THE ROLE OF DAILY PARTNER-DIRECTED GRATITUDE, RELATIONSHIP FUNCTIONING, AND FEAR OF RECURRENTNESS IN COUPLES COPING WITH BREAST CANCER

by

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A dissertation submitted to the Faculty of the University of Delaware in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Psychology

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ABSTRACT

Recent research on gratitude in the context of close relationships has demonstrated its importance in relationship development and maintenance as well as individual subjective well-being. However, this literature has not yet explored the role of gratitude for couples facing a significant life stressor, such as couples coping with cancer. The present study attempts to address this gap in the literature by exploring the influence of partner-directed gratitude on relationship intimacy and fear of cancer recurrence (FOR) in breast cancer patients and their partners. FOR has been shown to be one of the primary concerns facing cancer patients and their families. We hypothesized that felt and expressed gratitude would be associated within-person with relationship intimacy in patients and their partners. Moreover, we hypothesized that intimacy would be associated within-person with lower levels of FOR in patients and their partners. Using a daily-diary design, patients and spouses each independently reported on their daily experience of gratitude, intimacy, and FOR for 10 consecutive days. Using a generalized mediation framework, results showed that relationship intimacy was a significant within-person mediator of the link between gratitude and FOR for both patients and their partners. This work suggests that couples may benefit from gratitude-based interventions to aid in enhancing intimacy and management of psychosocial concerns that result from medical adversity.
Chapter 1

INTRODUCTION

Breast cancer (BC) is the most common cancer among women in the United States, with 235,030 projected new cases and 40,430 projected deaths in 2014 (American Cancer Society, 2014). Patients and their partners/spouses are both impacted by the diagnosis, treatment, and adjustment to life after cancer, and experience psychosocial concerns including emotional distress (i.e., anxiety, depression) and fear of recurrence (e.g., Kim, Carver, Spillers, Love-Ghaffari, & Kaw, 2011). There has been a recent movement in the literature to conceptualize cancer as a “we-disease” in which patient and partner work together to cope with emotional and practical elements of the disease (Kayser, Watson, & Andrade, 2007). Manne and Badr (2008) argue that the marital/relational context of cancer is important not only as a resource from which to draw in times of need, but also as an opportunity to enhance the relationship and build a more intimate bond that can influence and aid psychosocial adaptation to cancer. For example, recent work has demonstrated that provision of social support from BC patients to their spouses as well as from spouses to patients enhances intimacy for both partners (Belcher et al., 2011). A central goal of the present study is to form a better understanding of the processes that help couples maintain intimacy during health-related adversity.

One process that has been shown to strengthen relationship quality involves the experience and expression of gratitude (Gordon, Arnette, & Smith, 2011).
Gratitude supports the development and maintenance of intimate relationships (Algoe, Haidt, & Gable, 2008; Algoe, Fredrickson, & Gable, 2013; Lambert & Fincham, 2011), and is linked to increases in relationship satisfaction and connection (Algoe, Gable, & Maisel, 2010; Gordon et al., 2011), suggesting it may play an important role in enhancing relationship quality in BC patients and their partners. In addition to interpersonal benefits, gratitude has also been shown to enhance individual subjective well-being (Wood, Froh, & Geraghty, 2010) and lessen death anxiety (Lau & Cheng, 2011), a primary concern that BC patients and their partners experience in the form of fear of recurrence (FOR). However, the effects of partner-specific gratitude have not been investigated in the context of couples coping with cancer, a context in which enhancement of the marital relationship can be critical for optimal adaptation to cancer.

The objective of the present study is to examine the role of partner-directed gratitude in (1) enhancing relationship outcomes (i.e., intimacy) and (2) lessening cancer-specific psychosocial concerns (i.e., FOR) within the day-to-day context of couples coping with BC. This work has potentially important implications for managing couples’ relational and psychosocial adjustment to cancer. Moreover, a mediation model is proposed in which gratitude’s influence on FOR is mediated through enhanced relationship intimacy. Each of these expected links will be described further below.

**Cancer in an Interpersonal Context**

Although traditional approaches to exploring the psychosocial effects of cancer have involved a focus on individual distress and adaptation, recent research
demonstrates that cancer is best understood within a family context in which both patient and spouse/partner are impacted (Kayser et al., 2007) and couples can use their relationship as a resource to aid in better adjustment (Manne & Badr, 2008). Indeed, low marital quality puts individuals coping with cancer at risk for increased levels of depression, anxiety, and illness-induced family difficulties, suggesting high marital quality protects against some of the negative psychosocial effects of cancer (Rodrigue & Park, 1996). Interestingly, a considerable proportion of couples facing nonmetastatic breast cancer report improvements in their relationship in the year following cancer diagnosis (Dorval et al., 2005). In 42% of couples, both BC patients and their partners reported feeling the cancer diagnosis and treatment had brought them closer in the year following diagnosis. In addition, prediagnosis martial satisfaction did not predict couples reports of getting closer following diagnosis, suggesting couples at all levels of marital satisfaction have the ability to get closer during the time following diagnosis (Dorval et al., 2005). Northouse, Templin, and Mood (2001) found that husbands’ and wives’ adjustment to BC was directly affected by each other’s levels of adjustment. Couples coping with metastatic BC (Badr, Carmack, Kashy, Cristofanilli, & Revenson, 2010) and early stage prostate cancer (Berg et al., 2008) benefit from working together to manage the stress that arises from cancer through engaging in dyadic or collaborative coping, such as joint problem solving, emphasizing the way in which couples respond to stressors as interpersonal units rather than as separate individuals. Unsupportive partner behaviors (i.e., critical or avoidant responses), however, is associated with patients’ and partners’ reports of holding back and mental and behavioral disengagement by couples with early stage BC (Manne et al., 2014).
Manne and Badr (2008) argue that the context of cancer should be viewed as an opportunity to enhance the relationship and build intimacy, rather than simply using it as resource to draw upon when coping with sequelae of the disease. Intimacy serves a unique, dyadic experience that enables couples to better adapt to cancer or other health adversities. Evidence for this model has been provided in studies of head and neck and lung cancer patients and their partners in which communication styles were associated with intimacy that in turn predicted lower cancer-related distress (Manne & Badr, 2010; Manne, Badr, & Kashy, 2012). Partners of nonmetastatic BC patients who reported higher levels of intimacy had lower levels of depression and anxiety and reported higher levels of quality of life compared to those with lower levels of intimacy (Moreira & Canavarro, 2013). Couples with early stage BC who have an open engagement communication style, showing high amounts of emotional expressivity during the illness, show positive adjustment and enhanced cohesiveness, while couples who engage in mutual avoidance or pursue-withdraw patterns experience more deleterious outcomes (e.g., emotional distress, lower marital satisfaction; Naaman, Radwan, & Johnson, 2009). Social constraints on sharing by early stage BC patients and their partners is associated with lower levels of relationship intimacy and happiness, independent of global marital quality, suggesting that more closed forms of communication can have deleterious effects on couple functioning (Pasipanodya et al., 2012). Overall, it appears that a relational approach to examining adjustment to cancer best captures the experience of patients and partners.

**Positive Emotions during Difficult Times**

There is a growing body of work that suggests positive emotions are important not only in enhancing good experiences, but also function to decrease or
attenuate negative experiences and affect, such as coping with the cancer experience (Fredrickson, Tugade, Wauch, & Larkin, 2003; Wood & Terrier, 2010). Frederickson’s broaden-and-build theory of positive emotions posits that while negative emotions are associated with attention narrowing and focus, positive emotions play an important role in (1) broadening cognition to allow individuals to expand their attention, thinking and behavioral repertoires, and (2) building resources that endure over time and function as a reserve that can be used in future times of need (Fredrickson, 2001). In a study of the effect of positive emotions following September 11, 2001, Frederickson, et al. (2003) found that a tendency to experience positive emotions (i.e., trait resilience) reported prior to September 11th was associated with fewer depressive symptoms reported following from the attacks. Additionally, initial trait resilience predicted post-crisis growth in psychological resources, and this relationship was mediated by positive emotions, suggesting an important role of positive affect during tough times.

In addition to offsetting or preventing negative emotion, recent work on positive emotions has demonstrated that positive emotions can serve to down-regulate, or “undo,” the effects of negative emotions and return the body to its homeostasis (Fredrickson, Mancuso, Branigan, & Tugade, 2000; Yuan, McCarthy, Holley, & Levenson, 2010). Specifically, Yuan et al. found that periods of high negative arousal followed by low arousal were associated with greater periods of positive emotions. Similarly, Frederickson et al. (2000) found that the experience of positive emotions sped the return of heart rate to baseline following a stressor.

