, apply electrodes, and help monitor equipment during the stress protocol. Each of the two sessions lasted up to 90 minutes.
**Study Session**

The study protocol is illustrated in Figure 3. The participant was greeted by an experimenter shortly after arrival at the laboratory, and then given a few minutes alone to read and sign the consent form (Appendix H). If they agreed to participate, they were asked to fill out the Personal Data and Health Questionnaire and their height and weight was taken. Verification of the preparation instructions was obtained: that they had not consumed a moderate amount of caffeine or alcohol, or exercised rigorously, within the past two hours. Next, impedance bands and spot electrodes were applied as described above under *Cardiovascular Measures*, and a blood pressure cuff was attached to the participants’ non-dominant arm. The participant then relaxed during a 10-minute baseline period while listening to relaxing classical music. After the baseline period, participants were prompted by audio-recorded instructions to fill out the STAI (state anxiety) and PANAS. Following, the main manipulation of the study is described.

**Support Manipulation**

After the rest period, E-prime (Psychology Software Tools, Inc.) randomly assigned participants to one of four conditions during session one: supportive family, supportive friend, non-supportive family, or non-supportive friend. Session two differed from session one with respect to relationship type, but the relationship quality (supportive or non-supportive) was always the same for both sessions. Participants responded in writing to a series of questions meant to either activate thoughts regarding (a) a supportive friend *and* (b) a supportive family member, *or* (a)
a non-supportive friend and a non-supportive family member. Methods for the mental activation paradigm were partially adopted from Smith, Ruiz, and Uchino (2004).

Specifically, for the supportive friend condition participants were asked to select “a close friend who has been supportive and helpful to you in important ways…a specific person you have been close to, who you can rely on or turn to when you need help, advice, or encouragement.” They were then presented with the following four questions and asked to write their responses to each one during a 45-second period of silence:

1. Briefly describe instances this person provided you with help, advice, or encouragement.
2. Describe what you value or appreciate most about this person.
3. Describe what this person values or appreciates most about you.
4. Describe how you would feel if you saw this person...what would you say?

For the supportive family condition, participants were asked to select “a close family member who has been supportive and helpful to you in important ways…select either your mother, father, a sibling, or other immediate family member who you have been close to, who you can rely on or turn to when you need help, advice, or encouragement.” Participants were then asked to respond in writing to each of the following:
1. Briefly describe instances this person provided you with help, advice, or encouragement.

2. Describe what you value or appreciate most about this person.

3. Describe what this person values or appreciates most about you.

4. Describe how you would feel if you saw this person...what would you say?

For the non-supportive friend condition, participants were asked to select “a friend who has not been supportive or helpful to you during important events...a specific person you have been close to, who you cannot rely on or turn to when you need help, advice, or encouragement.” Participants were then asked to respond in writing to each of the following:

1. Briefly describe instances this person failed to provide you with help, advice, or encouragement.

2. Describe what this person does that is not supportive or unhelpful.

3. Describe what you think this person thinks about you, what you seem like to them.

4. Describe how you would feel if you saw this person...what would you say?

For the non-supportive family condition, participants were asked to select “a family member who has not been supportive or helpful to you during important events...select either your mother, farther, a sibling, or other immediate family member who you cannot rely on or turn to when you need help, advice, or
encouragement.” Participants were then asked to respond in writing to each of the following:

1. Briefly describe instances this person failed to provide you with help, advice, or encouragement.
2. Describe what this person does that is not supportive or unhelpful.
3. Describe what you think this person thinks about you, what you seem like to them.
4. Describe how you would feel if you saw this person…what would you say?

After responding in writing, participants were asked to re-read and review their answers for one full minute. Next, participants were instructed to take the sheet they wrote their responses on, fold it in half, and place it through a slot into a box within reach. They were also reminded of the confidentiality of their responses.

Immediately following the writing task, participants were prompted by pre-recorded instructions to complete the PANAS. Next, participants were given instructions for the interview-style speech task as outlined below.

**Speech Stressor (Interview-style)**

The speech task was based on the TSST, originally developed by (Kirschbaum, Pirke, & Hellhammer, 1993). Automated instructions of the interview-style speech task were given over speakers. Participants were asked to “imagine [they] have to video-record an interview for a job application they submitted internationally” for either a business marketing or executive consulting position. Due
to the chosen repeated measures design, two different job descriptions were used, in counterbalanced order, to maintain novelty to keep the nature and difficulty of the task relatively constant. It was explained to the participants that they would have three minutes to prepare for the video-taped interview.

After explanation of the task, pre-recorded instructions prompted participants to fill out the Pre-task Stress Appraisal form, and they were allowed to formulate their interview points in writing during a 3-minute preparatory period. They were given a form with a short written description of the job and brief instructions to prepare notes. If interviewing for the business marketing position, they were given the following description:

A marketer at our firm needs to be able to develop pricing strategies, balance firm objectives, and customer satisfaction. Additionally, they must have a knack for evaluating marketing strategy based on knowledge of market characteristics and cost and mark-up factors. The financial aspects of product development must be evaluated, such as setting budgets and expenditures. Finally, marketers at our firm are responsible for directing the hiring, training and performance of sales staff and to oversee their daily activities.

If interviewing for the executive consulting position, participants were given this description:

An executive consultant at our firm must be able to work long hours on tight deadlines. Therefore, they must be able to manage job-related stress. In order to be successful at our firm, you must be able to assist our clients with
selection, maintenance, and implementation of our products. Most importantly, consultants are responsible for making creative and innovative oral presentations and they must have good personnel management skills.

Below each job description, participants were given a list of brief suggestions to consider while preparing their speech, including the following points: (a) what qualifies you for this position (b) what strengths you have that are applicable to this position (c) what specific experiences you have had that relate to this position (d) why you applied for this position and (e) some other interests you have that are relevant to the job.

Immediately following the 3-minute preparation, the experimenter returned to set up the camera, take the participant’s notes, and begin video-recording. Automated instructions were then played over speakers to give a brief introduction to the task. Four pre-recorded questions were then stated, one at a time, every 45 seconds until all four questions were asked and three minutes had lapsed. The four interview questions were: (1) Why do you think that you are the best applicant for this position? (2) What coursework or studies have you had that gives you a special aptitude and motivation for this position? (3) What experiences have you had in this area? (4) What weaknesses will you have to overcome if obtaining this position? After the interview, the experimenter returned to the participant room, rotated the camera to its original position (lens facing the wall), and turned the camera off. The participant was then prompted by pre-recorded instructions to fill out the STAI and Post-task Stress Appraisal forms.
To assess time of return to baseline, the participant relaxed for five minutes while listening to classical music in a recovery period, immediately following the interview task. Thus, participants filled out the STAI and Post-task Stress Appraisal forms for the first minute or two of this recovery. After five full minutes of rest, the experimenter returned and asked participants to fill out a series of questionnaires regarding the relationship they wrote about during the writing task, including a modified version of the Social Relationships Index, the Emotional Support Scale, and three additional measures that were included as a part of a larger investigation, but was not the focus of this thesis: the McGill Friendship Questionnaire, the Dyadic Adjustment Scale (DAS), and the Self Disclosure Index (SDI). Finally electrodes were removed and participants debriefed (Appendix I).

