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The Stress-Buffering Effects of a Brief Dyadic Interaction Before an Acute Stressor

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Although previous studies have confirmed that affectionate interaction can reduce the effects of stress, whether or not this effect is due more to habituation or the accumulation of affection remains an area of debate. The goal of the present study was to determine how specific acts of affection mitigate the effects of stress. Sixty mixed-sex dyads (half platonic friends and half dating partners) were randomly assigned to one of three conditions, affectionate interaction, quiet rest with the friend/romantic partner present, or separation from the friend/romantic partner, before one of the partners experienced a series of stressful activities. Results revealed that participants in the affection condition experienced the smallest increase in cardiovascular arousal regardless of relationship status. Participants' endocrine responses were more nuanced and depended on both their biological sex and the nature of the relationship with the companion. Given that these systems did not act in concert with one another, results provide mixed evidence for both an accumulation and habituation effect.

Managing stress has become a central concern for individuals in the United States and around the world. Since 2007, the American Psychological Association (APA) has conducted the annual *Stress in America* survey to determine the amount of stress Americans experience on a daily basis and whether or not they possess the tools to manage stress adequately. The results of this longitudinal project have been mixed; when asked to rate the amount of stress they experience subjectively on a 10-point scale, Americans' responses have steadily decreased over the last several years from a high of 6.2 in 2007 to the current level of 4.9 (APA, 2012). Despite this apparent reduction in total stress, when asked how their stress levels changed over the previous year, 80% of respondents indicated that their stress level had increased or remained the same in the preceding 12 months. As a result, six in 10 Americans indicated that one of their long-term goals is reducing or managing stress more effectively (APA, 2012).

The results from the *Stress in America* survey indicate that a majority of Americans are in a double bind insofar as their stress levels are concerned: Although they feel that their stress levels are increasing, nearly 40% also report that they lack the tools to manage stress effectively (APA, 2012). As a result, the stress-alleviating efficacy of several lifestyle practices, including yoga/yogic meditation (Bilderbeck, Farias, Brazil, Jakobowitz, & Wikholm, 2013; Call, Miron, & Orcutt, 2013; Yadav, Magan, Mehta, Sharma, & Mahapatra, 2012), various forms of exercise (Bass, Enochs, & DiBrezzo, 2002; Puterman et al., 2010), and certain dietary changes (Rosch, 1995), has received considerable attention in recent

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social-scientific research. An additional area of growing interest within the social sciences explores how the quality of individuals' relationships affects both stress and overall health (for reviews see Cutrona & Gardner, 2006; Floyd & Afifi, 2011). Indeed, the fact that relationships significantly enhance long-term health outcomes has now been confirmed in several studies, with at least one large meta-analysis suggesting that the risk to individuals' health associated with a lack of positive relationships is greater than the individual risks of smoking, excessive drinking, or drug use (Holt-Lunstad, Smith, & Layton, 2010). Several studies within this line of research have focused specifically on the benefits of affectionate communication in the context of marital interaction; in a review of studies examining the consequences of marital quality, Robles and Kiecolt-Glaser (2003) determined that satisfying marriages confer significant benefits upon spouses in terms of both their physical and psychological health, especially when it comes to situations where stress is involved.

Although the research within this domain is fairly unequivocal in its determination that close relationships confer considerable stress-alleviating benefits upon their members, a pair of recent correlational studies has attributed the source of these benefits to different causes. Researchers in those studies sought to determine how affectionate interaction within marriage is associated with both long-term (Floyd & Riforgiate, 2008) and acute (Grewen, Girdler, Amico, & Light, 2005) endocrine markers of stress. Although both of these studies revealed that affectionate communication received from spouses was associated with improved regulation of the stress hormone cortisol, the explanations for these observed benefits differed greatly. Floyd and Riforgiate (2008) argued that the regulation of stress hormones is due primarily to the receipt of verbal, nonverbal, and supportive forms of affection from spouses, whereas Grewen and colleagues (2005) suggested that the regulation of endocrine responses to stress might be attributed to habituation—that is, the routine of being with a romantic partner—rather than discrete communication events or prevailing relational qualities. Although these perspectives are not completely incompatible insofar as the exchange of affectionate messages often occurs in the context of familiar relationships (Floyd, 2006a), they do offer different perspectives regarding the reason why close relationships are beneficial when it comes to managing stress. Understanding how relational communication affects specific physiological systems to reduce the effects of stress can help individuals know which kinds of messages, from which kinds of relational partners, might help them manage stressful events effectively.

The goal of the present study, then, is to determine whether affectionate interaction in and of itself or the habituation of affectionate interaction in close relationships is more responsible for helping individuals manage stress. This study addresses this question by examining hormonal and cardiovascular reactions to acute stress following one of two different communication encounters: one involving the exchange of an affectionate message and one focused on resting quietly in the presence of a close relational partner. In addition, the present study examines the effects of affectionate interaction in two different kinds of relationships, one where the expression of affection should be fairly common (romantic partnerships) and one where the expression of affection should be comparatively less common (mixed-sex friendships). In the following sections, we review the rationale for both the affection exchange theory (AET: Floyd, 2006a) and habituation (Grewen et al., 2005) perspectives on the stress-alleviating benefits associated with affectionate interaction in close relationships. From there, we review recent studies that have examined psychophysiological outcomes associated with face-to-face encounters that occur in conjunction with the experience of stress. Finally, we conclude this section with hypotheses and research questions derived from theory and empirical precedent.

THEORETIC OVERVIEW

Affection Exchange Theory

Floyd's (2006a) affection exchange theory (AET) posits that affectionate interaction is adaptive insofar as it promotes both physical and relational health. Indeed, some of the earliest studies of AET determined that affectionate individuals experience many psychological and relational advantages, including higher levels of happiness, self-esteem, relationship satisfaction, and overall mental health, when compared to less affectionate individuals (Floyd, 2002). In a series of follow-up studies, Floyd and colleagues (2005) found that these comparisons were consistent even when the amount of affection individuals reported receiving from their closest relational partners was statistically controlled. The implication of these findings is relatively straightforward: Individuals who regularly express verbal, nonverbal, and supportive messages of affection enjoy many advantages, in terms of both relational health and physical/psychological health, when compared to less affectionate peers.