Positive emotions have also been linked to improved physical health outcomes. Individuals randomly assigned to a loving-kindness meditation, compared
to a wait-list control group, reported an increase in positive emotions, which was associated with an increase in perceived social connectedness and improved vagal tone (Kok et al., 2013). In a sample of breast, prostate, and colorectal cancer patients of varying stages, higher levels of dispositional optimism were associated with less FOR in cancer patients, whereas those who were less optimistic reported greater worry about diagnostic tests (Diemling, Bowman, Sterns, Wagner, & Kahana, 2006). Optimism serves as a resource early in recovery, predicts positive adjustment during the year following breast cancer diagnosis, and is associated with more adaptive coping responses that lead to less distress following diagnosis and surgery (Carver et al., 1993; Stanton, Revenson, & Tennen, 2007). Indeed, optimism one-year prior to breast cancer diagnosis predicted better quality of life at a 1-year follow up (Schou, Ekeberg, & Ruland, 2005). Generally, optimists take better care of their health and are more proactive in health promotion (Carver, Scheier, & Segerstrom, 2010).

Gratitude has received little examination in the context of adversities such as cancer. The first study to our knowledge that examines gratitude in metastatic BC patients showed that cancer patients who report commonly feeling grateful following receipt of a benefit show increases in perceived social support over a three month period (Algoe & Stanton, 2011). However, these reports of gratitude were not necessarily directed at the patients’ romantic partner, but rather people with whom they had regular interactions. A recent examination of gratitude in a nonmetastatic BC population found that trait gratitude was associated with reports of post-traumatic growth (Ruini & Vescovelli, 2012). High-gratitude patients, compared to low-gratitude patients, reported higher levels of post-traumatic growth, contentment, and relaxation, and lower levels of anxiety, depression, and hostility, suggesting that those
with naturally higher levels of gratitude can perceive possible benefits from the cancer experience and have the potential for positive growth.

While gratitude has been linked to important individual and relationship outcomes, most of these outcomes are positive in nature (i.e., greater subjective well-being, better relationship quality). Little work has examined the benefit of gratitude on alleviation of negative outcomes. In one of the few studies to date, there is evidence that experimentally gratitude can decrease death anxiety, though this was not examined within a health population (Lau & Cheng, 2011). Participants in a gratitude condition were asked to recall events for which they felt grateful, thankful, or appreciative, and then completed a measure of death anxiety. Compared to individuals in a hassles or control condition, those in the gratitude condition reported less death anxiety. Lau and Cheng (2011) posit that gratitude operates by focusing an individual’s attention on his or her life in a positive light, and leads to reductions in a sense of unfulfilled wishes and regrets, promoting a sense of ego integrity and acceptance of death.

**Defining Gratitude**

Recent work has defined and explored the construct of gratitude as a complex, positive, and social emotion with clear intrapersonal and interpersonal effects that can be distinguished from other positively-valenced emotions and feelings of indebtedness or obligation (Algoe & Haidt, 2009; Goei & Boster, 2005; Tsang, 2006, 2007). Gratitude has been conceptualized in multiple ways: benefit-triggered gratitude occurs when one’s feelings of appreciation are related to receipt of a particular benefit (Lambert & Fincham, 2011). Research exploring this form of
gratitude suggests it is felt when the benefit is an intentional gesture that is valued to the recipient and comes at a cost to the benefactor (Tesser, Gatewood, & Driver, 1968). Another form discussed in the literature is generalized gratitude, which arises when feeling thankful occurs without the specific provision of a benefit (e.g., feeling grateful for waking up in the morning, being thankful for one’s health; Lambert, Graham, Fincham, & Stillman 2009). For the purpose of the present paper, we will be focusing on partner-specific gratitude which can be conceptualized as a combination of the previously described forms of gratitude in which one feels generally grateful to a specific person (i.e., his or her romantic partner). These feelings may be in response to a particular benefit provided by one’s partner (e.g., providing assistance in going to a doctor’s appointment) or may be a more general characteristic of the partner (e.g., feeling grateful that my partner is always there for me).

Gratitude (and most frequently, generalized forms of gratitude) has been consistently linked to individual well-being (e.g., McCullough, Emmons, & Tsang, 2002; Wood et al., 2010). People who are more grateful report experiencing more life satisfaction and greater subjective well-being (Peterson, Ruch, Beermann, Park, & Seligman, 2007; Sheldon & Lyubomirsky, 2006). Emmons and McCullough (2003) conducted a set of studies designed to examine the impact of gratitude on individual well-being, health, and positive emotion through an experimental manipulation designed to induce gratitude in daily life. Individuals in a gratitude condition experienced significantly higher levels of positive emotion and reported more prosocial behavior compared to control groups. Gratitude also has been shown to have unique effects on well-being when controlling for the 30 facets of the Big Five personality traits (Wood, Joseph, & Maltby, 2008). Moreover, a causal relationship
was demonstrated between gratitude and well-being such that gratitude was shown to lead to less stress, depression, and more perceived social support, while well-being was not a significant predictor of gratitude (Wood, Maltby, Gillett, Linley, & Joseph, 2008). Wood, Joseph, and Linley (2007) examined the effects of gratitude on coping style, and found that grateful individuals utilize more approach-oriented coping strategies, including instrumental and emotional social support, positive reinterpretation and growth, active coping, and planning. Gratitude was also negatively correlated with more dysfunctional forms of coping including behavioral disengagement, self-blame, substance use, and denial, and coping style was found to partially mediate the relationship between gratitude and well-being.

In addition to the individual benefits of gratitude, it has been linked with the promotion of prosocial behavior towards others (Bartlett & DeSteno, 1996) and has been described as a moral affect with important prosocial functions. Specifically, McCullough and colleagues (McCullough, Kilpatrick, Emmons, & Larson, 2001; McCullough, 2002) have argued that it functions as a moral barometer (a reliable emotional response to the perception that one is the recipient of a benefit provided by another), a moral motive (more motivated to act prosocially themselves), and a moral reinforcer (a grateful response provides reinforcement for a benefactor to act prosocially again in the future). Similarly, gratitude has been conceived of as an empathic emotion (Lazarus & Lazarus, 1994) in which a beneficiary can only experience gratitude when he or she is able to empathize with the benefactor’s expenditure of effort on behalf of the beneficiary. Wood et al. (2010) present a conceptualization of gratitude as a “life orientation,” containing eight factors including “appreciation of other people,” “focusing on the positive in the present moment,” and
“appreciation rising from understanding life is short” (pp. 891). Empirical research has demonstrated that these lower order facets of gratitude all load onto one single factor of gratitude, supporting the life orientation view (Wood, Maltby, Stewart, & Joseph, 2008). Taken together, this work demonstrates that gratitude is a positive emotion, associated with a positive life orientation, is related to enhanced life satisfaction and subjective and physical well-being, and serves to promote and engender prosocial behavior.

**Gratitude and Interpersonal Benefits**

Although much of the research on gratitude has focused on the intraindividual benefits described above, more recent work has begun to examine the social functions of gratitude and its role within interpersonal relationships, including friendships and romantic relationships. This work reveals that gratitude plays an important role in the development and maintenance of relationships, acting as a motivator of pro-relationship behavior in both new and ongoing relationships (Algoe et al., 2008; Kubacka, Finkenauer, Rusbult, & Keijzers, 2011; Lambert & Fincham, 2011). In an examination of newly forming friendships among sorority sisters, feelings of gratitude from gift recipients were predictive of both her own and her benefactor’s ratings of relationship quality in the short-term as well as one-month later (Algoe et al., 2008). Additionally, feelings of gratitude were predicted by perceived responsiveness of the benefactor, cost of the gift, and perceived effort. Lambert and Fincham (2011) found that expressions of gratitude enacted towards a friend, twice a week for three weeks, led to increases in voicing relationship concerns, a relationship maintenance behavior; individuals in neutral or positive thoughts conditions did not reap the same benefits.
In the context of romantic relationships, gratitude also plays an important role in the formation, sustainment, and enhancement of relationship functioning (Gordon et al., 2011; Lambert, Clark, Durtschi, Fincham, & Graham, 2010). Gratitude in ongoing, romantic relationships both arises from relationship maintenance behaviors and acts as a signal of partner responsiveness that in turn motivates one’s partner to enact future positive behaviors, creating a reciprocal system of positive behavior (Kubacka et al., 2011). In a diary study of gratitude in romantic relationships, daily reports of gratitude were associated with next day’s own relationship satisfaction for men and women and increased feelings of connectedness for men (Algoe et al., 2010). Additionally, partners of grateful individuals reported more next day relationship satisfaction and connection to their partners, suggesting that gratitude serves as a “booster shot” for romantic relationship. Gratitude has also been associated with increases in relationship commitment (Joel, Gordon, Impett, MacDonald, & Keltner, 2013). Perceptions of one’s partner’s investment in the relationship led to feelings of gratitude that motivated them to invest in the relationship and increase their own commitment to the relationship.