Data Reduction

Physiological Data

Heart Rate (derived from the inter-beat interval from the ECG signal) was manually processed or edited by importing digitized signals into Mindware software (Mindware Technologies, LTD). The data was first aggregated into 10 or 20 second interval ensemble averages, and was then aggregated across each task (10-minute baseline, 4-minute writing, 3-minute speech preparation, 3-minute speech, and 5-minute recovery, duplicated for two total sessions). The mean EKG R-R interval was used to determine HR in beats per minute. Systolic blood pressure (SBP) and diastolic blood pressure (DBP) values were directly entered into the data set. Mean values for baseline, writing, speech preparation, speech task, and recovery periods for all four
cardiovascular parameters were computed. Difference scores were then computed to determine the change from baseline to two subsequent tasks: speech preparation, speech. Finally, the change from speech to recovery was computed.

Data Imputation

Participant movement and other forms of interference, particularly during the speech task, resulted in inaccurate blood pressure and heart rate values. To correct this problem, and to replace missing values, a specified imputation procedure was used. First, any extreme outliers were counted as missing. Outliers within a particular blood pressure measurement were deemed extreme if they were greater than three standard deviations from the inter-quartile range. In addition to this, abnormally high and low BP and HR values were counted as missing, based on the following cut-offs: DBP values less than 40 and higher than 120, SBP values less than 60 and higher than 200, and HR values less than 40 and higher than 160. If there were only two available blood pressure values during a task (speech preparation and speech), and both values were missing, they were left missing. If only one of the two values was missing, the between groups mean difference was used to estimate the change between variables across the task (i.e. the group mean blood pressure at 0 minutes of the speech was consistently higher than the group mean blood pressure at 1.5 minutes). More specifically, the missing value was replaced by the corresponding value within the task plus or minus (depending on which value was missing) the between groups mean difference as just described. When three or more blood pressure values were present during a task (baseline, writing, and recovery), missing values at either end of the task
were replaced using the method described above. However, when a missing value was surrounded by at least two adjacent values within the same task, it was replaced by the mean of these two adjacent values. The total percentage of imputed data (including missing and extreme data) for each dependent variable was as follows: 1.1% of SBP (38/3,492), 1.3% of DBP (45/3,492), and 0.2% of HR (29/17,112).

Speech Task

The speech task was videotaped, words spoken by the participant were subsequently transcribed, and a word count of participants’ responses to each of the four interview questions was calculated from the speech transcripts.

Data Analysis

A series of t-tests were conducted to compare SRI ratings between the supportive conditions, negative and positive affect changes between the supportive and non-supportive condition, and to confirm significant changes in anxiety, SBP, DBP, and HR during the speech task.

Hypothesis I (Relationship Quality): It was predicted that those in the non-supportive condition would demonstrate greater reactivity to the speech task—including larger increases in HR, SBP, and DBP—relative to those in the supportive condition. To test Hypothesis I, univariate ANCOVAs were conducted, collapsing across sessions, with relationship quality (supportive vs. non-supportive) as the between groups factor; each dependent variable was tested, including change in HR, SBP, and DBP from baseline to speech task. Baseline levels were used as covariates.
Hypothesis II (Interaction of Quality and Type): For Hypothesis II, it was predicted that there would be a significant interaction between relationship quality and typology. Specifically, it was expected that a greater difference in cardiovascular reactivity between supportive and non-supportive family relationships—including larger increases in HR, SBP and DBP—compared to the difference between supportive and non-supportive friendships. To test this hypothesis, 2 (family vs. friend condition) x 2 (supportive vs. non-supportive condition) mixed effects models were tested to determine whether a significant interaction existed between relationship quality and type for each dependent variable (HR, SBP, and DBP). Planned comparisons followed all significant interactions to determine the direction of difference between groups. Baseline levels were used as covariates.

Exploratory Hypothesis (Mediation of Affect): It was predicted that affect would mediate any potential significant effects that the cognitive priming manipulation has on cardiovascular responses to the speech (including changes in HR, SBP, and DBP). Mediation was tested using the procedures described by Baron and Kenny (1986), with the priming condition (supportive or non-supportive) serving as the independent variable, each of the cardiovascular parameters (HR, SBP, and DBP) serving as the dependent variables, and any changes in affect before and after the priming manipulation serving as the possible mediator.

In addition to using the changes from baseline to speech, all three hypotheses were tested using change scores from baseline to both speech preparation and recovery as dependent variables.
Results

Sample Characteristics

The complete sample consisted of 97 single, non-smoking undergraduates who were in good health and not taking medication known to affect cardiovascular parameters. Of these, two participants were excluded because they failed to choose the appropriate relationship type in the first session; specifically, they chose a family member (step-father and brother) in the friend condition. One other participant made a similar error (chose a friend in the family condition), but since this mistake was made during the second session, they were included when possible in between-group analyses. A total of six additional participants did not complete the second session, but were also included in some between-group analyses. Eighty-eight participants (31 male, 57 female) were included in all analyses (20 friend support, 19 friend non-support, 25 family support, and 24 family non-support). Table 2 provides frequencies of gender and race by condition for this sample. As can be seen in Table 3, there were significant between groups differences for BMI (p < .01), session one baseline SBP (p < .01), but not for age or any other baseline BP. Specifically, individuals in the non-supportive condition had higher BMI and session one baseline SBP compared to those in the supportive condition. Further, participants in the supportive condition perceived their relationships as having higher support than participants in the non-supportive condition. Also indicated in Table 3, results from the social relationships inventory (SRI) demonstrated that, during session one, participants rated their chosen supportive tie as significantly more supportive and helpful (p < .0001) than their
chosen non-supportive tie. The same pattern was found during session two (p < .0001). Further, during session one it was observed that those in the non-supportive condition had an increase in negative affect whereas those in the supportive condition had a small decrease (p < .01). During session two, those in the non-supportive condition had an increase in negative affect relative to little change in the supportive condition (p < .01) and a relative decrease in positive affect (p < .01) compared to those in the supportive condition. Additionally, as displayed in Table 4, there were no within participant differences for baseline BP, SRI support, positive affect change, or negative affect change, indicating friend and family relationships were rated similarly based on self-report.

**Confirming Task Effects**

Paired samples t-tests were used to determine whether significant changes in anxiety, SBP, DBP, and HR occurred due to the speech. Anxiety (i.e., STAI) scores were found to be significantly higher during the speech ($M = 44.9, SD = 13.3$ and $M = 40.9, SD = 11.6$) relative to baseline ($M = 33.5, SD = 8.3$ and $M = 34.2, SD = 9.3$) at both session one ($t(92) = 9.36, p < .0001, d = 1.03$) and session two ($t(89) = 6.23, p < .0001, d = 0.63$), confirming an effect of the speech task on anxiety. Further, as indicated in Table 5, the speech preparation and speech tasks evoked significant change from baseline for SBP, DBP, and HR, for each of the two sessions.

**Potential Covariates**

Age, body mass index, and number of words used in the speech were considered as potential covariates in the cardiovascular analyses. As shown in Table
3, there were no significant differences between group differences in age, hence this variable was not controlled for in subsequent analyses. Similarly, examination of word count revealed no significant differences either between group ($F(1,83) = 0.98$, $p = .32$, $\eta_p^2 = .012$), or within participants across conditions, ($F(1,83) = 0.39$, $p = .54$, $\eta_p^2 = .005$), hence this variable was not used as a covariate. However, as shown in Table 3, BMI was found to vary significantly between supportive and non-supportive groups ($p = .006$). Further, correlations between BMI and the nine DVs revealed that BMI was significantly related to SBP speech preparation reactivity in session one ($r(94) = .308$, $p < .01$). Accordingly, each of the following analyses was conducted with and without BMI as a covariate; however the adjustment for BMI did not alter the findings and therefore are not reported.