Of the claims advanced by AET, one that has received a great deal of empirical attention is the assertion that physiological systems associated with stress and reward are linked to and influenced by the exchange of affectionate messages (Floyd, 2006a). Given that early studies of AET determined that the exchange of affectionate messages is beneficial insofar as it promotes long-term pair bonding and overall relational health, the theory asserts that physiological systems associated with health and well-being reinforce affectionate behavior, inducing the feelings of calm and reward that are commonly associated with positive relational experiences. In the area of affection exchange, much of this research has focused on the interplay between affectionate communication and a stress-linked hormone known as cortisol. Commonly referred to as “the stress hormone,” cortisol is the final product of the hormonal cascade associated with activation of the hypothalamic–pituitary–adrenal (HPA) axis (Sapolsky, 2002). When people perceive a stressful situation, HPA axis activation enables their bodies to deal with the stressor by increasing available energy. Cortisol energizes the body by promoting the breakdown of muscle proteins into their constituent amino acids (Sapolsky, 2002).

Previous research conducted by Floyd and colleagues has determined that affectionate communication strongly influences the production and regulation of cortisol. In a pair of studies, Floyd and colleagues (Floyd, 2006b; Floyd & Riforgiate, 2008) analyzed the amount of diurnal (24-hour) variation in salivary cortisol. Among healthy, non-distressed individuals, cortisol follows a reliable pattern, peaking 30 to 40 minutes after waking and declining steadily throughout the day until it reaches its lowest point around midnight (Nicholson, 2008). Results from the Floyd (2006b) study demonstrated that when controlling for the amount of affection individuals reported receiving from relational partners, the amount of affection they expressed was directly related to the amount of morning-to-evening cortisol change ($r = .56$). In the follow-up study, Floyd and Riforgiate (2008) likewise found that affection received from a spouse helped to regulate individuals’ daily cortisol variation. Results from that study revealed that spouses’ reports of all three types of affection (verbal, nonverbal, and supportive acts) were associated with both participants’ waking cortisol response (average $\beta = .53$) and their total morning-to-evening cortisol change (average $\beta = -.49$).

The Habituation Hypothesis

In addition to those studies conducted by Floyd and colleagues, a series of studies conducted by Grewen and colleagues (Grewen, Anderson, Girdler, & Light, 2003; Grewen et al., 2005) has likewise explored the role that affectionate interaction with a spouse plays in the regulation of stress hormones. Studies from that research program have focused on hormonal and cardiovascular effects associated with a period of warm contact—a brief, affectionate interaction that includes sitting with a romantic partner in close proximity, viewing romantic film clips together, having brief conversations about significant moments in their relationship, and sharing a brief hug. In the Grewen and colleagues’ (2005) study, romantic partners were asked to complete a brief questionnaire about the quality of their relationship and were later asked to complete a 10-minute period of warm contact. Participants’ physiological reactions to the period of warm contact were assessed with pre- and post-contact measures of hormonal reactivity and cardiovascular output. Overall, results revealed that the quality of the relationship (as determined by the amount of support partners showed to one another) predicted increases in plasma oxytocin (a neuropeptide that is associated with the bonding process and initiates feelings of calm; Uvnäs-Moberg, Arn, & Magnusson, 2005) such that participants in highly supportive relationships exhibited significantly higher levels of oxytocin at all time points in the study and greater oxytocin reaction in response to warm contact when compared to participants in less supportive relationships. Interestingly, the patterns for cortisol did not follow this trend; instead, all participants demonstrated a significant decrease in cortisol throughout the postcontact period regardless of the quality of the support in their relationship, a feature that Grewen and colleagues (2005) attributed to the habituation of the relationship rather than the interaction itself.

In the psychological literature, habituation implies that repeated interactions produce consistently diminishing effects as the novelty of situation wanes (Rescorla, 1988). In terms of the cortisol effect present in the Grewen and colleagues (2005) study, the implication is that the familiar nature of the warm contact interaction with a long-term romantic partner is sufficient to reduce individuals’ cortisol in and of itself; that is, the stress-alleviating benefit is owed more to the routine of being with one’s partner than to the content of the interaction itself. Although such a view might not be wholly inconsistent with the AET (Floyd, 2006a) perspective on the significance of affectionate exchanges—the theory acknowledges that much affectionate interaction occurs in the context of committed, long-term relationships wherein both affectionate feelings and a comfortable pattern of affectionate interaction are established—the habituation hypothesis does undermine the premise that “affectionate *interaction* (accompanied . . . by affectionate feelings) is manifested in physiological processes that induce calm, ameliorate pain, and diminish stress” (Floyd, 2006a, p. 170, emphasis added).

RATIONALE AND HYPOTHESES

The studies of Grewen and colleagues (2005) and Floyd and Riforgiate (2008) each determined, through correlational methods, that affectionate communication affects the regulation of cortisol; however, each of these studies has limitations that should be addressed. First, because neither study employed a true experimental design, any claims about causality must be considered with caution. A second concern related primarily to the Grewen and colleagues (2005) design is the inclusion of romantic film clips in their study protocol. Given that Fredrickson’s (Fredrickson, Mancuso, Branigan, & Tugade, 2000) work on the undoing hypothesis has demonstrated that film clips designed to elicit positive emotions can reduce physiological indices of stress (in that case, cardiovascular arousal), it is impossible to determine whether or not the reduced cortisol levels were due to the conversations between partners or to the effects of viewing romantic film clips together.

In order to compare the stress-alleviating efficacy of both affection exchange and relational habituation, the present study employs an experimental design in which individuals are asked to engage in either a brief period of affectionate interaction or a period of quiet rest in the presence of relational partners before exposure to a series of acute stressors. Several recent studies (e.g., Coan, Schaefer, & Davidson, 2006; Ditzen et al., 2007; Grewen et al., 2003) have determined that individuals who engage in a period of affectionate interaction with a romantic partner experience less arousal in response to acute stressors when compared to participants who remain separated from their partners. Although those studies are unanimous in finding that various forms of affectionate interaction alleviate one or more effects of stress, they leave unanswered important questions that should be addressed in future research. First, it is not clear from these studies whether or not the benefits associated with the various forms of affectionate interaction in these studies can be attributed to specific communicative events or to the familiarity of the relationship itself. Although one of those studies experimentally manipulated the type of affection participants expressed (supportive affection vs. nonverbal affection in the form of a massage: Ditzen et al., 2007), none included conditions that compared the stress-alleviating efficacy of discrete affectionate acts and the presence of a romantic partner during the experiment.

Given the theoretic claims of AET (Floyd, 2006a) and the consistency of the finding that specific acts of affectionate interaction reduce the effects of stress in empirical studies, we posit that engaging in affectionate interaction results in lower endocrine and cardiovascular responses to acute stress than does the mere presence of a relational partner.