Recent work has made the distinction between feeling grateful versus expressions of gratitude to one’s significant other, and has produced some mixed results. Direct expressions of gratitude toward one’s partner have been linked with increases in one’s own perception of relationship communal strength (Lambert et al., 2010) and increases in comfort voicing relationship concerns (Lambert & Fincham, 2011). Both of these studies found that it was expressions of gratitude that led to these relationship benefits, while alternative conditions of grateful thoughts and positive thoughts did not, suggesting the unique power of spoken or written words of gratitude.
Expressions of gratitude during a gratitude-expression task for dating and married couples was associated with increased relationship satisfaction over a 6-month period for the benefactor of the expression (Algoe, Frederickson, and Gable, 2013). However, Gordon et al. (2011) reported a different pattern of results in a study of long-term married couples. In a daily diary study on partner-specific gratitude in long-term marriages, they found significant, unique effects for both daily felt and expressed gratitude on one’s own relationship satisfaction and relationship happiness. When examining cross-partner effects, Gordon et al. found that one partner’s felt gratitude, but not expressed gratitude, was associated with his or her partner’s relationship satisfaction and happiness. The authors had difficulty explaining these effects, but hypothesized that expressions of gratitude could be misinterpreted or may be overlooked in long-term relationships in which they become habit. Due to the relative novelty of this research area and divergent findings to date, we propose examining both felt and expressed gratitude, but do not have specific hypotheses about which of these forms may be more strongly related to relationship outcomes.

In the context of cancer, only two studies to date have examined gratitude. Ruini and Vescovelli (2012) examined the impact of gratitude on post-traumatic growth and psychological well-being in a cross-sectional examination of non-metastatic BC patients. Individuals who scored high on trait gratitude also reported greater amounts of post-traumatic growth and positive affect, and lower symptomatology (anxiety, depression, hostility-irritability) and reduced distress. Moreover, gratitude was associated with psychological well-being after controlling for age, in which younger individuals, who also reported higher levels of trait gratitude, reported higher levels of purpose in life and personal growth. The authors argue that
these associations indicate the importance of enhancing gratitude in a BC population to aid in adaptation. However, as a cross-sectional investigation, this study neglected how gratitude may operate in daily life or in the context of relationships with others.

In a second study examining the role of gratitude in the cancer context (Algoe & Stanton, 2011), patients with metastatic BC reported on how grateful they were for times during the previous month when others did things for them, and rated the frequency of their emotions, yielding a “typical grateful response” score. Typical grateful responding to benefits was associated with an increase in perceived social support from her network over a three-month period for women who were unambivalent about emotion expression; perceived social support did not increase for ambivalent women. This work suggests that gratitude, when experienced in the context of chronic stress, has implications for adaptive outcomes. However, this work fails to address how gratitude operates within the specific context of romantic relationship, arguably the person of most significance who frequently takes on the primary role of support for BC patients (Pistrang & Barker, 1995).

The present study addresses these issues by specifically examining gratitude within the context of a romantic relationship and uses reporting of affect and relationship functioning on a daily basis rather than retrospective or cross-sectional accounts. Although Algoe and Stanton (2011) examined the social functions of gratitude in a cancer context, their work does not address the functions of gratitude within the marital relationship, which has been conceptualized as critical to adjustment to cancer. Given the established importance of relationship functioning in adjustment to cancer for both patients and spouses/partners, and the robust effect of gratitude on relationship quality, the first aim of the present study is to examine the role of daily
partner-directed gratitude in enhancing relationship quality in couples coping with BC. We hypothesize that daily reports of felt and expressed gratitude towards one’s partner will be associated with increases in same day daily intimacy for both patients and partners (see Figure 1). To examine whether these effects can be more easily explained by simply feeling good, we will control for same day positive affect.

**Gratitude and Fear of Recurrence**

Because gratitude has been shown to provide interpersonal benefits as well as intrapersonal benefits, our second aim is to examine the effect of gratitude on fear of recurrence (FOR), one of the primary concerns of cancer patients and their partners for early stage BC (Costanzo et al., 2007) and head and neck cancer (Hodges & Humphris, 2009). Indeed, several studies in a wide range of cancers have found that caregivers often endorse higher levels of FOR than patients (e.g., Kim et al., 2011, Simard et al., 2013). FOR can be defined as the concern that one’s cancer may return, progress in the same organ, or the diagnosis of different cancers in the future. This fear is reported as one of the most common and persisting concerns of both cancer patients and their partners. Indeed, in many surveys of reported concerns of patients, it is most frequently one of the top two concerns reported. Fear of illness returning was rated as a number one or two concern with 48.8-74.2% of breast, colorectal, prostate, and lung cancer patients endorsing it as a main concern (Baker, Denniston, Smith, &West, 2005). FOR has been reported as a significant concern particularly during surveillance scans following treatment in lymphoma survivors (Thompson et al., 2010), suggesting certain cancer-related events that will continue for survivors may trigger feelings of FOR over time. Age has been shown to be a significant predictor of FOR, in which
younger BC patients report higher levels of FOR than older BC patients (Lebel, Beattie, Ares, & Bielajew, 2013).

FOR is a significant area of concern for patients and spouses in part because it is associated with psychological distress, such as anxiety, depression, intrusive thoughts, and PTSD symptoms in breast, prostate, colorectal (Diemling et al., 2006); head and neck (Hodges & Humphris, 2009), and short-term and long-term cancer patients (Gotay & Pagano, 2007). FOR is also correlated with lower levels of optimism, lower social support, and lower quality of life for both partners in breast cancer patients of all stages (Mehnert, Berg, Henrich, & Herschbach, 2009), breast, prostate, and colorectal cancers (Diemling et al., 1996), and the 10 most common forms of cancer (Kim et al., 2011). Although FOR is correlated with these psychosocial concerns, it also appears to be distinct from general emotional distress, indicating that it is a unique aspect of the cancer survivor experience (Diemling et al., 2006; Kim et al., 2011; Zhao, Portier, Stein, Baker, & Smith, 2009). In a factor analysis of the Cancer Problems in Living Scale (CPILS), Zhao et al. (2009) identified four distinct factors among patients with one of the 10 most highly incident cancers, comprising physical distress, emotional distress, employment/financial problems, and FOR, suggesting that FOR should be considered independent of general emotional distress that patients or their partners may report. Additionally, FOR is only moderately correlated with measures of psychological distress (e.g., .40-.60) in patients with BC (Mehnert et al., 2009) and breast, prostate, lung, and colorectal cancers; Simard & Savard, 2009).

In summary, cancer represents an experience that is associated with significant fear and anxiety for both patients and their partners. Chief among these
concerns is that of cancer returning or progressing in the body. Muzzin et al. (1994) described the experience of FOR as the sword of Damocles that hangs over the head of the patient and their family throughout their lives, without certainty of whether or when it might drop. Because of an initial experimental indication of gratitude’s role in allaying fears of death (Lau & Cheng, 2011), the second aim of the present study is to examine the role of daily partner-directed gratitude in lessening FOR. We hypothesize that daily reports of partner-directed gratitude will be associated with same day daily reports of FOR for both patients and their partners (see Figure 2). Again, to examine whether the effects of gratitude are unique, we controlled for same day positive affect.

**Interpersonal Context of FOR**

As described above, the relational context also plays an important role in adaptation to life after cancer and perhaps to fears of recurrence. Indeed, being in a supportive relationship has been linked to adjustment following breast cancer (Stanton et al., 2007), and specifically linked to lower FOR for some cancer patients. In a sample of men with prostate cancer, partnered men reported lower FOR than unpartnered men (Bergman, Gore, Saigai, Kwan, & Litwin, 2009). FOR occurs in a dyadic context, such that in a sample of head and neck patients, one partner’s FOR predicted subsequent FOR and distress in his/her partner (Hodges & Humphris, 2009), and in a sample of the top 10 highly incident cancers, a caregiver’s FOR was related to patient’s physical health (Kim et al., 2011).

Experimental research has shown relationships are an important resource for helping individuals cope with negative emotions. Coan, Schaefer, and Davidson (2006) demonstrate that social relationships, and particularly intimate relationships,
aid in regulation of individual emotions. Coan et al. (2006) found that when women were subjected to the threat of electric shock, holding their partner’s hand (vs. a stranger or no hand holding) was associated with an attenuation of activation in the neural systems supporting behavioral and emotional threat responses. Moreover, this effect was moderated by relationship quality, such that women in higher quality relationships reaped the neural activation benefit of holding their partner’s hand. Knowing that one’s partner is there for them and cares about them in a time of stress, may contribute to decreases in their fear.