Analysis of the Cognitive Priming Manipulation on BP and HR Responses

*Cardiovascular Responses to Speech Preparation*

A series of 2 x 2 ANCOVAs were conducted on changes in SBP, DBP, and HR responses to speech preparation while controlling for baseline levels. As can be seen in Table 6, absence of any significant main effects of Quality failed to support the first hypothesis of reactivity differences as a function of priming supportive versus non-supportive relationships. Similarly, absence of significant Type x Quality interactions for all variables failed to support hypothesis two. Although the primary hypotheses were not supported, the data did reveal a significant main effect of Type for DBP ($F(1,84) = 5.23$, $p = .025$, $\eta_p^2 = .059$), which reflected lower DBP reactivity when participants thought of a family member versus a friend (see Figure 4).
Mediation was tested to determine if the significant effect of relationship Type on DBP speech preparation reactivity occurred through either negative or positive affect change. Judd, McClelland, and Kenny’s (2001) procedures for testing mediation through a within-participant effect were followed. According to Judd et al., it must be confirmed that, within each condition, the mediators (positive and negative affect) significantly predict the DV (DBP reactivity). Linear regression analyses revealed that, within the friend condition, neither positive (p = .58) nor negative (p = .87) change in affect predicted DBP reactivity. This pattern emerged in the family condition as well (positive affect change, p = .90; negative affect change, p = .70). Thus, change in affect due to the priming manipulation did not mediate the effect of relationship Type on DBP speech preparation reactivity.

Table 2.

*Basic Demographic Information by Condition*

<table>
<thead>
<tr>
<th>Session One Condition</th>
<th>Gender</th>
<th>Race/Ethnicity</th>
</tr>
</thead>
<tbody>
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<td></td>
<td>Female</td>
<td>Male</td>
</tr>
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<td>Supportive Friend</td>
<td>14</td>
<td>7</td>
</tr>
<tr>
<td>Supportive Family</td>
<td>20</td>
<td>6</td>
</tr>
<tr>
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<td>11</td>
<td>11</td>
</tr>
<tr>
<td>Non-Supportive Family</td>
<td>16</td>
<td>10</td>
</tr>
</tbody>
</table>
Table 3.  
*Independent Samples t-tests of Important Variables*

| Variable             | Supportive | | Non-Supportive | | | t    | d |
|----------------------|------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|
|                      | M   | SD | M   | SD | t    | d |
| **Session One**      |     |   |     |   |
| BMI                  | 22.3| 2.5 | 24.1| 3.8 | 2.79*| 0.59|
| Age                  | 19.1| 1.1 | 19.2| 1.1 | 0.53 | 0.11|
| SRI Support          | 10.7| 1.49| 5.9 | 2.31| 12.01*| 2.50|
| Positive Affect Change| 0.8  | 4.2  | -0.9 | 5.4 | 1.77  | 0.37|
| Negative Affect Change| -1.0 | 2.9  | 2.4  | 5.6  | 3.76* | 0.80|
| Baseline SBP         | 114.6| 8.3 | 117.2| 9.3 | 1.39 | 0.30|
| Baseline DBP         | 63.6 | 6.1 | 64.7 | 6.7 | 0.87  | 0.19|
| Baseline HR          | 75.3 | 12.5 | 78.8 | 8.8 | 1.55  | 0.33|
| **Session Two**      |     |   |     |   |
| SRI Support          | 10.8 | 1.83 | 6.5 | 2.91 | 8.45*  | 1.80|
| Positive Affect Change | 1.6  | 4.8  | -1.5 | 4.1 | 3.35*  | 0.72|
| Negative Affect Change | -0.03  | 2.6  | 2.1  | 4.1  | 2.91*  | 0.62|
| Baseline SBP         | 114.5 | 7.5  | 118.8 | 8.7 | 2.5*  | 0.54|
| Baseline DBP         | 62.8 | 5.3  | 64.6 | 6.8  | 1.14  | 0.24|
| Baseline HR          | 74.6 | 13.8 | 76.7 | 11.1 | 0.79  | 0.17|

*Note.* *p < .01
Table 4.
*Paired t-tests of Important Variables*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Friend</th>
<th></th>
<th>Family</th>
<th></th>
<th></th>
<th></th>
</tr>
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<tbody>
<tr>
<td></td>
<td><em>M</em></td>
<td><em>SD</em></td>
<td><em>M</em></td>
<td><em>SD</em></td>
<td>Paired-t</td>
<td><em>d</em></td>
</tr>
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<td>SRI Support</td>
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<td>3.1</td>
<td>8.6</td>
<td>3.1</td>
<td>0.22</td>
<td>0.03</td>
</tr>
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<td>5.1</td>
<td>1.00</td>
<td>0.04</td>
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<tr>
<td>Negative Affect Change</td>
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<td>3.3</td>
<td>0.92</td>
<td>5.2</td>
<td>0.03</td>
<td>0.01</td>
</tr>
<tr>
<td>Baseline SBP</td>
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<td>115.9</td>
<td>8.2</td>
<td>1.00</td>
<td>0.06</td>
</tr>
<tr>
<td>Baseline DBP</td>
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<td>63.9</td>
<td>6.2</td>
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<td>0.02</td>
</tr>
<tr>
<td>Baseline HR</td>
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<td>12.5</td>
<td>76.1</td>
<td>11.2</td>
<td>0.08</td>
<td>0.02</td>
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Table 5.  
*Paired t-tests confirming Significant Change from Baseline to Speech Preparation and Speech Tasks*

<table>
<thead>
<tr>
<th>Measure</th>
<th>Session</th>
<th>Task</th>
<th>Paired-t</th>
<th>$d$</th>
</tr>
</thead>
<tbody>
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<td></td>
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<td>Preparation</td>
<td>6.4*</td>
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<td></td>
<td></td>
<td>Speech</td>
<td>13.5*</td>
<td>1.20</td>
</tr>
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<td>SBP</td>
<td>2</td>
<td>Preparation</td>
<td>4.0*</td>
<td>0.27</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Speech</td>
<td>7.9*</td>
<td>0.81</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Preparation</td>
<td>7.5*</td>
<td>0.53</td>
</tr>
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<td></td>
<td></td>
<td>Speech</td>
<td>9.5*</td>
<td>0.94</td>
</tr>
<tr>
<td>DBP</td>
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<td>Preparation</td>
<td>4.4*</td>
<td>0.38</td>
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<tr>
<td></td>
<td></td>
<td>Speech</td>
<td>4.1*</td>
<td>0.43</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Preparation</td>
<td>10.7*</td>
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<tr>
<td></td>
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<td>Speech</td>
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<td>0.84</td>
</tr>
<tr>
<td>HR</td>
<td>2</td>
<td>Preparation</td>
<td>10.6*</td>
<td>0.37</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Speech</td>
<td>12.5*</td>
<td>0.58</td>
</tr>
</tbody>
</table>

*Note.* $p < .001$
Cardiovascular Responses to the Speech Task

Results with regard to the speech task were parallel to the findings for speech preparation. A series of 2 x 2 ANCOVAs were conducted on changes in SBP, DBP, and HR responses to speech preparation while controlling for baseline levels. As can be seen in Table 7, absence of any significant main effects of Quality failed to support the first hypothesis of reactivity differences as a function of priming supportive versus non-supportive relationships. Similarly, absence of significant Type x Quality interactions for all variables failed to support hypothesis two. Although the primary hypotheses were not supported, the data did reveal a significant main effect of Type for DBP ($F(1,82) = 15.67, p < .0001, \eta_p^2 = .16$), which reflected lower DBP reactivity when participants thought of a family member versus a friend (see Figure 4). Mediation was tested to determine whether the significant effect of relationship type on DBP speech reactivity occurs through either negative of positive affect. Again, procedures by Judd et al. (2001) were followed, and regression analyses revealed that, within the friend condition, neither positive ($p = .37$) nor negative ($p = .66$) change in affect predicted DBP reactivity. This pattern emerged in the family condition as well (positive affect change, $p = .18$; negative affect change, $p = .19$). It can therefore be concluded that change in affect due to the priming manipulation does not mediate the effect of relationship type on DBP speech reactivity.