H1: When compared to the effects associated with the presence of a relational partner, affectionate interaction serves as a more efficacious buffer against cortisol reactivity in response to acute stress.

H2: When compared to the effects associated with the presence of a relational partner, affectionate interaction serves a more efficacious buffer against increases in (a) systolic blood pressure, (b) diastolic blood pressure, and (c) heart rate that accompany an acute stressor.

The second critical question left unaddressed by previous studies deals directly with the habituation of affectionate interaction in different relational contexts. As mentioned, most studies of affectionate interaction have examined romantic relationships; to address this limitation, the present study examines affectionate exchanges that occur in either opposite-sex romantic partnerships or opposite-sex friendships. The decision to include opposite-sex friends as a point of comparison to opposite-sex romantic partners is based upon two established empirical precedents. First, studies to date have examined the benefits of social interaction in mixed-sex dyads almost exclusively. In addition to those studies that have focused on heterosexual romantic dyads, at least two other studies have experimentally examined the effects of interaction in nonromantic mixed-sex dyads (e.g., Floyd et al., 2005; Kirschbaum, Klauer, Filipp, & Hallhammer, 1995). One notable exception to this pattern is the work of Heinrichs, Baumgartner, Kirschbaum, and Ehlert (2003); in that study, participants (all men) assigned to the supportive interaction condition were simply instructed to bring their closest friend with them to the lab (Heinrichs et al. provide no data about the number of participants who invited male or female friends).

A second reason that opposite-sex friendship pairs were included in the present study is the finding that these friendships are commonly named as particularly important relationships during young adults' mid- to late-twenties (for review, see Collins & Madsen, 2006). Despite the significance of these relationships and the intimacy associated with them, many young adults are cautious about overt expressions of affection in their cross-sex platonic friendships because of the relational ambiguity that can accompany such expressions (Floyd, 2006a; Guerrero & Chavez, 2005).

Cross-sex friendships therefore present a unique context to examine the specific benefits of affectionate interaction; if expressions of affection produce stronger psychophysiological effects when they are relatively novel (as a habituation explanation would suggest), participants who engage in affectionate interaction with a close cross-sex friend might experience more pronounced physiological reactions than individuals in romantic relationships.

RQ1: Do friendships and romantic partnerships differ in their stress-alleviating efficacy in terms of (a) endocrine and (b) cardiovascular markers of stress when an individual is exposed to a stressful event following a period of affectionate interaction?

METHOD

Participants

In total, 120 individuals (60 participants, 60 nonparticipant companions) participated in the present study. The sample was balanced for sex and relational status (romantic partners or platonic friends). The average age of participants was 22.33 years (range = 18 to 34 years, *SD* = 3.15) and the average age for companions was 22.40 years (range = 18 to 35 years, *SD* = 4.02). Among participants, the majority (*n* = 46, 76.7%) was White/Caucasian, seven (11.7%) were Latino/a, two were African American or Asian (3.3% each), and three indicated other ethnic origins. Among companions, the majority was also White/Caucasian (*n* = 44, 73.3%), five were Latino/a (8.3%), four were Asian (6.7%), two were

African American (3.3%), one was Native American (1.7%), and two indicated other ethnic origins.

Procedure

Recruitment. Individuals for the present study were recruited from undergraduate communication courses at a large university in the southwestern United States. To qualify for the study, prospective participants were required to be normotensive and not colorblind. As a condition of the study, prospective participants were also informed that they had to be able to enlist the participation of an opposite-sex platonic friend or an opposite-sex romantic partner whom they had known in this capacity for at least 3 months who was also normotensive and not colorblind. All participants met the eligibility criteria and members of all 60 dyads agreed on the nature and duration of their relationships. Participation in the present study occurred in two phases: an online questionnaire followed by a laboratory appointment.

Laboratory protocol. The present study employed a 2 (participant sex) × 2 (relationship type: friend or romantic) × 3 (condition: affectionate interaction, presence only, or control) factorial design. Prospective participants were allowed to self-select whether they brought a friend or romantic partner to their laboratory appointments; however, one member of each dyad was randomly selected (allowing random selection of participant sex) and subsequently randomly assigned to a condition before arriving at the laboratory. At the beginning of each session, all participants and companions were given a standard informed consent document that briefly outlined the nature of the procedure. After consent forms were signed and collected by researchers, participants were informed that they would instrumented with a Dinamap 100 (General Electric, Tampa, FL) cardiovascular monitoring unit. The Dinamap was set to measure systolic blood pressure, diastolic blood pressure, and heart rate at 2-minute intervals for the duration of the lab session. In addition to the cardiovascular measures, participants were informed that they would be required to give a total of four saliva samples during their laboratory session. Samples were collected at 10-minute intervals. Saliva samples were obtained via passive drool and collected in plastic cryovials.

After the participants were instrumented, their companions were removed from the room and taken into an adjacent computer lab. Participants were instructed to sit alone in silence for 6 minutes, during which time baseline cardiovascular measures were obtained. Following the baseline acclimation period, the first of four saliva samples was collected. Next, participants went through the 10-minute manipulation period. The manipulation was constructed such that participants were assigned to one of three conditions: a period of affectionate expression with the friend/romantic partner (modeled from the Grewen et al., 2003, 2005 experimental protocol), a period of quiet rest in the presence of their friend/romantic partner, and a control condition in which participants remained separated from their friend/romantic partner.[1]

During the manipulation period, the researcher left the room (leaving the door slightly ajar) and stood nearby in the hallway outside of the laboratory with a stopwatch to time the procedure. After 10 minutes had passed, the researcher returned to the laboratory and escorted companions into an adjacent computer lab. The second saliva sample was then collected from the participant prior to the beginning of the stress induction. Participants subsequently underwent a series of five stress-inducing tasks: a cold pressor test, Stroop color-word test, mental math challenge, viewing video clips of couples arguing, and another Stroop test, a protocol that has been shown to effectively induce stress in laboratory settings (Floyd et al., 2007a, 2007b; Grossi, Ahs, & Lundberg, 1998). Specific details about the protocol are available elsewhere (e.g., Floyd, Pauley, & Hesse, 2010) or can be obtained from the authors by request.

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[1]Participants assigned to the affectionate communication and quiet rest condition were reunited with their companions and given the following directions derived from the warm contact interaction utilized by Grewen and colleagues (2003, 2005), with the distinction that participants were instructed to focus exclusively on positive aspects of their relationship and were not shown romantic video clips:

> What I'd like for you to do now is talk to each other about fond memories of times that you've spent together. It's best for you to start with the first time you met. Include as many details as possible: where you were, what the situation was like, what you liked best about one another, etc. After that, I'd like you to talk about some of your favorite memories of times you've spent together, especially times that made you feel close to one another. I am going to step outside in a moment, and I'll give you ten minutes to talk together.