Because of the dyadic nature of FOR and the importance of intimacy and good relationship quality in adaptation to cancer, we propose that intimacy may be the mechanism through which gratitude influences FOR. That is, being grateful to one’s partner serves to enhance relationship processes such as intimacy, making both patient and partner feel understood and cared for (Reis & Shaver, 1988), and aiding in alleviation of fear. This mediation model is exploratory.

**Overview of the Present Study and Hypotheses**

The overall goal of the present study is to examine the potential benefits of partner-directed gratitude in daily life for couples undergoing a significant stressor, early stage BC in the female partner. Based on research demonstrating the relational nature of psychosocial adaptation to cancer diagnosis and treatment, and the importance of engaging couples in processes that serve to enhance relationship intimacy to better cope with adversity, we aim to examine the association between daily gratitude, relationship closeness, and FOR in both patients and partners.
These aims are examined using an electronic daily diary methodology. Diary methods are conducive to i) assessing more dynamic processes in interpersonal relationships that might otherwise be obscured when using cross-sectional or long-term longitudinal assessments, and ii) elucidating within-subject processes that unfold over time (Bolger & Laurenceau, 2013; Laurenceau & Bolger, 2005). Moreover, diary studies also lessen retrospective bias errors by decreasing the amount of time between the experience of an event and the report of the event, asking individuals to report on experiences and emotions they are currently experiencing or have experienced during that day (Bolger, Davis, & Rafaeli, 2003).

We specifically hypothesize that (1) on days that patients and spouses/partners report expressing and feeling partner-directed gratitude, they would also report greater levels of relationship intimacy and closeness, (2) on days that patients and spouses/partners report expressing and feeling partner-directed gratitude, they would also report lower levels of FOR, and (3) the daily association between partner-directed gratitude and FOR would be mediated through relationship intimacy, such that increased levels of gratitude would lead to greater intimacy towards one’s partner, that in turn would lead to lower levels of FOR. All variables were measured on the same day and analysis focused on contemporaneous within-person links as we expect that the effects of gratitude and intimacy on FOR would occur over the course of minutes or hours (rather than days) and any day-lagged effects would fail to capture these associations. Implications of this work include informing psychosocial interventions that can aid couples in better adaptation to life following BC treatment.
Chapter 2

METHOD

Participants

The sample consisted of 44 BC patients and their spouses/partners. Eligible participants were recruited from the Helen F. Graham Cancer Center of the Christiana Care Health System. Eligibility criteria included: (1) cancer patients must have had a diagnosis of early stage BC (i.e., DCIS, stage 1, 2a, 2b, or 3a), (2) must have received surgery for breast cancer, either a mastectomy or lumpectomy, and (3) must be married or in a cohabiting relationship. Following surgery, participants were able to receive a) adjuvant radiation, b) chemotherapy, c) both treatments, or d) neither adjuvant treatment. Participants also had to be English speakers over the age of 18. Potential participants were identified by a research coordinator working at the Helen F. Graham Cancer Center, who obtained a list of positive biopsies, reviewed medical records to determine cancer stage and marital/partnership, and referred eligible participants to a research assistant at the University of Delaware immediately following BC surgery. For their participation in the study, individuals were compensated up to $105 for volunteering their time to this portion of a larger, ongoing study.

Patients were on average 52.07 years old (SD = 11.24) and spouses/partners were on average 54.44 years old (SD = 13.00). With regard to race, 6.8% of participants identified themselves as Asian, 6.8% identified themselves as Black/African-American, 84.1% identified themselves as Caucasian, and 2.3% identified themselves as “Other.” For yearly household income, 11.4% reported they
made between $20,001-$40,000, 13.6% reported they made between $40,001-$60,000, 22.7% reported that they made between $60,001-$80,000, 18.2% reported that they made between $80,001-$100,000, and 27.3% reported that they made more than $100,000. Three couples did not report their yearly income. For patients, 36.4% reported that they were not working, 36.4% reported that they worked part time, and 27.3% reported that they worked full time. For spouses, 22.7% reported that they were not working and 70.5% reported that they worked full time. Three spouses did not report their occupational status.

Couples had been in their relationships on average 24.21 years (SD = 13.95). Regarding relationship status, 93.2% percent of couples were married and 4.5% were in a committed relationship, which included one same-sex couple. One couple did not disclose their relationship status. With regard to cancer treatments, 36.4% of patients reported that they received chemotherapy and 56.8% of patients reported that they received some type of anti-hormonal treatment (e.g., Tamoxifen, Arimidex). Two patients did not report whether they had received chemotherapy or anti-hormonal treatments.

**Procedure**

Couples participated in a daily diary study that was funded by an NCI grant. The study followed a diary burst design in which two 10-day daily diary periods took place six months apart. The first time point of participation was on average 24 days (SD = 16.10) following surgery and the second time point was on average 7.7 months (SD = 1.49 months) following surgery. An approximate six month gap between times points was selected because most patients engaging in any adjuvant
treatments would be expected to be completed by that time. Specifically, we expected that FOR would be more likely to be experienced by patients once they had completed their treatments, excluding longer term anti-hormonal treatments, and were engaging in less regular contact with their hospital and treatment team. The data presented in the current study come exclusively from the second time point, which is when FOR was measured.

Eligible patients were identified by a research coordinator located at the Helen F. Graham Cancer Center using information gained from surgical pathology reports following patients’ definitive surgical procedures. This information was gathered from patients’ medical charts and tumor registries. Contact information for those early stage BC patients meeting the study criteria outlined above was then provided to a UD research assistant. Each eligible couple was mailed a brochure that provided information about the study and study contact information for interested couples. Eligible couples were also contacted by phone to determine interest in participation. Interested couples were then mailed packets containing consent forms, forms to determine the dates of their daily diary participation, and information to access the internet surveys. Participants then returned their consent forms and forms indicating their dates for completing their daily diaries by mail and were then able to login to the cross-sectional and daily surveys. Participants were instructed to complete the cross-sectional measures, including demographic information, prior to beginning the diary period. They were also instructed to complete the daily diary surveys before bed. For all cross-sectional and daily surveys, each participant was instructed to complete the surveys independently from their partner and were provided unique ID
numbers that permitted their data to remain confidential and to be linked to all of their responses and their partner’s responses.

One hundred and twenty two (122) couples were contacted to participate (244 individuals). Of those couples, 64 declined participation (53.3%; 47 were passive decliners, 8 were not interested, and 10 husbands were not willing to participate). Fifty seven (57) couples consented to participate (46.7%). Of those couples, three did complete the surveys (passive decliners). The remaining 54 couples completed their participation for the first time point. Of those 54 couples, 44 couples completed participation for the second time point (81.5%; 6 passive decliners, 2 declined, and 2 provided incomplete data).

All survey items, both cross-sectional and daily, were completed via a secure, online survey website (www.qualtrics.com) so that all participants could complete them from their home computers. Any entries that were completed outside of the instructed evening hours were considered invalid and discarded. On average, participants completed 8.23 valid diary days out of 10. All valid data were used in these analyses.

**Daily Measures**

Partner-directed gratitude. Gratitude was measured as both felt gratitude and expressed gratitude. Participants indicated their felt gratitude by rating the extent to which they felt thankfulness, appreciation, and gratitude as a result of their partner’s actions on that day (Algoe, Gable, & Maisel, 2010). These three items were rated on a 7-point Likert scale ranging from 0 (not at all) to 6 (very much). Reliability for this measure was calculated using coefficient Omega, which assesses within-person
change for multi-item scales through multilevel confirmatory factor analysis (Bolger & Laurenceau, 2013; Cranford et al., 2006; Shroot & Lane, 2012). Reliability of within-person change for these multi-item daily diary scales showed excellent reliability for patient (ω = 0.91) and spouse (ω = 0.90) felt gratitude. Participants indicated their expressed gratitude using a single-item with a binary response: whether or not (yes/no) “I thanked my spouse/partner for something he/she did that I appreciated.”

**Positive affect.** Momentary positive affect was measured with items culled from the Positive and Negative Affect Schedule – Expanded Form (PANAS-X; Watson & Clark, 1994). These items included interested, determined, enthusiastic, excited, inspired, cheerful, and lively. Participants rated the extent to which they felt each item AT THIS MOMENT on a 5-point Likert scale ranging from 1 (very slightly or not at all) to 5 (extremely). These items were averaged to create a positive affect (PA) composite. Reliability of within-person change for these multi-item daily diary scales showed good reliability for the PA composite for both patients (ω = 0.88) and spouses (ω = 0.87).