Cardiovascular Recovery from the Speech

No significant main effects or interactions were revealed, with or without BMI as a covariate. As such, it was not appropriate to conduct a mediation analysis.
Table 6.
Results of 2 (Supportive, Non-Supportive) x 2 (Friend, Family) Mixed ANCOVAs for all Dependent Variables

<table>
<thead>
<tr>
<th>Task</th>
<th>Measure</th>
<th>Source</th>
<th>F</th>
<th>p-value</th>
<th>η²</th>
</tr>
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<tbody>
<tr>
<td>Preparation SBP</td>
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</tr>
<tr>
<td></td>
<td>Type</td>
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<td>.89</td>
<td>.00</td>
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</tr>
<tr>
<td></td>
<td>Quality x Type</td>
<td>3.15</td>
<td>.08</td>
<td>.04</td>
<td></td>
</tr>
<tr>
<td>Preparation DBP</td>
<td>Quality</td>
<td>0.83</td>
<td>.37</td>
<td>.01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Type</td>
<td>5.23</td>
<td>.03</td>
<td>.06</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Quality x Type</td>
<td>1.36</td>
<td>.25</td>
<td>.02</td>
<td></td>
</tr>
<tr>
<td>Preparation HR</td>
<td>Quality</td>
<td>0.04</td>
<td>.83</td>
<td>.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Type</td>
<td>0.03</td>
<td>.87</td>
<td>.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Quality x Type</td>
<td>0.06</td>
<td>.81</td>
<td>.00</td>
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</tr>
<tr>
<td>Speech SBP</td>
<td>Quality</td>
<td>0.65</td>
<td>.42</td>
<td>.00</td>
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<tr>
<td></td>
<td>Type</td>
<td>0.76</td>
<td>.39</td>
<td>.00</td>
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</tr>
<tr>
<td></td>
<td>Quality x Type</td>
<td>0.41</td>
<td>.52</td>
<td>.00</td>
<td></td>
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<tr>
<td>Speech DBP</td>
<td>Quality</td>
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<td>.58</td>
<td>.00</td>
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</tr>
<tr>
<td></td>
<td>Type</td>
<td>15.67</td>
<td>.00</td>
<td>.16</td>
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</tr>
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<td>Quality x Type</td>
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<td>.22</td>
<td>.02</td>
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<tr>
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<td>.67</td>
<td>.00</td>
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<td></td>
<td>Type</td>
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<td>Quality x Type</td>
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<td>.63</td>
<td>.00</td>
<td></td>
</tr>
<tr>
<td>Recovery SBP</td>
<td>Quality</td>
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<td>.34</td>
<td>.01</td>
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<tr>
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<td>.00</td>
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</tr>
<tr>
<td></td>
<td>Quality x Type</td>
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<td>.18</td>
<td>.02</td>
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<tr>
<td>Recovery DBP</td>
<td>Quality</td>
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<td>.74</td>
<td>.00</td>
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<td>.59</td>
<td>.00</td>
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<td>Quality x Type</td>
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<td>Recovery HR</td>
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<td></td>
<td>Quality x Type</td>
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<td>.62</td>
<td>.00</td>
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Figure 4. Significant main effects of relationship type (family and friend) on DBP reactivity, after controlling for baseline DBP.
Discussion

This study aimed to investigate the role that thoughts of important relationships have on subsequent physiological responses to acute stress. Hypothesis one predicted that activating thoughts about a supportive relationship would result in lower stress responses when compared to activating thoughts of a non-supportive relationship. This hypothesis was not supported, and resulted in null effects for all three dependent variables. Further, hypothesis two predicted that an interaction between relationship quality and type would emerge, such that there would be a greater difference in cardiovascular responses between priming supportive and non-supportive family relationships, relative to this difference in friends. Hypothesis two was also not supported. In addition, and unrelated to the present study’s hypotheses, a significant main effect of relationship type emerged, such that priming family relationships resulted in significantly lower DBP responses during the preparation and speech tasks, compared to priming friends. Mediation was tested to determine whether this effect occurred through change in affect, but was not affirmed. Taken together, the results of the present study parallel both published and unpublished studies which used the same writing manipulation (i.e. Smith et al., 2004; Borchardt & Heffner, 2008; Warfel, Borchardt, Heffner, Ng & Richards, 2008). In the sections to follow, potential reasons for and interpretations of both the null effects and main effect of relationship type will be explored.
Hypothesis One

Hypothesis one was not supported for BP or HR, and there are several possibilities for why this hypothesis was disconfirmed. First, the present study’s writing manipulation may not have been powerful enough to demonstrate differences between priming supportive versus non-supportive relationships on subsequent stress responses. Simply, null BP and HR reactivity effects may have indicated a lack of effect of the writing manipulation itself. At least one other recent study using the same manipulation had difficulty finding effects on subsequent BP and HR reactivity (Borchardt & Heffner, 2008). In addition, Uno et al. (2002) did not find significant cardiovascular stress-buffering effects using a manipulation which involved reading supportive notes from either a non-present supportive or ambivalent friend, during the stressor. Thus, a manipulation involving writing and thoughts may simply not be powerful enough to elicit significant impact on laboratory stress.

A lack of effect may also reflect the limited consistency of prior research examining the effect of relationship quality on HR and BP. For instance, two studies have found that interactions with a supportive friend or family member buffered SBP, but not DBP, during the interaction, relative to those in a dialogue with an ambivalent friends or family (Holt-Lunstad et al., 2007; Holt-Lunstad et al., 2003). Two other studies are more similar to the present study such that relationship *thoughts*, rather than physical presence, served as the key manipulation. One of these studies found no differences in HR or BP reactivity between receipt of supportive notes from an ambivalent versus a supportive friend (Uno et al., 2002). However, another study
measuring BP during recall of a past conflict with a spouse found that maritally-distressed women had higher BP during recall compared to non-distressed women (Carels et al., 1998). Thus, overall the literature comparing thoughts or interactions with ambivalent versus supportive relationships has revealed a trend towards a supportive tie buffering effect on blood pressure responses during actual interactions or thoughts; however, the inconsistencies of findings may help to explain the present study’s null effects. One important distinction of the present study is that all four of these past studies measured cardiovascular responses during the actual manipulation, as opposed to the present study which measured cardiovascular responses five minutes after the priming manipulation. The current study was specifically interested in whether the trend found in past research was sufficiently powerful to affect subsequent stress, but its null finding may have simply added to the evidence that perceived relationship quality’s effects on HR and BP is not robust.

Another potential explanation for the null effects is that both the supportive and the non-supportive conditions may have elicited similar responses (i.e., both attenuated cardiovascular responses or both heightened cardiovascular responses). Although there was no control condition in the present study, past evidence indicates that writing about both supportive and non-supportive ties can attenuate cardiovascular responses. For example, Smith et al. (2004) found that participants who wrote about a supportive tie had significantly lower HR and BP stress responses, relative to those who wrote about an acquaintance. Another recent study in our lab replicated the present study’s null effects, and also found that, compared to writing
about an acquaintance, writing about either a supportive or non-supportive relationship attenuated SBP, but not DBP, stress reactivity. These two studies suggest that the null findings of the present study may be due to an ameliorated cardiovascular impact for both the supportive and non-supportive conditions. On the other hand, because some research indicates low quality relationships can elicit increased BP and HR responses (Carels et al., 1998; Holt-Lunstad et al., 2003; Holt-Lunstad et al., 2007), it is possible that both conditions in the present study heightened subsequent cardiovascular responses to stress. However, this is an unlikely explanation for the null effects, given that past research of similar design suggests responses in the opposite direction occurred.