At the conclusion of their conversation, researchers asked participants to give one another a brief (<10 seconds) hug as part of the affectionate interaction.

For participants assigned to the presence only condition, the companion was again reintroduced into the lab and participants were given the following directions:

> What I'd like for you to do is sit together quietly for the next few minutes and just relax. Please do not talk to one another. I am going to step outside for a few minutes and leave the two of you to relax quietly together.

For participants assigned to the control condition, the companion remained separated from the participant for the ten-minute manipulation period. The participant was read the following instructions:

> I am going to give you ten minutes to sit quietly and just relax before we begin the challenging activities. Please do your best to sit quietly and clear your head. I am going to step out of the room again, and when I return, we will begin.

Measures

Affectionate communication in participants' ongoing relationships with their chosen companions was assessed via the 18-item Affectionate Communication Index (ACI: Floyd & Morman, 1998). The ACI contains items related to the three types of affection identified by AET (Floyd, 2006a): verbal statements of affection (e.g., "How often do you say how important your relationship is?"), nonverbal forms of affection (e.g., "How often do you put your arm around his/her shoulder?"), and supportive acts of affection (e.g., "How often do you help each other with problems?"). Reliability for the ACI was acceptable with $\alpha = .96$.

Relational satisfaction in participants' ongoing relationships with their chosen companions was assessed via the seven-item Relational Assessment Scale (RAS: Hendrick, 1988). The RAS assesses respondents' feelings about relationships by presenting them with different attitude-related questions about the relationship (e.g., "How good is your relationship compared to most?") that are answered on unique scales for each item (e.g., *not good* to *very good* for the aforementioned sample item). Reliability for the RAS was acceptable with $\alpha = .82$.

Physiological measures. Cardiovascular measures were recorded every 2 minutes using a Dinamap 100 automatic oscilloscope (General Electric, Tampa, FL). The U.S. Food and Drug Administration approved the Dinamap 100 for clinical and general use (General Electric, 2002). Oscillometric devices like the Dinamap are often used in research designs similar to the present study because they are relatively simple to operate and can be preprogrammed to record measures unobtrusively at specific time intervals (Gerin, Goyal, Mostofsky, & Shimbo, 2008; Uno, Uchino, & Smith, 2002). In the present study, we used the data obtained from the Dinamap to calculate a total of seven aggregate cardiovascular measures: one corresponding to the baseline period, the manipulation, and each of the five stress induction activities.

After each individual appointment, the cryovials containing participant saliva samples were stored in a refrigerator in the laboratory at 40°F until analysis. All salivary analyses were conducted at the Clinical Research Unit at Arizona State University using a commercially prepared competitive immunoassay test (Salimetrics, State College, PA). Prior to analysis, the cryovials were centrifuged at 3,000 rpm to separate mucins from the saliva. Duplicate 25-μl samples were pipetted into test wells and were allowed to incubate for 100 minutes before analysis. During the incubation period, free cortisol in the participant saliva samples binds to cortisol-specific antibodies coating the bottom of each test well. Following incubation, all remaining unbound cortisol is removed over a series of five washings with a prepared solution of phosphate and water. The bound cortisol remaining after the washing is subsequently measured using a 96-well Genios plate reader (Tecan, Männedorf, Switzerland). For the present study, the average intra-assay coefficient was 7.32% and the average interassay coefficient was 10.21% (each of these is a measure of reliability wherein lower values indicate higher reliability).

RESULTS

Manipulation Check

We conducted a series of four repeated-measures within-subjects analyses of variance (ANOVAs) to assess the efficacy of the stress induction activities: one for cortisol, one for systolic blood pressure (SBP), one for diastolic blood pressure (DBP), and one for heart rate (HR). Results for all five physiological outcomes revealed a main effect of time such that values increased throughout the manipulation (all $ps < .01$). The means for cortisol measures appear in Table 1 and cardiovascular indices appear in Table 2.

Additional analysis of the cardiovascular means appeared to indicate that one of the stressors, the couples arguing video, failed to produce the same level of arousal as the other stress-inducing activities. Indeed, paired-samples *t*-tests revealed that measures of SBP, DBP, and HR obtained during the couples arguing videos were all significantly lower than measurements taken during the preceding mental math activity, $t(59) = 9.76$, 8.93, and 9.43, respectively, all $ps < .001$, and subsequent Stroop color word test, $t(59) = 7.84$, 9.90, and 10.13, respectively, all $ps < .001$. There is neither a logical nor a theoretic reason why participants' cardiovascular indices should have decreased so

TABLE 1
Means and Standard Deviations for Salivary Cortisol Measures

Time	*Mean*	*Standard Deviation*
Cortisol 1	0.367	0.418
Cortisol 2	0.286	0.233
Cortisol 3	0.292	0.265
Cortisol 4	0.306	0.267

Note. All values reported in μg/dl.

TABLE 2
Means and Standard Deviations for Cardiovascular Measures

Time	*Systolic BP*	*Diastolic BP*	*Heart Rate*
Baseline	113.30 (12.25)	62.04 (8.32)	78.32 (12.30)
Manipulation	109.97 (13.10)	60.66 (8.39)	77.63 (11.83)
Cold pressor	120.69 (14.74)	69.90 (10.93)	79.36 (12.02)
Stroop Test 1	126.90 (15.31)	72.93 (9.06)	84.70 (11.58)
Mental math	127.01 (15.04)	70.97 (8.10)	86.47 (13.44)
Couples arguing	115.69 (12.87)	63.58 (8.10)	75.77 (12.00)
Stroop Test 2	124.42 (14.18)	70.18 (7.97)	87.74 (14.26)

Note. All values reported in mm Hg.

markedly during this particular activity. It seemed instead that participants were not engaged while viewing the conflict scenarios. As can be seen in Table 2, the initial peak of cardiovascular arousal (regardless of condition) occurred during the mental math challenge. As a result, we selected this time period as the point of maximum arousal for all subsequent tests.