**Relationship outcomes.** Relationship intimacy was assessed during each evening diary using three items. The first two items, “At this moment, how much intimacy/connectedness do you feel with your partner?” and “At this moment, how emotionally close do you feel with your partner?” were rated on a 7-point Likert scale ranging from 0 (not at all) to 6 (an extreme amount). Items such as these have been used previously to assess daily relationship intimacy (e.g., Laurenceau, Troy, & Carver, 2005; Laurenceau, Feldman-Barrett, & Rovine, 2005). The third item, from the Dyadic Adjustment Scale (Spanier, 1976), asked participants to rate their “degree
of happiness, all things considered, with their relationship right now,” and was also rated on a 7-point Likert scale from 1 (extremely unhappy) to 7 (perfect). These three items were averaged to create an intimacy composite. This composite demonstrated good reliability of within-person change for patients ($\omega = 0.84$) and spouses ($\omega = 0.91$).

**Fear of Recurrence (FOR).** FOR was assessed each evening for both patients and partners using the Cancer Worry Subscale of the Assessment of Survivor Concerns (ASC; Gotay & Pagano, 2007). Patients indicated the degree to which they worried about the following three items that day: “future diagnostic tests,” “another type of cancer,” and “about my cancer coming back.” These items were rated on a 4-point Likert scale: 0 (not at all), 1 (a little bit), 2 (somewhat), 3 (very much). Spouses/partners completed complementary items assessing their worries about these items for their partner using the same scale. These items were summed and the ASC composite showed acceptable reliability of within-person change: patients ($\omega = 0.78$) and spouses ($\omega = 0.81$).
Chapter 3

RESULTS

Data Analytic Strategy

The diary design consisted of 10 consecutive daily observations provided by each of the breast cancer patients and her spouse/partner. For the purpose of clarity, all patients will be referred to as “patient” and all spouses or partners will be referred to as “spouse” in the analyses below. These data corresponded to a multilevel data structure (Kenny, Kashy, & Bolger, 1998; Laurenceau & Bolger, 2005; Raudenbush & Bryk, 2002) where there were repeated measures of predictors nested within individuals who in turn are nested within couples. We conceived of patient and spouse outcomes as multivariate outcomes of a couple, thus resulting in within-couple and between-couple levels of analysis (Laurenceau & Bolger, 2005; Raudenbush, Brennan, & Barnett, 1995). Multilevel modeling of these data allows for the interdependency due to individuals coming from couples to be modeled.

Dyadic multilevel path modeling with multivariate outcomes for patients and spouses was employed, enabling us to estimate parameters for both spouses simultaneously (Bolger & Laurenceau, 2013; Cook & Kenny, 2005). We also used the actor-partner interdependence model (APIM; Cook & Kenny, 2005; Kashy & Kenny, 1999) that permits us to estimate both actor and partner effects. Actor effects are those within-person effects of regressing patient outcomes on patient predictors (termed patient actor effects) and regressing spouse outcomes on spouse predictors (termed spouse actor effects). These effects are represented in Figure 1 by the paths labeled A. Partner effects are those within-person effects of regressing patient outcomes on spouse predictors (termed patient partner effects) and regressing spouse outcomes on patient predictors (termed spouse partner effects). That is, the person associated with
the outcome variable is identified in reference to that particular partner effect. These partner effects are represented by the paths labeled B in Figure 1. The APIM framework enabled us to examine whether patient and spouse partners influenced one another’s outcomes, above and beyond any actor effects. Analyses were conducted using both R (R Core Team, 2013) and Mplus 7 (Muthén & Muthén, 1998-2012).

Additionally, we accounted for the fact that each of the daily predictor variables comprises both within-person (i.e., day-to-day) and between-person (i.e., person-to-person) variability. We isolated the within-person variability in each of our predictor variables by mean centering these variables and extracting the between-person components of variability that can be considered more trait-like and re-entering them into the model as level 2 predictors (Bolger & Laurenceau, 2013; Graber, Laurenceau, & Carver, 2011). This was done for each of the models described below to allow coefficients used to evaluate the hypotheses to represent pure within-person effects.

For all of the results presented below, separate models were run with felt gratitude and expressed gratitude as predictors. Results are provided for models with felt gratitude followed by expressed gratitude. Means, standard deviations, and intraclass correlations for study variables are presented in Table 1. Correlations of predictor variables are presented in Table 2.
Table 1

*Means, Standard Deviations and Interclass Correlations of Study Variables*

<table>
<thead>
<tr>
<th>Daily Variable</th>
<th>Mean</th>
<th>Variance</th>
<th>ICC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Between</td>
<td>Within</td>
</tr>
<tr>
<td>Patient Felt Gratitude</td>
<td>4.304</td>
<td>0.077</td>
<td>0.714</td>
</tr>
<tr>
<td>Spouse Felt Gratitude</td>
<td>3.458</td>
<td>2.032</td>
<td>0.810</td>
</tr>
<tr>
<td>Patient Expressed Gratitude</td>
<td>0.661</td>
<td>0.077</td>
<td>0.145</td>
</tr>
<tr>
<td>Spouse Expressed Gratitude</td>
<td>0.616</td>
<td>0.097</td>
<td>0.135</td>
</tr>
<tr>
<td>Patient Intimacy</td>
<td>4.290</td>
<td>0.734</td>
<td>0.266</td>
</tr>
<tr>
<td>Spouse Intimacy</td>
<td>4.278</td>
<td>0.851</td>
<td>0.414</td>
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<tr>
<td>Patient FOR</td>
<td>1.644†</td>
<td>4.524</td>
<td>1.077</td>
</tr>
<tr>
<td>Spouse FOR</td>
<td>1.761†</td>
<td>4.377</td>
<td>1.579</td>
</tr>
<tr>
<td>Patient PA</td>
<td>1.145</td>
<td>0.363</td>
<td>0.266</td>
</tr>
<tr>
<td>Spouse PA</td>
<td>1.164</td>
<td>0.569</td>
<td>0.228</td>
</tr>
</tbody>
</table>

†Note: FOR for patients and spouses is a sum rather than a mean.
Table 2

*Within-person Correlations of Study Predictor Variables*

<table>
<thead>
<tr>
<th></th>
<th>Patient Felt Gratitude</th>
<th>Spouse Felt Gratitude</th>
<th>Patient Expressed Gratitude</th>
<th>Spouse Expressed Gratitude</th>
<th>Patient Intimacy</th>
<th>Spouse Intimacy</th>
<th>Patient PA</th>
<th>Spouse PA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient Felt Gratitude</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spouse Felt Gratitude</td>
<td>0.219</td>
<td>1.000</td>
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<td></td>
</tr>
<tr>
<td>Patient Expressed Gratitude</td>
<td>0.183</td>
<td>-0.006</td>
<td>1.000</td>
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<tr>
<td>Spouse Expressed Gratitude</td>
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<td>0.260</td>
<td>0.120</td>
<td>1.000</td>
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<tr>
<td>Patient Intimacy</td>
<td>0.516</td>
<td>0.331</td>
<td>0.154</td>
<td>0.173</td>
<td>1.000</td>
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<tr>
<td>Spouse Intimacy</td>
<td>0.113</td>
<td>0.493</td>
<td>0.074</td>
<td>0.305</td>
<td>0.389</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient PA</td>
<td>0.172</td>
<td>0.228</td>
<td>0.025</td>
<td>0.011</td>
<td>0.209</td>
<td>0.063</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>Spouse PA</td>
<td>0.122</td>
<td>0.235</td>
<td>-0.040</td>
<td>0.095</td>
<td>0.234</td>
<td>0.258</td>
<td>0.279</td>
<td>1.000</td>
</tr>
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</table>
**Effects of Gratitude on Intimacy**