If writing about either supportive or non-supportive relationships resulted in an attenuation of cardiovascular reactivity, this interpretation is not in line with the original conceptualization of the writing manipulation by Smith et al. (2004) as a support priming paradigm. The present study’s original expectation, based on Smith’s work, was that writing about non-supportive relationships would heighten reactivity, and that writing about supportive relationships would buffer stress responses. However, the interpretation that both conditions attenuated stress counters past research indicating heightened cardiovascular responses during interactions or thoughts of a lower quality relationship compared to a higher quality relationship (Carels et al., 1998; Holt-Lunstad et al., 2003; Holt-Lunstad et al., 2007). In addition, meta-analyses indicate support-attenuating cardiovascular responses, when compared to low support (i.e. Thorsteinsson & James, 1999; Uchino et al., 1996). However, as
alluded to above, there is at least one other major difference between the present study’s design and past research: namely, the present study’s manipulation involves writing. Writing about either supportive or non-supportive relationships may attenuate subsequent cardiovascular responses; this interpretation may be better understood from the perspective of the expressive writing research paradigm. Specifically, evidence indicates that expressive writing about either negative or positive emotive events may benefit health (Lepore & Smyth, 2002), and it was recently suggested that even writing in short intervals is beneficial (Smyth & Pennebaker, 2008). Importantly, the act of emotive writing may result in a form of expression, which is subtly different from passive engagement in thinking (i.e., Carels et al., 1998). Thus, rather than serving as a substitute for the physical presence of relationships, writing about either high or low quality relationships may instead serve as a mode of emotional expression, resulting in a short-term ameliorative impact on cardiovascular stress.

It was clear that the present study’s null effects were not due to a lack of difference in perceived support or affect change between the supportive and non-supportive conditions. Self-report data in the current study indicated significant differences in perceptions of support between supportive and non-supportive relationships; the latter were perceived as being significantly lower in support and helpfulness. Further, an increase in negative affect occurred after writing about non-supportive relationships relative to a decrease after writing about supportive relationships; this effect occurred in reverse for positive affect. In light of the affect
findings, emotive writing literature, and recent findings by Warfel et al. (2008), writing about supportive or non-supportive relationships may result in either positive or negative affective expression, respectively, resulting in attenuation of subsequent stress. Thus, it is possible that palliative benefits of emotive writing occur through an improved coping response; the present paradigm which involves brief emotive writing may provide insight at this level.

Hypothesis Two

This is the first study to consider the effect of priming non-romantic family and friend relationships on subsequent stress responses; however the specific expectation of a Quality x Type interaction on cardiovascular responses was not supported. Thus, differences in CV reactivity between priming supportive and non-supportive relationships do not appear to occur as a function of relationship type (family versus friend). One potential reason for the null interaction effects is that the manipulation simply did not have a large enough impact on subsequent stress responses to reflect moderating effects of relationship type on quality, for reasons indicated during the discussion of hypothesis one. Further, it is possible that writing about relationships of various qualities is simply not moderated by relationship type. Although some studies suggest low quality family relationships have a more negative impact on mental health than low quality friendships (Bolger & Eckenrode, 1991; McLaughlin et al., 2002), they did not use the same dependent variables as the present study. Only one prior study has simultaneously considered the effects of both relationship quality and type on cardiovascular responses, and they found that
interactions with relationships of various qualities and types affected ambulatory BP independent of one another (Holt-Lunstad et al., 2003). Thus, evidence that there is a moderating relationship of quality on type for BP is low, which explains the lack of support for interaction effects in the present study.

Although the second hypothesis was not supported, and a main effect of relationship quality was not found, the present study did find a main effect of relationship type. Specifically, results revealed a within-participant main effect of relationship type on subsequent DBP responses to the preparation and speech tasks. For both tasks, writing about family relationships resulted in lower DBP responses than writing about friends, regardless of relationship quality. This parallels results of the above-mentioned study, which found that interactions with family members was associated with significantly lower ambulatory SBP and DBP, relative to interactions with non-familial relationships, independent of relationship quality (Holt-Lunstad et al., 2003). A similar study also found that ambulatory SBP and DBP was lower in the presence of a family member relative to a friend, and relationship type accounted for a significant amount of the variance (23-37%) in BP (Spitzer et al., 1992). Thus, despite the present study’s weak manipulation (i.e. thoughts) and timing delay in measurement of BP responses, the influence of relationship type on BP may be robust enough for the present design to demonstrate significant DBP effects.

What might explain attenuated blood pressure responses in the family priming context? The basic difference between family and friend relationships is their level of familiarity (Levinger, 1972). In quantitative terms, family and friends can be
distinguished by the amount of one’s lifetime that has been spent in the presence of each respective type of relationship; this increase in familiarity with family relationships may translate into a deeper connection. Further, a family relationship is obligatory in nature, relative to a friend, and thus the permanence attached to a family relationship may add to its depth, relative to friends. Thus, one potential explanation for attenuated DBP stress responses in family versus friend priming is based on the association between familiarity and relationship type. Specifically, thoughts of a more familiar other (i.e. family) may result in a greater ability to cope with subsequent stressors than thoughts of a less familiar relationship (i.e. friend). Interpreted in this way, results of the present study parallels findings by both Smith et al. (2004) and Warfel et al. (2008). Smith et al. found that writing about a supportive tie buffered HR, SBP, and DBP responses relative to writing about an acquaintance. Similarly, Warfel et al. found that writing about either a supportive or non-supportive relationship buffered SBP responses relative to writing about an acquaintance. A third study found a similar result for BP (Borchardt & Heffner, 2008), but the effect was moderated by social anxiety. Specifically, high social anxiety participants in the acquaintance condition had higher BP reactivity than high social anxiety individuals in the supportive tie condition and low social anxiety participants in both the acquaintance and supportive tie conditions. Although somewhat inconsistent with respect to both the independent and dependent variables, studies of similar design report significantly greater buffering effects subsequent to writing about relationships higher in familiarity, relative to writing about relationships low in familiarity (i.e.
acquaintances; Borchardt & Heffner; Smith et al.; Warfel et al.). However, because this effect was only found for SBP by Warfel et al., and was not replicated by Borchardt and Heffner, it cannot be interpreted as a robust effect.

Along these lines, the somewhat inconsistent findings by Smith et al. (2004), Warfel et al. (2004) and Borchardt and Heffner (2008) that a supportive tie significantly buffers responses to stress relative to an acquaintance parallels inconsistencies of studies which manipulated the physical presence of a friend versus an acquaintance. Christenfeld et al. (1997) found that only SBP reactivity varied as a result of the presence of a supportive friend versus confederate. Further, Edens et al. (1991) only found greater reactivity effects during the presence of strangers compared to friends for HR and DBP. Gender differences may have been a potential confound for these studies, as Craig et al. (2002) found that among males, emotional support from either a stranger or friend elicited greater DBP reactivity than instrumental support received from a friend. Overall, there is a trend of more familiar relationships buffering stress responses; however, the lack of a robust impact was paralleled by the present study’s results which were limited to DBP.