Descriptive Statistics

We utilized the questionnaire measures to determine how participants' relationships varied in terms of factors like duration, satisfaction, and affectionate interaction. Overall, participants reported that they had known their companions for a little more than 31 months (M = 31.24 months, SD = 40.17). As would be expected in a population of young adults, friendships (M = 36.25 months, SD = 49.81) had persisted for slightly longer than romantic partnerships (M = 26.22, SD = 26.92), although this difference was not significant, $t(106) = 1.30$, $p = .196$. Results from analyses of relational satisfaction and affectionate communication were consistent with previous empirical findings: Although friends (M = 5.66, SD = .93) and romantic partners (M = 5.87, SD = .98) did not significantly differ in their reported relationship satisfaction, $t(106) = –1.14$, $p = .257$, participants in romantic relationships (M = 5.76, SD = .96) reported significantly more affectionate interaction in their relationships than did participants in friendships (M = 3.81, SD = 1.37), $t(106) = –8.56$, $p < .001$. Taken together, these data suggest that friendships and romantic partnerships were equally satisfying, despite the fact that participants in the romantic condition expressed significantly more affection.

Before conducting hypothesis tests, we conducted a series of ANOVAs to ensure group equivalency on baseline levels of the dependent measures. In terms of cortisol, baseline measures ranged from 0.05 to 2.96 μg/dl with a mean of .36 μg/dl (SD = .42). Baseline cortisol did not significantly differ between sexes, as a function of relational status, or between experimental groups (all ps > .05). Baseline SBP ranged from 87.50 to 140.00 mm Hg with a mean of 112.92 (SD = 12.52). As would be expected, men and women differed in terms of their baseline SBP, $t(58) = 3.44$, $p < .001$, with men (M = 118.51 mm Hg, SD = 12.02) exhibiting higher SBP than women (M = 107.32, SD = 10.46). Baseline DBP ranged from 42.50 to 95.67 mm Hg with a mean of 61.91 (SD = 8.31). DBP did not significantly differ between sexes. Baseline heart rate (HR) ranged from 50.67 to 104.67 beats per minute (BPM) with a mean of 78.20 (SD = 12.24). Men and women differed in terms of their baseline HR, $t(58) = –2.04$, $p = .046$, with women (M = 81.34 BPM, SD = 12.11) exhibiting higher HR than men (M = 75.07, SD = 11.73). Despite randomly assigning participants to condition, participants assigned to the affectionate communication differed from participants in the other groups on measures of SBP and DBP. In terms of SBP, participants assigned to the affection group (M = 116.96 mm Hg, SD = 11.00) and the control group (M = 114.25 mm Hg, SD = 15.66) exhibited higher pressure than did participants in the presence-only group (M = 107.53 mm Hg, SD = 8.39), $F(2, 59) = 3.24$, $p = .046$. For DBP readings, participants in the affectionate communication condition (M = 66.20 mm Hg, SD = 10.14) exhibited higher baseline readings that participants in the presence-only (M = 58.32 mm Hg, SD = 6.45) and control (M = 61.20 mm Hg, SD = 6.06) groups. Experimental groups did not significantly differ in their HR. Given that participants' initial cardiovascular output differed as a function of group assignment and given that the law of initial values posits that physiological responses are moderated by baseline readings, initial values for all physiological samples were used as covariates in hypothesis tests (Jin, 1992).

Hypotheses and Research Question

Hypothesis 1. H1 predicted that affectionate communication buffers individuals against increases in cortisol associated with acute stress. Because salivary cortisol samples tend to be positively skewed (in the present study, skewness = 1.43, SE = .31), we applied a natural logarithmic (log_e) transformation to the data to reduce the high degree of skewness (Nicholson, 2008; Tabachnick & Fidell, 2007). Additionally, cortisol exhibits a fairly strong diurnal rhythm, with the highest values obtained in the morning hours (Nicholson, 2008). To control for this natural variation in cortisol levels, we conducted a mixed-model ANCOVA with the time of day (coded in military time) as one covariate, the date of the collection as the second covariate, and baseline cortisol values as the third covariate. Cortisol samples taken at Time 2 (following the affectionate communication activity) and Time 3 (preceding the couples arguing video) were entered as the within-subjects variables with sex, relationship status, and experimental condition as between-subjects variables. Overall, this analysis produced two significant between-groups effects. Results indicated that the experimental condition-by-relationship status interaction effect was significant, $F(2, 44) = 4.99$, $p = .011$, partial $\eta^2 = .19$, as was the interaction between sex and relationship status, $F(2, 44) = 4.24$, $p = .045$, partial $\eta^2 = .09$.

Given that RQ1 focused on the relative stress-buffering efficacy of friendships and romantic partnerships, we explored these interaction effects using one-way ANOVA and post hoc comparisons. To analyze the first interaction effect, we created a nominal variable consisting of six groups and representing the interaction of experimental condition and relationship status. Next, given that the effects were between-subjects effects, we computed the average cortisol value at Time 2 and Time 3 (derived from the transformed data) to be the dependent variable. We entered these variables into a one-way ANOVA and requested pairwise comparisons based on the least significant differences (LSD) test. Results of the post hoc analysis revealed one significant difference: Friends assigned to the affectionate expression condition exhibited significantly higher cortisol values than romantic participants assigned to the presence-only condition across both time points, mean difference = .75, $p = .030$. One other comparison was significant at $p < .10$: Friends in the affectionate communication condition exhibited higher levels of cortisol than romantic participants in the control group, mean difference = .58, $p = .088$.

To analyze the second interaction effect involving sex and relationship status, we created a nominal variable with four conditions and used the same average cortisol variable computed in the previous step. These variables were again entered into a one-way ANOVA and LSD tests were used to identify significant between-groups differences. Results of the pairwise comparisons revealed one significant difference: Across both time points analyzed, male participants who brought a friend to the laboratory exhibited higher levels of cortisol than men who brought a romantic partner to the lab, mean difference = .56, $p = .047$. Results also revealed that one comparison was significant at $p < .10$: Women who brought a friend to the lab exhibited higher levels of cortisol than men who brought their romantic partner to the lab, mean difference = .49, $p = .078$.

Hypothesis 2. H2 predicted that an affectionate interaction prior to stressful events buffers individuals' cardiovascular reactivity to stress with greater efficacy than the presence of a friend or romantic partner. To test the prediction of hypothesis two for the cardiovascular indices, we conducted a series of mixed-model ANCOVA tests for each individual cardiovascular outcome. For each test, experimental time period (manipulation, cold pressor test, first Stroop test, and mental math) served as the within-subjects factor; baseline values served as covariates; and experimental condition, participant sex, and relationship status served as between-subjects factors. For H2, our primary outcome of interest for each ANCOVA was the within-subjects time-by-condition interaction. When these effects were significant, we proceeded with planned comparisons. All of the hypotheses in the present study predicted that participants in the affectionate communication interaction would experience less of an increase in physiological indices of stress (compared to the presence-only and control conditions) as a result of the experimental manipulation. To test this prediction for H2, we calculated a change score based on the difference between the mental math output and the manipulation output for each cardiovascular index. These change scores were then entered into a series of planned contrasts with the following coefficients: –2 for the affectionate communication condition, 1 for the presence-only condition, and 1 for the control condition (Keppel & Wickens, 2004). Results of the within-subjects time-by-condition interaction and subsequent planned comparisons are reported in the following.