To examine Hypothesis 1, we first tested the effect of gratitude on relationship intimacy, controlling for positive affect (see Figure 1). The dyadic multilevel mixed model equations for the relationship between partner-directed felt gratitude and intimacy, controlling for positive affect, is as follows:

\[
\text{Intimacy}_{\text{tip}} = \gamma_{00p} + \gamma_{01p}(PF\text{Grat}b)i + \gamma_{02p}(SFG\text{rat}b)i +
\gamma_{10p}(PF\text{Grat}w)ti + \gamma_{20p}(SFG\text{rat}w)ti + \gamma_{30p}(PP\text{Aw})ti + \gamma_{40p}(\text{Day0})ti +
\]

\[
u_{0ip} + u_{1ip}(PF\text{Grat}w)ti + u_{2ip}(SFG\text{rat}w)ti + etip
\]

\[
\text{Intimacy}_{\text{tis}} = \gamma_{00s} + \gamma_{01s}(SFG\text{rat}b)i + \gamma_{02s}(PF\text{Grat}b)i +
\gamma_{10s}(SFG\text{rat}w)ti + \gamma_{20s}(PF\text{Grat}w)ti + \gamma_{30s}(SP\text{Aw})ti + \gamma_{40s}(\text{Day0})ti +
\]

\[
u_{0is} + u_{1is}(SFG\text{rat}w)ti + u_{2is}(PF\text{Grat}w)ti + etis
\]

where Intimacy_{tip} and Intimacy_{tis} are daily outcomes of patient (p) and spouse (s) relationship intimacy for a particular couple where t represents diary day and i represents couple; \(\gamma_{00p}\) and \(\gamma_{00s}\) are model intercepts for patient and spouse, respectively; \(\gamma_{01p}\) and \(\gamma_{01s}\) are between-couple felt gratitude coefficients for patient and spouse, representing actor effects; (PFGratb)i and (SFGratb)i are between-couple mean variables, representing the average of each person’s reports across the 10 diary days for patient and spouse of felt gratitude for couple i; \(\gamma_{02p}\) and \(\gamma_{02s}\) are between-couple felt gratitude coefficients for patient and spouse, respectively, representing partner effects; (SFGratb)i and (PFGratb)i are between-couple mean variables, representing the average of each person’s reports across the 10 diary days for patient and spouse of expressed gratitude at the end of day t for couple i; \(\gamma_{10p}\) and \(\gamma_{10s}\) are the within-couple coefficients of daily felt gratitude for patients and spouses,
respectively, representing an actor effect; (PFGratw)ti and (SFGratw)ti are person-centered variables, representing within-couple (day-to-day) variability of patient and spouse report of felt gratitude at the end of day t for couple i; γ20p and γ20s are the within-couple coefficients of daily felt gratitude for patients and spouses, respectively, representing a partner effect; (SFGratw)ti and (PFGratw)ti are person-centered variables, representing within-couple (day-to-day) variability of patient and spouse report of expressed gratitude at the end of day t for couple i; γ30p and γ30s are the within-couple coefficients of daily positive affect for patients and spouses, respectively, representing an actor effect; (PPAw)ti and (SPA)ti are person-centered variables, representing within-couple (day-to-day) variability of patient and spouse report of positive affect at the end of day t for couple i; and γ40p and γ40s are the within-couple coefficients of day for patients and spouses, respectively; and (Day0)ti represents time elapsed from 0 to 9.

Turning to the random effects, u0ip and u0is, u1ip and u1ip, and u2ip and u2ip, are between-couple residual components; and etip and etis are the within-couple error terms, or random components of relationship intimacy for patients and spouses, respectively, on day t for couple i. The within-couple error components are permitted to covary between partners and represents the within-day interdependence between patient and spouse in intimacy that is not accounted for by felt gratitude or positive affect. This paired set of multilevel regression equations was estimated and permitted us to examine the unique within-couple effects of felt gratitude, controlling for positive affect on that same day.
Figure 1. Dyadic Multilevel Model Examining the Effect of Gratitude on Relationship Intimacy, Controlling for Positive Affect

Level 2 (between-couple)

Level 1 (within-couple)

Patient Gratitude

Patient PA

Spouse Gratitude

Spouse PA

Patient Intimacy

Spouse Intimacy

Spouse Gratitude

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**Felt Gratitude.** When the above models were run, the effect of felt gratitude on intimacy for patients and spouses appeared similar and we constrained these effects to create a more parsimonious model. The chi-square goodness-of-fit value showed that there was not a statistical difference between the models when comparing one model that held the two parameters to be equal, and a second model that allowed them to vary independently ($\Delta \chi^2(1) = .01, p=.99$), thus providing evidence that the constrained model was a good fit for these data. The results described below and presented in Table 3 reflect the constrained model.

We found a significant within-person actor effect where felt gratitude emerged as a significant predictor of intimacy for both patients and spouses ($B = 0.316, t = 10.71, p < .0001$). That is, on days that patients and spouses reported higher levels of grateful feelings, they also reported higher levels of intimacy with their partner on that same day. In terms of partner effects, patient’s reports of felt gratitude was a significant within-person predictor of spouse’s intimacy ($B = 0.156, t = 3.83, p = .0004$), but spouse’s felt gratitude did not significantly predict patient intimacy ($B = 0.011, t = 0.27, p > .05$). These findings controlled for same day positive affect.

**Expressed Gratitude.** The model described above was also examined with expressed gratitude as a predictor and results are shown in Table 3. Again, the effects were constrained between wives and husbands and a statistical comparison of constrained and unconstrained models showed no significant difference between model fit ($\Delta \chi^2(1) = 3.86, p = ns$). For actor effects, gratitude was a significant within-person predictor of intimacy ($B = 0.338, t = 4.43, p < .0001$), controlling for same day positive affect. On days that patients and spouses reported expressing their gratitude to
their partner, they also reported experiencing higher levels of relationship intimacy. There were no significant partner effects in this model.
Table 3
Results for Hypothesis 1: Effects of Gratitude on Relationship Intimacy Controlling for Positive Affect

<table>
<thead>
<tr>
<th>Effect</th>
<th>Estimate</th>
<th>SE</th>
<th>Lower</th>
<th>Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Felt Gratitude</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient Actor Effect</td>
<td>0.306***</td>
<td>0.030</td>
<td>0.247</td>
<td>0.365</td>
</tr>
<tr>
<td>Spouse Actor Effect</td>
<td>0.306***</td>
<td>0.030</td>
<td>0.247</td>
<td>0.365</td>
</tr>
<tr>
<td>Patient Partner Effect</td>
<td>0.156***</td>
<td>0.041</td>
<td>0.076</td>
<td>0.236</td>
</tr>
<tr>
<td>Spouse Partner Effect</td>
<td>0.011</td>
<td>0.041</td>
<td>-0.069</td>
<td>0.091</td>
</tr>
<tr>
<td>Patient PA</td>
<td>0.073</td>
<td>0.074</td>
<td>-0.072</td>
<td>0.218</td>
</tr>
<tr>
<td>Spouse PA</td>
<td>0.238***</td>
<td>0.008</td>
<td>0.222</td>
<td>0.254</td>
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<tr>
<td><strong>Expressed Gratitude</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Patient Actor Effect</td>
<td>0.338***</td>
<td>0.076</td>
<td>0.189</td>
<td>0.487</td>
</tr>
<tr>
<td>Spouse Actor Effect</td>
<td>0.338***</td>
<td>0.076</td>
<td>0.189</td>
<td>0.487</td>
</tr>
<tr>
<td>Patient Partner Effect</td>
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<td>0.108</td>
<td>-0.011</td>
<td>0.413</td>
</tr>
<tr>
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<td>0.105</td>
<td>-0.104</td>
<td>0.308</td>
</tr>
<tr>
<td>Patient PA</td>
<td>0.183*</td>
<td>0.080</td>
<td>0.026</td>
<td>0.340</td>
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<tr>
<td>Spouse PA</td>
<td>0.328***</td>
<td>0.083</td>
<td>0.165</td>
<td>0.491</td>
</tr>
</tbody>
</table>

*Note. Actor effects have been constrained to be equal for patients and spouses, *p<0.05 **p<0.01 ***p<0.001*
Effects of Gratitude on FOR

To evaluate Hypothesis 2, we examined the effect of gratitude on FOR, again controlling for positive affect (see Figure 2). The dyadic multilevel mixed model equations for the relationship between partner-directed gratitude and FOR, controlling for positive affect, are the same as the models described above with FOR as the outcome variable instead of relationship intimacy. FOR emerged as a non-normally distributed variable with a strong positive skew. This type of distribution violates the assumption of normally distributed residuals in an outcome variable and can lead to inaccurate standard errors and p-values when using OLS regression (Atkins & Gallop, 2007). To account for this, we used a Poisson distribution for FOR in all of the multilevel modeling analyses described below (Coxe, West, & Aiken, 2009).
Figure 2. *Dyadic Multilevel Model Examining the Effect of Felt and Expressed Gratitude on Fear of Recurrence, Controlling for Positive Affect*
**Felt Gratitude.** Results for this analysis are presented in Table 4. As done above, the effect of felt gratitude was constrained between wives and husbands and a statistical comparison of constrained and unconstrained models showed no significant difference between model fit (Δχ2(1) = 0.21, p=0.65). Within-person felt gratitude was not a significant predictor of FOR for patients and spouses (B = 0.03, t = 0.861, p > .05, rate ratio = 1.03). We did find a significant partner effect for spouses (B = 0.16, t = 2.806, p = .008, rate ratio = 1.17), such that on days that spouses reported feeling more grateful, patients reported higher levels of FOR on that same day. This rate ratio shows that for every 1 unit increase in spouse felt gratitude, the model predicted a 17% increase in the expected FOR count for patients. The corresponding partner effect was not significant for patients (B = -0.01, t = 0.11, p = ns, rate ratio = 0.99).