Interpretation of the present study’s significant main effect of relationship type can also be considered from the perspective of an emotive writing manipulation, such that greater attenuation of cardiovascular responses is expected after writing about a topic that elicits greater emotional responses, relative to a less emotionally involved topic. Because it has been suggested that the main requirement for writing to elicit health benefits is that it must involve significant emotional upheaval
(Pennebaker, 2004), writing about an inherently deeper and more familiar relationship (family) may naturally elicit greater emotion and hence greater attenuation of subsequent stress responses. However, because there were no significant differences in either positive or negative affect change after writing about a family versus a friend relationship, this interpretation is not supported by self-reported affect. Nonetheless, it remains a possibility that there were implicit differences in affective responses after writing about a family relative to a friend. On the other hand, given that the present study was conducted within a single session, an emotive writing interpretation is in contrast to the suggestion by Pennebaker (2000) that there are short-term costs associated with writing about negative emotions which take hours to wear off. Further, Pennebaker (2004) suggests that the benefits of emotive writing are gradual and accumulating, and may be greatest after at least one month following writing. Future studies are needed to clarify these issues.

Regardless of the potential explanation for the observed attenuation of DBP reactivity, the potential health benefits of this effect must be considered with caution. First, this effect was restricted to only one of the cardiovascular variables measured and hence the robustness of the effect is in question. Second, it is unknown what underlying processes are associated with this DBP effect, and further examination of impedance measures may shed light on whether the effect is driven by increased vasoconstriction (i.e. total peripheral resistance) or greater myocardial response (i.e. cardiac output). Third, to date there is only limited evidence for the validity of the reactivity hypothesis. For example, few controlled, longitudinal studies exist (i.e.
CARDIA; Matthews et al., 2006) and there is still no concrete evidence that cardiovascular disease can be reliably predicted based on heightened BP and HR reactivity to stress. Further, because the reactivity hypothesis is largely based on laboratory data, some studies have questioned the external validity of the theory (i.e., Brondolo, Karlin, Alexander, Bobrow, & Schwartz, 1999). Similarly, another study questioned the time-limitation to measuring acute stress, suggesting that prolonged reactors are those we should be concerned about (Pieper & Brosschot, 2005). Much work is needed to address these issues so that the health implications of the present study’s findings can be placed in context.

**Exploratory Hypothesis**

The exploratory hypothesis aimed to determine whether positive or negative affect is a mediator of any main effects of either relationship quality or type. Mediation could not be tested with respect to relationship quality due to null effects, but was tested for relationship type. However, affect did not mediate the effect of relationship type on DBP responses. It is not surprising that mediation of affect was not supported because family and friend relationships included a mix of high and low quality (supportive and non-supportive) relationships, hence any differences in affect between family and friend conditions may have been overshadowed by even more extreme differences in affect between supportive and non-supportive conditions.

**Limitations of the Present Study**

An important caveat of the present study’s manipulation is the possibly faulty assumption that brief writing mirrors the influence of daily thoughts of specific
relationships on cardiovascular responses to stress. Smith et al. (2004) interpreted their finding that those who wrote about a supportive tie buffered HR, SBP, and DBP reactivity relative to those who wrote about an acquaintance as potential evidence of a social support effect without need for actual supportive transactions. However, whether one writes or thinks about a relationship, it is conceivable that these types of manipulations are not a substitute for actual transactions.

In addition, the present study’s manipulation may be interpreted in terms of a mood manipulation. Since high versus low quality relationship priming created significant differences in both positive and negative affect change, the manipulation was indeed successful in creating self-reported changes in mood. While evidence shows that mood inductions affect cardiovascular parameters (Etzel et al., 2006; Smith, 2005), and that laboratory stress enhances negative affect (Feldman et al., 1999), only one known study has demonstrated that negative affect can enhance cardiovascular responses, and positive affect can contribute to reductions in these parameters (Fredrickson & Levenson, 1998). Mood inductions, however, have never been shown influence cardiovascular responses to an active coping stressor. Therefore, this study may be the first to demonstrate that a successful mood induction may not affect cardiovascular stress responses. It is also possible that—although the present manipulation facilitated changes in affect—the null effects of CVR were caused independent of these changes in self-reported affect.

Previously mentioned limitations notwithstanding, the main limitation of the present study is the use of writing in a manipulation meant to prime thoughts or
cognitions associated with specific relationships. Smith et al’s (2004) decision to use writing was based on evidence that supportive relationship priming through structured writing is a valid way to reduce negative affect (Pierce et al., 1997), which was also validated in the present study. Only recently has it been shown that short intervals of emotive writing may be associated with health benefits (Smyth & Pennebaker, 2008). Writing about relationships is a relatively rare occurrence in day-to-day experiences, and thus a more ecologically valid manipulation would not have incorporated writing. It is interesting to consider that if an individual brings to mind a certain friend or family member, this may affect how they cope with a subsequent stressor. However, the present study cannot address this common occurrence.

A second limitation of this study was the absence of a control condition that did not include emotional writing. Although the main interest of the study was the effect of priming relationships of various qualities and types, as is noted above interpretation of the null effects in the context of emotional disclosure may have been aided through comparison to a control group that wrote about a mundane topic. Interpretation of the present findings was also limited by the fact that a five minute lag occurred between the writing manipulation and the speech task. Other studies have typically measured cardiovascular function during the actual support manipulation, and thus it is difficult to compare this study to past social support research. This five minute lag may help to explain why results in the present study were not significant for SBP and HR. Future studies of this type should consider using a speech stressor that is not preceded by a preparatory period, so that the
immediate impact of a priming manipulation on subsequent stress can be determined. Finally, because the present study’s sample was composed solely of college students the observed findings are limited in terms of generalizability. Past research suggests social relationships develop over the course of the lifespan (McLaughlin et al., 2002), and it is therefore possible that the effects of relationship priming may vary as a function of age, maturity, or life stage.

Conclusions and Future Directions

The overarching finding of this study was null effects, and the only directional effects were found across within-participant conditions. This suggests that the manipulation, perhaps also due to the five minute lag aforementioned, may not have been powerful enough to elicit between-participant effects. However, because between-participant effects have been previously found using the same manipulation (Smith et al., 2004; Warfel et al., 2008), it is also possible that another explanation may serve to explain the null effects. Specifically, this study and previous studies which resemble it (Borchardt & Heffner, 2008; Smith et al., 2004; Warfel et al., 2008) may provide evidence that brief emotive writing can have immediate benefits on one’s ability to cope with stress. The present study in particular provides evidence that writing about family relationships provides increased coping benefits, relative to writing about friend relationships. And, three other studies provide similar findings, such that writing about a relationship higher in familiarity buffers subsequent stress, relative to writing about a less familiar relationship. This evidence may shed light on
one potential physiological mechanism of the associated health benefits of emotive
writing.

Overall, the effects found in this and three related studies are not robust, and
thus future research should aim to improve upon the present design. Future studies
should consider the original question of this study through a paradigm which
encompasses greater parallels to real life. Specifically, a similar relationship priming
paradigm should be used but writing should be eliminated completely. In other words,
participants should be asked to think about or imagine aspects of specific
relationships, but should not be allowed to write. Further, a future study’s design
should not involve such a significant lag between the priming manipulation and
measurement of cardiovascular reactivity; priming should occur immediately prior to
the stressor. These two changes will contribute to the ecological validity of the
results, as writing about relationships is a less typical daily activity than simply
thinking about relationships. Further, thoughts occurring immediately prior to a
stressor are most likely to impact the stressor in real life, rather than thoughts that
occur five minutes prior to the stressor.