In terms of SBP (H2a), results from the mixed-model ANCOVA revealed a significant time-by-condition interaction, $F(6, 138) = 5.64$, $p < .001$, partial $\eta^2 = .20$, and the planned contrast was also significant, $t(57) = 2.15$, $p = .036$, confirming that the change scores for participants in the affectionate communication condition (9.88 mm Hg) were significantly lower than the change scores for both the presence-only (17.60 mm Hg) and control (22.30 mm Hg) conditions (Figure 1). H2a was supported.

In terms of DBP (H2b), results of the time-by-condition interaction were significant, $F(6, 138) = 6.38$, $p < .001$,

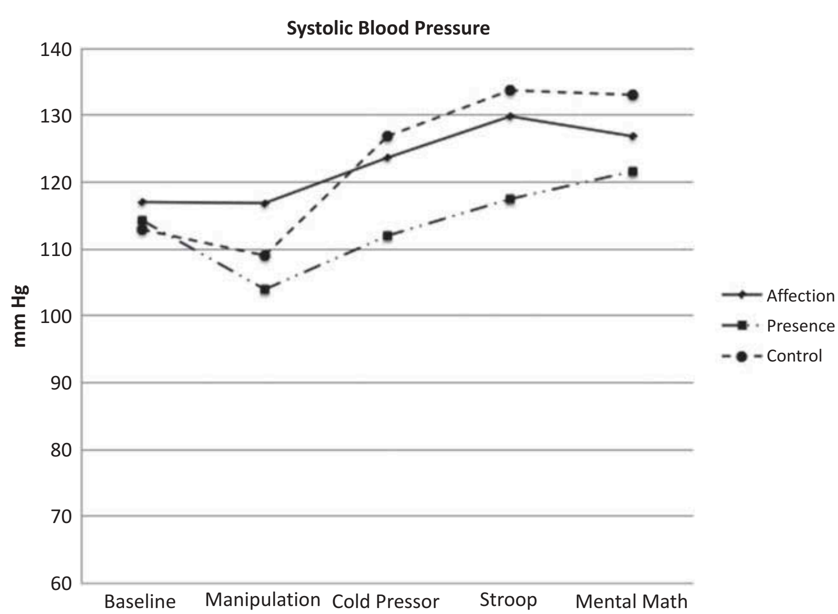

FIGURE 1 Changes in systolic blood pressure by experimental condition.

partial $\eta^2 = .22$, and the planned contrast revealed that DBP change scores for participants in the affectionate communication condition (6.59 mm Hg) were significantly lower than those in the presence-only (11.26 mm Hg) and control (13.26 mm Hg) conditions, $t(57) = 2.82$, $p = .007$ (Figure 2). H2b was supported.

In terms of HR (H2c), results of the mixed-model ANCOVA revealed that the time-by-condition interaction was significant, $F(6, 138) = 2.78$, $p = .01$, partial $\eta^2 = .11$, and results of the contrast confirmed that participants in the affection interaction condition experienced less of an increase in HR (2.34 BPM) than participants in the presence-only (11.51 BPM) and control (12.43 BPM) conditions, $t(57) = 3.89$, $p < .001$ (Figure 3). H2c was supported.

Research question. RQ1 inquired about the relative stress-alleviating efficacy of friendships and romantic partnerships. Results relevant to RQ1 were previously reported in relation to cortisol and revealed that participants who engaged in affectionate interaction with friends experienced higher levels of cortisol than did romantic participants in the presence-only condition. In terms of cardiovascular

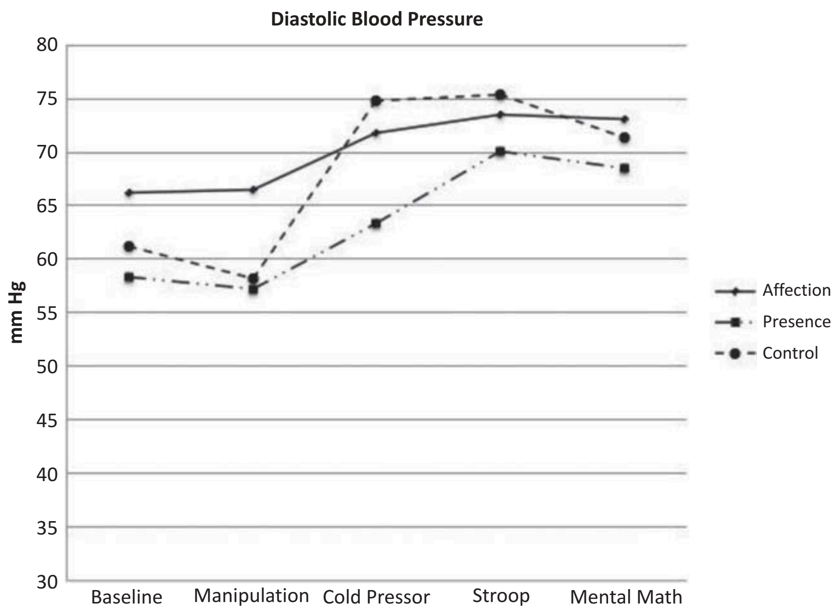

FIGURE 2 Changes in diastolic blood pressure by experimental condition.

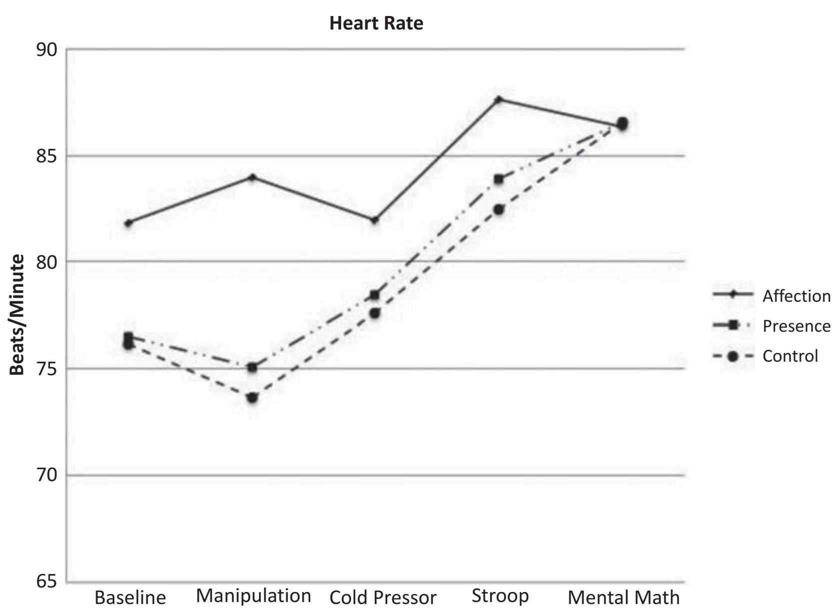

FIGURE 3 Changes in heart rate by experimental condition.