**Expressed Gratitude.** Results for this analysis are shown in Table 4. Examining the model above using expressed gratitude as the focal predictor, telling one’s partner of their gratitude was not associated with one’s own reports of FOR (B = -0.02, t = -0.235, p > .05, rate ratio = 0.98). Additionally, there were no significant partner effects for patients (B = 0.06, t = 0.481, p > .05, rate ratio = 1.06) or spouses (B = 0.05, t = 0.422, p > .05, rate ratio = 1.05).
Table 4
Results for Hypothesis 2: Effects of Gratitude on FOR Controlling for Positive Affect

<table>
<thead>
<tr>
<th>Effect</th>
<th>Estimate</th>
<th>SE</th>
<th>Lower</th>
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</thead>
<tbody>
<tr>
<td><strong>Felt Gratitude</strong></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Patient Actor Effect</td>
<td>0.032</td>
<td>0.037</td>
<td>-0.041</td>
<td>0.105</td>
</tr>
<tr>
<td>Spouse Actor Effect</td>
<td>0.032</td>
<td>0.037</td>
<td>-0.041</td>
<td>0.105</td>
</tr>
<tr>
<td>Patient Partner Effect</td>
<td>-0.005</td>
<td>0.050</td>
<td>-0.103</td>
<td>0.093</td>
</tr>
<tr>
<td>Spouse Partner Effect</td>
<td>0.160**</td>
<td>0.057</td>
<td>0.048</td>
<td>0.272</td>
</tr>
<tr>
<td>Patient PA</td>
<td>0.107</td>
<td>0.090</td>
<td>-0.069</td>
<td>0.283</td>
</tr>
<tr>
<td>Spouse PA</td>
<td>-0.118</td>
<td>0.084</td>
<td>-0.283</td>
<td>0.047</td>
</tr>
<tr>
<td><strong>Expressed Gratitude</strong></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Patient Actor Effect</td>
<td>-0.020</td>
<td>0.231</td>
<td>-0.473</td>
<td>0.433</td>
</tr>
<tr>
<td>Spouse Actor Effect</td>
<td>-0.020</td>
<td>0.231</td>
<td>-0.473</td>
<td>0.433</td>
</tr>
<tr>
<td>Patient Partner Effect</td>
<td>0.056</td>
<td>0.116</td>
<td>-0.171</td>
<td>0.283</td>
</tr>
<tr>
<td>Spouse Partner Effect</td>
<td>0.049</td>
<td>0.115</td>
<td>-0.176</td>
<td>0.274</td>
</tr>
<tr>
<td>Patient PA</td>
<td>0.119</td>
<td>0.087</td>
<td>-0.052</td>
<td>0.290</td>
</tr>
<tr>
<td>Spouse PA</td>
<td>-0.073</td>
<td>0.080</td>
<td>-0.230</td>
<td>0.084</td>
</tr>
</tbody>
</table>

*Note. Actor effects have been constrained to be equal for patients and spouses, *p<0.05 **p<0.01 ***p<0.001. Due to the use of poisson regression, estimates are on a log scale.*
Mediation Model Examining Effect of Gratitude on FOR through Intimacy

To examine Hypothesis 3 in which relationship intimacy is proposed to mediate the relationship between partner-directed gratitude and FOR for both partners and spouses, we used a dyadic, within-subject multilevel mediation model in which all three variables are lower level within-person variables (i.e., $1 \rightarrow 1 \rightarrow 1$; Bauer, Preacher, & Gill, 2006; Kenny Korchmaros, & Bolger, 2003; Krull & MacKinnon, 2001). In addition, we employed the extended version of the APIM framework described above that is designed specifically for mediation, APIMeM (actor-partner interdependence mediation model; Ledermann, Macho, & Kenny, 2011). As depicted in Figure 3, APIMeM allows for examination of actor and partner effects of the a ($X \rightarrow M$; association between gratitude and relationship intimacy), b ($M \rightarrow Y$; association between intimacy and FOR), and c’ ($X \rightarrow Y$; association between gratitude and FOR) paths. For each of these paths, actor effects are notated by the subscript “A” and partner effects are notated by the subscript “B.” Effects for the patient are notated by the subscript “1” and effects for the spouse are notated by the subscript “2.” Combining actor and partner effects for the a, b, and c’ paths allow for four distinct types of mediation effects to be examined. Actor-mediated actor effects are those in which the X, Y, and M variables all come from the same person. In Figure 3, this can be represented by paths aA1, bA1, and c’A1. Partner-mediated partner effects are those in which the X and Y variables come from different persons and the M and Y variables come from different persons. In Figure 3, this is represented by the associations between spouse gratitude, spouse intimacy, and patient FOR (paths aA2, bP1, and c’P1). Partner-mediated actor effects are those in which the X and Y variables come from one person and the M comes from the other partner. For example,
this is represented in Figure 3 by the association between patient gratitude, spouse intimacy, and patient FOR (paths aP2, bP1, and c’A1). Finally, actor-mediated partner effects are those in which the X and Y variables come from different partners and the M and Y variables come from the same person. This is depicted in Figure 3 by the association between patient gratitude, spouse intimacy, and spouse FOR (paths aP2, bA2, and c’P2). In summary, the relationship between the mediator (M) and outcome (Y) variables dictates whether the effect is actor-mediated or partner-mediated and the relationship between the predictor (X) and the outcome (Y) dictates whether the effect is an actor effect or partner effect.
Figure 3. *APIM Dyadic Multilevel Mediation Model where the Effect of Gratitude on Fear of Recurrence is Mediated by Relationship Intimacy*

*Note.* Because Patient and Spouse Intimacy are outcome variables of the $a$ paths and Patient and Spouse Fear of Recurrence are outcome variables of the $b$ and $c'$ paths, our analyses include a covariance between their errors but is not depicted. In this model, all actor effects (i.e., pathways $a_{A1}$ and $a_{A2}$, $b_{A1}$ and $b_{A2}$, and $c'_{A1}$ and $c'_{A2}$) are constrained to be equal. Patient and spouse positive affect are not depicted in this model but were controlled for in this analysis.
In addition, this model would allow us to examine within-couple processes as well as between-couple heterogeneity by allowing the a and b paths to vary across participants. As with the previous models, we used person-mean deviated versions of gratitude and intimacy to isolate the within-person variability of these variables in the multilevel mediation model.

An important hurdle to examining mediation in the context of the present study is that traditional approaches to mediation assume that the mediator and outcome variable are both continuous and normally distributed in nature. This assumption, however, does not hold here. In the present study, the a path is based on a linear regression model where intimacy (the mediator) is regressed on gratitude (the predictor). However, the b path is based on a nonlinear Poisson regression model where FOR (the outcome) is a count outcome regressed on intimacy (the mediator), holding constant gratitude (the predictor). When the assumption of normally distributed mediator and outcome variables is violated, the product of the a path and b paths as a traditional test of the indirect effect is incorrect (Valeri & VanderWeele, 2013). This is because, in the present study, the a path results in a coefficient that represents the linear shift in the outcome due to the predictor whereas the b path represents the expected shift in the log count of the outcome due to the mediator. To estimate indirect effects and conduct appropriate significance tests, we made use of a more general approach to mediation analysis (Imai, Keele, & Tingley, 2010; VanderWeele and Vansteelandt, 2009, 2010) based on recent statistical advances that can accommodate nonlinearities (e.g., count or binary models) in the associations between predictors and outcomes. When the mediator and outcome variables are both continuous and normally distributed, this general approach will yield the same results.
as the traditional Baron and Kenny (1986) model of mediation. Additionally, similar to the traditional Baron and Kenny model, this more general mediation framework allows for estimation of the total effects, direct effects, and indirect effects as well as provides confidence intervals for inference tests.

To explore Hypothesis 3, we first utilized the results from Hypothesis 1 in which daily reports of gratitude was a significant predictor of daily relationship intimacy for patients and spouses (a path; see Tables 5 and 6). We then regressed FOR on gratitude and intimacy to identify the b and c’ paths. The results for the dyadic multilevel mediation model with felt gratitude as the focal predictor are reported first, followed by the corresponding model with expressed gratitude.