In addition, studies examining the health benefits of written emotional
disclosure should consider whether attenuated responses to subsequent stress serves
as one possible mediator of resulting improvements in health. One recent study has
attempted to test the effects of expressive writing on cardiovascular responses to
stress (O’Conner & Ashley, 2008), but there was a two week lag between writing and
measurement of BP responses to an acute stressor. Additonal studies considering this
question should measure the impact of written disclosure on subsequent stress responses at multiple time-points to help shed light on the timing boundaries associated with the effects of emotive writing on buffering subsequent stress.

In sum, experimental studies aiming to consider how thoughts of close relationships impact one’s health should use a more ecologically valid manipulation that focuses on isolating thoughts and measures immediate cardiovascular responses. In addition, other types of more reliable health or biological markers should be used so that health implications associated with thinking about close relationships can be determined. Perceptions of support are important to study, as an individual’s health and coping ability is largely dependent on their perceptual processes surrounding specific close relationships.
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Appendix A

Pre-Test Eligibility Form

Please answer TRUE or FALSE to the following statements, as they pertain to you:

1. At least one member of my immediate family is not supportive or unhelpful to me. TRUE □ FALSE □

2. At least one of my friends is not supportive or unhelpful to me. TRUE □ FALSE □

3. At least one member of my immediate family is at times not supportive or unhelpful to me. TRUE □ FALSE □

4. At least one of my friends is at times not supportive or unhelpful to me. TRUE □ FALSE □

If all of the following statements apply to you, then you may be eligible to participate in a study worth 1 experiment point:

- I am between the ages of 18 and 25
- I have no history of heart problems
- I do not have high blood pressure
- I am not a smoker
- I am not married
- I am not currently pregnant or nursing
- I am not taking cardiovascular medication
- I am not excessively overweight (obese)
- I am generally in good health

If each of the above statements applies to you and you would be interested in learning more about this study, please check the YES box below:

YES □ NO □
Appendix B

Social Relationships Index

When we need support such as advice, understanding, or a favor, our friends or family may or may not have both helpful and upsetting aspects. Please complete the scale below with reference to the friend or family member you just wrote about. Remember, all of your answers are confidential.

<table>
<thead>
<tr>
<th>Relationship to you (friend, mother, father, sister, or brother):</th>
<th>Approximate length of time you have known this person (years or months):</th>
<th>Average number of times per week you have contact with this person:</th>
<th>HOW IMPORTANT is this person to you? 1=Not at all 2=A little 3=Somewhat 4=Moderately 5=Very 6=Extremely (circle one number)</th>
<th>HOW LIKELY are you to go to this person for support? 1=Not at all 2=A little 3=Somewhat 4=Moderately 5=Very 6=Extremely (circle one number)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>1 2 3 4 5 6</td>
<td>1 2 3 4 5 6</td>
</tr>
</tbody>
</table>

When you need support such as advice, understanding or a favor...

<table>
<thead>
<tr>
<th>HOW HELPFUL is this person to you? 1=Not at all helpful 2=A little helpful 3=Somewhat helpful 4=Moderately helpful 5=Very helpful 6=Extremely helpful (circle one number)</th>
<th>HOW UPSETTING is this person to you? 1=Not at all upsetting 2=A little upsetting 3=Somewhat upsetting 4=Moderately upsetting 5=Very upsetting 6=Extremely upsetting (circle one number)</th>
<th>HOW MIXED OR CONFLICTED are your thoughts and feelings for the person? 1=Not at all 2=A little 3=Somewhat 4=Moderately 5=Very 6=Extremely (circle one number)</th>
<th>HOW UNPREDICTABLE is this person to you? 1=Not at all 2=A little 3=Somewhat 4=Moderately 5=Very 6=Extremely (circle one number)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 2 3 4 5 6</td>
<td>1 2 3 4 5 6</td>
<td>1 2 3 4 5 6</td>
<td>1 2 3 4 5 6</td>
</tr>
</tbody>
</table>
Appendix C

The Emotional Support Scale

I am going to ask about the amount of support you receive or have received from the person you just wrote about.

1 = Not at all
2 = Once or twice
3 = About once a week
4 = Several times a week
5 = About every day

Thinking about A TYPICAL MONTH, how often has this person done any of the following:

1. Talked with you about some interests of yours.       ____
2. Let you know you did something well.                 ____
3. Told you that you are OK just the way you are.       ____
4. Told you that she/he would keep the things that you talk about private—just between the two of you.  ____
5. Expressed esteem (respect) for a personal quality of yours.  ____
6. Comforted you by showing you some physical affection.  ____
7. Listened to you talk about your private feelings.     ____
8. Let you know that she/he will always be around if you need assistance.  ____
9. Expressed interest and concern in your well-being.   ____
10. Joked and kidded to cheer you up.                    ____
Appendix D

Personal Data and Health Questionnaire

Please respond to the questions below as accurately as you can. All of your responses are completely confidential and will be identified only by your participant ID number. As with all of the information we will collect today, your name and identity will not in any way be tied to your responses.

1. Gender (circle one): Male Female

2. Age ____________________

3. Are you Hispanic or Latino?  
   Yes____ No____

4. Which of the following would you say is your race? (Please mark all that apply):
   ______ White
   ______ Black or African American
   ______ Asian
   ______ Native Hawaiian or other Pacific Islander
   ______ American Indian, Alaska Native
   ______ Other: Please specify: __________________________________________
   ______ Don’t know/Not sure

   If you chose more than one option above, please answer question 3a. If not, please go to question 4.

3a. Which of these groups would you say best represents your race? (Please mark only one response):
   ______ White
   ______ Black or African American
_______ Asian
_______ Native Hawaiian or other Pacific Islander
_______ American Indian, Alaska Native
_______ Other: Please specify: _____________________________________
_______ Don’t know/Not sure

4. What is your relationship status (please check one)?

☐ single
☐ in a dating relationship
☐ cohabitating with my partner
☐ married
☐ common law marriage
☐ separated
☐ divorced
☐ widowed

5. Do you have a heart murmur?

Yes____  No____

6. Do you have high blood pressure?

Yes____  No____

7. Have you had any heart or blood vessel disease such as heart attack or stroke?

Yes____  No____

8. Are you taking beta blockers or other heart or blood pressure medication?

Yes____  No____

If YES, please indicate type of medication:____________________________

9. Do you take oral contraceptives (i.e., the pill) or use some other type of birth control hormone therapy (e.g., Depo-Provera or similar injections)?

Yes____  No____
10. Please list any other medications you are taking, especially for any conditions above (for example, asthma or arthritis medications):

For the following questions, use your best estimate:

11. When was the last time you had anything to eat? Please indicate the time: ____:____ am pm

12. On average, how much caffeine do you consume each day?
   - Caffeinated coffee/tea: ______________ cups
   - Caffeinated soda: ______________ cups
   - Other caffeinated beverage: ______________ cups

   Have you had any caffeinated beverages today? Yes_______ No_______
   - If Yes, what time did you consume your last caffeinated beverage? ____:_______ am pm

13. On average, how much of the following do you consume each day?
   - Fruit: ______________ cups
   - Vegetables: ______________ cups

14. Do you exercise regularly?
   - Yes______ No______

   If yes, approximately how much time per week do you spend on the following activities? (please specify minutes or hours)
   - Walking/jogging: ______________ (do not include walking to classes)
   - Walking/jogging to classes: ______________
   - Swimming: ______________
   - Weight Lifting: ______________
   - Aerobics: ______________
   - Other (please specify) ____________________________
**Appendix E**

**STAI-X1 (State)**

**DIRECTIONS:** Please read the statements below and then circle the number that corresponds with how you feel right now, that is **at this moment**. There are no right or wrong answers. Use the following scale:

1 = Not at all  
2 = Somewhat  
3 = Moderately  
4 = Very Much

<table>
<thead>
<tr>
<th>Statement</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I feel calm</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2. I feel secure</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>3. I am tense</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4. I am regretful</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5. I feel at ease</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>6. I feel upset</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>7. I am presently worrying over possible misfortunes</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>8. I feel rested</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>9. I feel anxious</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>10. I feel comfortable</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>11. I feel self-confident</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>12. I feel nervous</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>13. I am jittery</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>14. I feel “high strung”</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>15. I am relaxed</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>16. I feel content</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>17. I am worried</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>18. I feel over-excited and “rattled”</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>19. I feel joyful</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>20. I feel pleasant</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
Appendix F

PANAS-X

This scale consists of a number of words and phrases that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you feel this way right now. Use the following scale to record your answers:

<table>
<thead>
<tr>
<th></th>
<th>1 very slightly or not at all</th>
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with self
PANAS

**Directions**

This scale consists of a number of words that describe different feelings and emotions. Read each item and then circle the appropriate answer next to that word. Indicate to what extent you have felt this way right now.

Use the following scale to record your answers.

(1) = Very slightly or not at all  (2) = A little  (3) = Moderately  (4) = Quite a bit  (5) = Extremely

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<th>A little</th>
<th>Moderately</th>
<th>Quite a bit</th>
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## Appendix G

### Stress Appraisal Questions

#### Pre-task

1. **How threatening do you expect the upcoming task to be?**
   
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2. **How demanding do you expect the upcoming task to be?**
   
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3. **How stressful do you expect the upcoming task to be?**
   
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4. **How able will you be to cope with the upcoming task?**
   
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5. **How well do you think you will perform on the task?**
   
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### Stress Appraisal Questions

**Post-task**

1. **How threatening was the task you just performed?**
   
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2. **How demanding was the task you just performed?**
   
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3. **How stressful was the task you just performed?**
   
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4. **How able were you to cope with the task you just performed?**
   
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5. **How well do you think you performed on the task?**
   
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Appendix H

Ohio University Consent to Participate in a Research Study

Title of Research: Relationships and Health  Department: Psychology
Principal Investigator: Regina M. Warfel, B.S.

You are being asked to participate in research. For you to be able to decide whether you want to participate in this project, you should understand what the project is about, as well as the possible risks and benefits in order to make an informed decision. This process is known as informed consent. This form describes the purpose, procedures, possible benefits, and risks. It also explains how your personal information will be used and protected. Once you have read this form and your questions about the study are answered, you will be asked to sign it. This will allow your participation in this study. You should receive a copy of this document to take with you.

Explanation of Study

Purpose of the research: The purpose of this research is to examine how social factors influence physiological responses during a moderately engaging task.

Description of study: During the study session, you will fill out a few questionnaires, and you will engage in a 10-minute resting period. Following the rest period, you will engage in a writing task, and shortly afterwards you will participate in a moderately engaging task and another rest period. The second study session will be very similar. Cardiovascular measures will be assessed continuously throughout the experiment.

Procedures to be followed: To be eligible to participate, you must: be a male or female between the ages of 18 and 35; have no history of heart problems; have no high blood pressure; not be taking cardiovascular medication; and be generally in good health. If you choose to participate, we will attach disposable, adhesive electrodes to your neck and torso and a blood pressure cuff for cardiovascular measures. Portions of this session will be videotaped for research purposes. Some of your responses to questions you answered during the Psychology pre-test will be matched to your data that we collect in this study.

Duration of subject's participation: Each of the two experiments will last up to 1 hour.

Identification of specific procedures that are experimental: n/a

Risks and Discomforts: There is minimal risk associated with the cardiovascular assessment procedures. You may experience discomfort during the removal of the adhesive electrodes; the experimenter will use care when removing them or you may choose to remove them yourself.
**Benefits:** You will learn about research in psychophysiological mechanisms related to stress and health and through the debriefing procedures, you will be made aware of existing knowledge regarding associations among social relationships and health.

This research will improve our understanding of social support’s effects on physiological reactivity to stress. In turn, we will gain a better picture about the associations between social support and health.

**Confidentiality and Records:** All information and data collected from you will be identifiable only by a numeric code; no identifying information will be tied to the raw data. Videotaped material of this session will only be accessible to the researchers, will be identified by number only, and will be kept in a locked cabinet for a maximum of 7 years and then destroyed.

All of your information obtained from this research will be kept strictly confidential and maintained in locked files, accessible only to the Principle Investigator. However, if the data resulting from this study are published, members of the scientific community are, in accordance with policies of several government and scientific agencies, privy to the computer version of the data. Again, there would be no identifying information in this version of the data and the Primary Investigator will keep the copies of the raw data. Your name will be in no way tied to these data.

Additionally, while every effort will be made to keep your study-related information confidential, there may be circumstances where this information must be shared with:
* Federal agencies, for example the Office of Human Research Protections, whose responsibility is to protect human subjects in research;
* Representatives of Ohio University (OU), including the Institutional Review Board, a committee that oversees the research at OU

**Compensation:** You will be compensated 2 credit hours. You may withdraw at any point in the study, and you will be given pro-rated credit for your time, without penalty.

**Contact Information:** If you have any questions regarding this study, please contact Ms. Regina Warfel, email: rw333205@ohio.edu, phone number: (740) 593-0052.

If you have any questions regarding your rights as a research participant, please contact Jo Ellen Sherow, Director of Research Compliance, Ohio University, (740)593-0664.

By signing below, you are agreeing that:
- you have read this consent form (or it has been read to you) and have been given the opportunity to ask questions
- known risks to you have been explained to your satisfaction.
- you understand Ohio University has no policy or plan to pay for any injuries you might receive as a result of participating in this research protocol
- you are 18 years of age or older
- your participation in this research is given voluntarily
• you may change your mind and stop participation at any time without penalty or loss of any benefits to which you may otherwise be entitled.

Signature____________________________________ Date_______

Printed Name_____________________________ OAK ID (not PID)_____

Experimenter Signature________________________ Date________

Printed Name_____________________________ Version Date: [12/13/07]
Appendix I

Debriefing Form

Thank you very much for participating in this study. Your participation is extremely valuable for our understanding of the ways stress influences health. The purpose of this study is to examine how different social relationships influence the way people respond physiologically to a stressful evaluative situation. Studies show that having supportive people in our lives helps us to cope with stress better. In some studies, people respond in physiologically healthier ways to stress when they perceive themselves as being supported by other people, but not all studies have provided consistent results. We are examining whether the quality and type of relationships may help explain these inconsistencies. For instance, a supportive family member may be more beneficial than a non-supportive friend in coping with a stressful social evaluative task.

To address this, you were randomly assigned to either write about a supportive family and friend in your life to activate thoughts about their social support, or to write about a non-supportive family and friend. After the writing, you performed a speech task. We did not inform you of the nature of the speech because it was meant to catch you off guard. Since the speech task is a crucial aspect of this study, we ask that you not reveal the nature of the speech to other students who may sign up for this study. You can, however, inform them that physiological measures will be taken and that they will engage in a few simple tasks.

We will examine whether people with activated thoughts of support will have reduced physiological responses to the speech. Finally, experimenters will rate your videotaped speech performance so we can determine whether social support and self-reports of nervousness about speech-making influence actual speech performance. No one but the experimenters have access to your videotape. Your videotaped speech will be destroyed immediately after it is rated for research purposes.

If you have any questions, please feel free to contact us (see informed consent form for contact information).