TABLE 3
H3b: Results From Repeated-Measures ANCOVA Tests Examining the Effects of Relationship Status on Participants' Cardiovascular Responses

Test	*F value*	*Significance (p)*	*Partial η^2*	*Observed Power*
1. Systolic blood pressure				
Time-by-relationship status	0.27	.85	.01	.10
Time-by-relationship-by-condition	1.88	.09	.08	.68
2. Diastolic blood pressure				
Time-by-relationship status	2.42	.07	.05	.59
Time-by-relationship-by-condition	1.58	.16	.06	.59
3. Heart rate				
Time-by-relationship status	0.97	.41	.02	.26
Time-by-relationship-by-condition	0.78	.60	.03	.30

Note. All hypothesis tests were $F(6, 138)$.

outcomes (RQ1b), we utilized a procedure identical to the one employed for H2 with the exception that the outcomes of interest for RQ1b were the within-subjects time-by-relationship status interaction and the three-way interaction involving time, relationship status, and experimental condition. Of these six within-subjects tests, none were significant (Table 3), an indication that communication with friends or romantic partners did not differ in its ability to minimize cardiovascular reactions to stress. RQ1b seems to suggest that, insofar as cardiovascular markers of stress are concerned, friendships and romantic partnerships are equally efficacious in their ability to reduce the physical signs of stress.

DISCUSSION

The present study assessed the effectiveness of a ten-minute period of affectionate communication as a buffer against the physiological effects of acute stress. Although previous studies have confirmed that affectionate communication helps to regulate physiological responses to stress, different scholars have utilized different explanations to explain why this effect occurs. The present study compared two such predictions: one derived from the tenets of AET (Floyd, 2006a) that focuses on the contribution of specific affectionate exchanges, and one based on the idea that partners habituate to episodes of affection in their relationships (Grewen et al., 2005). The present study sought to extend research in this area by examining the role that discrete communication events (either with friends or romantic partners) play in the stress-alleviation process.

To test the hypothesis that affectionate communication buffers participants against the effects of stress, we measured physiological reactions to stressors in two systems that have been examined extensively in the literature: the cardiovascular system and the endocrine system. Results obtained from cardiovascular indices primarily supported the hypothesis that affectionate interaction can serve as a buffer against the physiological arousal associated with the stress response. Although participants in the affectionate communication condition experienced increases in SBP, DBP, and HR, the rate of the observed increase was significantly lower than increases observed in the presence-only and control conditions. Results further confirmed that this effect was not moderated by participants' relationship status, an indication that specific acts of communication (and not the existing affectionate tenor of the relationship; see RQ1b) might buffer individuals against the cardiovascular changes associated with an episode of acute stress.

In terms of cortisol, results suggest that the stress-buffering effects of affectionate interaction might have been moderated by relationship type. Across all of the time periods analyzed in the present study, we found that participants who brought a friend to the laboratory and expressed affectionate feelings experienced significantly higher levels of cortisol compared to participants who were accompanied by a romantic partner. Additional analyses further revealed that differences in cortisol reactivity between the friendship and romantic partner conditions were particularly evident for men. Compared to men who brought their romantic partners to the experimental session, men who brought a friend experienced significantly higher levels of cortisol throughout the duration of the time period included in the analysis. Overall, it appears that asking friends to participate in a laboratory session together might have contributed to higher endocrine arousal than was evident among participants who were accompanied by a romantic partner.

In the following sections, these results are discussed in terms of their theoretic implications for Floyd's (2006a) affection exchange theory and the habituation hypothesis (Grewen et al., 2005). Next, the strengths and limitations of the present study, as well as some directions for future research, are discussed. Finally, we offer some tentative conclusions that can be derived from the present study.

Theoretic Implications

Affection exchange theory (AET; Floyd, 2006a) posits that because the expression of affection is beneficial insofar as it promotes immediate physical health and affords access to close relationships, certain physiological systems reinforce the expression of affection. Previous studies have investigated this claim in several domains with consistent results. The present study adds to this growing body of evidence directly implicating the exchange of affectionate messages as an important tool in minimizing the effects of stress (see Floyd et al., 2007b; Floyd et al., 2010). Previous studies that have investigated the stress-buffering efficacy of a brief affectionate interaction similar to the one utilized in the present study (Coan et al., 2006; Ditzen et al., 2007; Grewen et al., 2003) have reported that affectionate interaction with a romantic partner alleviates the physiological reactivity that is commonly associated with the experience of stress. Recent studies have likewise determined that specific acts of affection can reduce physiological responses to acute stress; in one study, the amount of day-to-day affection individuals experienced in their closest relationships predicted greater oxytocin production in response to stress (Floyd et al., 2010). Indeed, the bulk of research conducted up to this point is uniform in its conclusion that affectionate interaction (and, by extension, affectionate relationships) confers numerous stress-alleviating benefits upon individuals.

A relatively novel feature of the present study is the comparison of the stress-buffering efficacy of friendships and romantic partnerships. Results from the present study demonstrated that participants who engaged in an affectionate interaction focused on positive feelings and fond relational memories experienced less of an increase in all cardiovascular measures than did participants who sat in the presence of a relational partner or were separated from their partner, regardless of the nature of their relationship. Given that many studies have confirmed the cardiovascular-protective benefits of romantic relationships (specifically marriage; for review, see Robles & Kiecolt-Glaser, 2003), the consistency of the cardiovascular results obtained from both friendships and romantic partnerships in the present study suggests that those benefits to the cardiovascular system might be due more to specific acts of affection in the context of ongoing relationships. Future studies could continue to examine this claim by assessing how the quantity and frequency of affectionate exchanges in various types of established relationships (e.g., family relationships, professional relationships) affect individuals' reactions to stress.

In terms of endocrine system reactivity, results from the present study revealed some modest but consistent differences between participants in the friendship and romantic partnership groups, perhaps providing support for the habituation hypothesis of Grewen and colleagues insofar as endocrine markers of stress are concerned (Grewen et al., 2005). If this is indeed the case, the overall findings from this study suggest a difference between the cardiovascular and endocrine responses to affectionate communication. Such a perspective would not be unwarranted: Henry (1992) proposed that the mechanisms at work in the activations of the sympathetic nervous system (SNS; marked by changes in the catecholamines epinephrine and norepinephrine that result in cardiovascular responses to stress) and HPA-axis arousal (culminating in the cortisol activation assessed in the present study) are theoretically distinct. According to the "distress–defeat" typology (Henry, 1992), SNS arousal occurs in the immediate aftermath of a stressful event and subsides with time. Activation of the HPA axis, however, is associated with lingering stress that results in confusion and triggers the "defeat" mechanism. Recent studies have confirmed that the SNS and the HPA axis do not always act in concert, leading to a call for social scientists to examine these systems concurrently (Granger et al., 2006).

In the context of the present study, the potential implications of the distress–defeat system are interesting and could potentially extend our understanding of affectionate interaction's specific physiological effects. First, in the context of immediate physiological responses to stress (attributed to the SNS and manifested in cardiovascular arousal), affectionate messages from any source might alleviate the effects of stress; however, these results also suggest that relationship ambiguity might become a persistent and chronic stressor, thereby triggering the activation of the HPA axis. Given the nature of the interactions included in the present study, such an explanation is at least tenable. Indeed, some forms of affectionate communication carry a certain degree of risk, and that level of risk is heightened when the expression of affection might be misinterpreted or taken to mean something beyond what is actually conveyed (Floyd & Pauley, 2010). As Guerrero and Chavez (2005) note, cross-sex friendships can present one such situation for many heterosexual young adults because of the relational ambiguity that can be associated with these relationships. Given that the friends in this study indicated using significantly less affectionate interaction in their typical encounters than did romantic participants, one possibility is that the expression of affectionate feelings might have seemed unnatural or uncomfortable in nonromantic cross-sex friendships, thereby resulting in feelings of discomfort and stress for these participants.

In terms of extending our theoretic understanding of affection, AET posits that each individual has an "optimal tolerance" (Floyd, 2006a, p. 171) for affectionate interaction and that expressions of affection (both given and received) that violate an individual's optimal range initiate a physiological cascade designed to encourage a cognitive appraisal of the event. According to the theory, these events are primarily associated with reactions linked to the SNS; however, results from the present study might indicate that this reaction is linked to HPA-axis arousal, providing a potential point of agreement with the distress–defeat model of stress (Henry, 1992). This might present an interesting area of future investigation for researchers interested in AET: When expressions of affection are fraught with some degree of relational ambiguity—as might be the case when friends are asked to engage in affectionate interaction that is somewhat atypical in their relationship—the visceral reaction to this exchange might be somewhat subdued (indicating little to no activation of the SNS), only to give way to a delayed "defeat" response accompanied by activation of the HPA axis. Although these findings are potentially interesting, they must be interpreted with a great deal of caution. This is especially important to note given the somewhat inconsistent findings for endocrine system reactivity; indeed, the implications mentioned here are tentative, and future studies must continue to examine this hypothesis by exploring the physiological effects associated with affectionate expression in a range of relationships, particularly those where the expression of affection is not routine.

Strengths, Limitations, and Future Directions

This study features a number of unique elements that strengthen the credibility of its findings. Chief among these strengths is the application of objective physiological measures of stress associated with two distinct physiological systems. The present study adds to a growing number of experimental tests that have directly measured individuals' physiological reactions to stressful activities, demonstrating that physiological reactions to relational communication and stressful events can be complex. Results obtained from the analysis provide implications for both short- and long-term stressors.

This study also has a few limitations that are worth noting. First, there is no way to systematically account for the communication that took place while participants and their partners were engaged in the affectionate manipulation period. Although researchers stood by outside of the laboratory during the manipulation, no attempt was made to record and subsequently analyze the conversations that occurred during the experiment (a procedure that was likewise utilized by Grewen and colleagues (2003, 2005) to enhance the authenticity of the interaction). It is worth noting that such data might be of theoretic interest to communication scholars: Goldsmith's (2004) enacted support model primarily focuses its attention on the conversations that people have during moments of distress; likewise, one of the most significant findings to emerge from studies of affectionate communication is that the act of expressing affection has benefits for participants above and beyond the effects of receiving affection alone (Floyd et al., 2005). In the present study, it is not possible to account for the types of messages exchanged before the stressful event; however, given the theoretic interest in this area, such analysis would be insightful.

Another limitation is the possibility that, given the number of statistical tests conducted in the analysis, some of the results may be attributable to type I error. Although only the within-subjects effects served as the main hypothesis tests, the MANCOVAs used in the present analysis included 48 univariate and multivariate tests. Despite the number of statistical tests run, the consistency of the findings lends support to the claims of the present study.

An additional consideration that must be noted is that the manipulation utilized in the present study compared only the stress-alleviating efficacy of affectionate interaction and the presence of a relational partner. Given that the expression of affectionate is commonly associated with the experience of positive emotion, it is not possible to disentangle the effects of affectionate interaction from the effects of emotionally positive communication more generally. A related limitation is the inability to differentiate the benefits of speaking to a relational partner about affectionate feelings from the effects of speaking generally. Although previous studies have demonstrated that verbal forms of affection, in the form of written messages, alleviate stress more effectively than affectionate thoughts (Floyd et al., 2007b) or written messages about nonrelational topics (e.g., the layout of one's home; Floyd et al., 2010), studies have not examined whether or not there are stress-alleviating benefits associated simply with the act of speaking to another person. Future studies can address these limitations by examining whether the pattern of stress alleviation observed in the present study is specific to affectionate interaction or can be extended to other conversations, particularly those involving the expression of different positive emotions.

Conclusions

When defining the importance of studying affectionate communication, Floyd (2006a) argued that expressing affection is a ubiquitous but essential component of each stage of relationship development. Further, the expression of affection carries with it a host of benefits to physical and mental health. Results from the present study additionally reveal that the benefits of affectionate interaction might be due more to the simple act of engaging in affectionate interaction with another human than to the quality or context of the relationship itself. Such a perspective both underscores the fundamental perspective that humans are social creatures (Baumeister & Leary, 1995) and emphasizes the primacy of specific communicative acts in promoting and reinforcing individual well-being.

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