**Felt Gratitude.** Results are presented in Table 5 and depicted in Figure 4. Statistical comparison of constrained and unconstrained models showed no significant difference between model fit ($\Delta \chi^2(2) = 3.86$, $p=.05$) and the actor effects for felt gratitude and intimacy were constrained between wives and husbands. For the b path, representing the effect of relationship intimacy on FOR while controlling for felt gratitude, we found a significant actor effect in which on days that patients and spouses reported higher intimacy, they also reported significantly lower levels of FOR ($B = -0.29$, $t = -4.25$, $p = .0001$; rate ratio = 0.75). This indicates that for every one unit increase in intimacy, patients and spouses experienced a 25% decrease in the expected FOR count that same day. The corresponding partner effects for patients ($B = -0.11$, $t = -1.25$, $ns$; rate ratio = 0.89) and spouses ($B = 0.03$, $t = 0.22$, $ns$; rate ratio = 1.03) were not significant.
For the c’ path, representing the direct effect of felt gratitude on FOR, controlling for intimacy, we found a significant actor effect in which higher levels of felt gratitude were associated with higher levels of FOR (B = 0.15, t = 3.23, p = .002; rate ratio = 1.16). For every one unit increase in felt gratitude, patients and spouses reported a 16% increase in the expected FOR count that same day. The corresponding partner effects for patients (B = 0.07, t = 1.08, ns; rate ratio = 1.07) and spouses (B = 1.51, t = 0.22, ns; rate ratio = 1.11) were not significant.
Table 5

Results for Hypothesis 3: Multilevel Regressions of Intimacy on Felt Gratitude (a effects) and FOR on Felt Gratitude and Intimacy (b and c’ effects)

<table>
<thead>
<tr>
<th>Effect</th>
<th>Estimate</th>
<th>SE</th>
<th>Lower</th>
<th>Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>a effects (X ( \rightarrow ) M)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient Actor Effect ( a_{AI} )</td>
<td>0.306***</td>
<td>0.030</td>
<td>0.247</td>
<td>0.365</td>
</tr>
<tr>
<td>Spouse Actor Effect ( a_{A2} )</td>
<td>0.306***</td>
<td>0.030</td>
<td>0.247</td>
<td>0.365</td>
</tr>
<tr>
<td>Patient Partner Effect ( a_{P1} )</td>
<td>0.156***</td>
<td>0.041</td>
<td>0.076</td>
<td>0.236</td>
</tr>
<tr>
<td>Spouse Partner Effect ( a_{P2} )</td>
<td>0.011</td>
<td>0.041</td>
<td>-0.069</td>
<td>0.091</td>
</tr>
<tr>
<td>Patient PA</td>
<td>0.073</td>
<td>0.074</td>
<td>-0.072</td>
<td>0.218</td>
</tr>
<tr>
<td>Spouse PA</td>
<td>0.238</td>
<td>0.008</td>
<td>0.222</td>
<td>0.254</td>
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<tr>
<td><strong>b effects (M ( \rightarrow ) Y)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient Actor Effect ( b_{AI} )</td>
<td>-0.293***</td>
<td>0.069</td>
<td>-0.428</td>
<td>-0.158</td>
</tr>
<tr>
<td>Spouse Actor Effect ( b_{A2} )</td>
<td>-0.293***</td>
<td>0.069</td>
<td>-0.428</td>
<td>-0.158</td>
</tr>
<tr>
<td>Patient Partner Effect ( b_{P1} )</td>
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<td>0.090</td>
<td>-0.288</td>
<td>0.065</td>
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<tr>
<td>Spouse Partner Effect ( b_{P2} )</td>
<td>0.025</td>
<td>0.115</td>
<td>-0.200</td>
<td>0.250</td>
</tr>
<tr>
<td><strong>c’ effects (X ( \rightarrow ) Y)</strong></td>
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<td></td>
</tr>
<tr>
<td>Patient Actor Effect ( c'_{AI} )</td>
<td>0.149</td>
<td>0.046</td>
<td>0.059</td>
<td>0.239</td>
</tr>
<tr>
<td>Spouse Actor Effect ( c'_{A2} )</td>
<td>0.149</td>
<td>0.046</td>
<td>0.059</td>
<td>0.239</td>
</tr>
<tr>
<td>Patient Partner Effect ( c'_{P1} )</td>
<td>0.066</td>
<td>0.061</td>
<td>-0.054</td>
<td>0.186</td>
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<tr>
<td>Spouse Partner Effect ( c'_{P2} )</td>
<td>0.100</td>
<td>0.067</td>
<td>-0.031</td>
<td>0.231</td>
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<tr>
<td><strong>Time on</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient Intimacy</td>
<td>0.030</td>
<td>0.008</td>
<td>0.014</td>
<td>0.046</td>
</tr>
<tr>
<td>Partner Intimacy</td>
<td>0.030</td>
<td>0.008</td>
<td>0.014</td>
<td>0.046</td>
</tr>
<tr>
<td>Patient FOR</td>
<td>-0.030**</td>
<td>0.085</td>
<td>-0.197</td>
<td>0.137</td>
</tr>
<tr>
<td>Partner FOR</td>
<td>-0.030**</td>
<td>0.085</td>
<td>-0.197</td>
<td>0.137</td>
</tr>
</tbody>
</table>

Note. \( X \) = Felt Gratitude, \( M \) = Intimacy, \( Y \) = Fear of Recurrence, \( a = \) Actor Effect, \( p = \) Partner Effect, \( 1 = \) Patient Effect, \( 2 = \) Spouse Effect, Actor effects have all been constrained to be equal for patients and spouses, *\( p < 0.05 \) **\( p < 0.01 \) ***\( p < 0.001 \); For paths b and c’, estimates are on a log scale due to the use of poisson regression.
Figure 4. *APIM Dyadic Multilevel Mediation Model where the Effect of Felt Gratitude on Fear of Recurrence is Mediated by Relationship Intimacy with Significant Pathways Highlighted*

*Note.* Because Patient and Spouse Intimacy are outcome variables of the *a* paths and Patient and Spouse Fear of Recurrence are outcome variables of the *b* and *c’* paths, this model includes covariance between their errors. In this model, all actor effects (i.e., pathways *aA*1 and *aA*2, *bA*1 and *bA*2, and *c’A*1 and *c’A*2) are constrained to be equal. Non-significant pathways are greyed out.
Expressed Gratitude. Results are presented in Table 6 and depicted in Figure 5. Again, statistical comparison of constrained and unconstrained models showed no significant difference between model fit ($\Delta \chi^2(2) = 1.45, p=48.$) and the actor effects for expressed gratitude and intimacy were constrained between wives and husbands. For the b path, representing the effect of relationship intimacy on FOR, controlling for expressed gratitude, we found a significant actor effect where days on which patients and spouses reported higher intimacy, they also reported significantly lower levels of FOR ($B = -0.22, t = -3.73, p = .0006; \text{rate ratio } = 0.80$). This indicated that for every one unit increase in intimacy, patients and spouses experienced a 20% decrease in expected FOR counts. Corresponding partner effects for patients ($B = -0.09, t = -1.1, \text{ns}; \text{rate ratio } = 0.92$) and spouses ($B = 0.13, t = 1.43, \text{ns}; \text{rate ratio } = 1.14$) were not significant.

For the c’ path, representing the direct effect of expressed gratitude on FOR, controlling for intimacy, there were no significant actor effects ($B = 0.04, t = 0.48, \text{ns}; \text{rate ratio } = 1.04$) or partner effects for patients ($B = 0.15, t = 1.19, \text{ns}; \text{rate ratio } = 1.16$) or spouses ($B = 0.05, t = 0.46, \text{ns}; \text{rate ratio } = 1.05$).
Table 6

Results for Hypothesis 3: Multilevel Regressions of Intimacy on Expressed Gratitude

(*a effects) and FOR on Expressed Gratitude and Intimacy (b and c’ effects)

<table>
<thead>
<tr>
<th>Effect</th>
<th>Estimate</th>
<th>SE</th>
<th>Lower</th>
<th>Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>a effects (X → M)</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient Actor Effect ($a_{A1}$)</td>
<td>0.338***</td>
<td>0.076</td>
<td>0.189</td>
<td>0.487</td>
</tr>
<tr>
<td>Spouse Actor Effect ($a_{A2}$)</td>
<td>0.338***</td>
<td>0.076</td>
<td>0.189</td>
<td>0.487</td>
</tr>
<tr>
<td>Patient Partner Effect ($a_{P1}$)</td>
<td>0.201</td>
<td>0.108</td>
<td>-0.011</td>
<td>0.413</td>
</tr>
<tr>
<td>Spouse Partner Effect ($a_{P2}$)</td>
<td>0.102</td>
<td>0.105</td>
<td>-0.104</td>
<td>0.308</td>
</tr>
<tr>
<td>Patient PA</td>
<td>0.183*</td>
<td>0.080</td>
<td>0.027</td>
<td>0.340</td>
</tr>
<tr>
<td>Spouse PA</td>
<td>0.328***</td>
<td>0.083</td>
<td>0.165</td>
<td>0.491</td>
</tr>
<tr>
<td><strong>b effects (M → Y)</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Patient Actor Effect ($b_{A1}$)</td>
<td>-0.223***</td>
<td>0.060</td>
<td>-0.3416</td>
<td>-0.105</td>
</tr>
<tr>
<td>Spouse Actor Effect ($b_{A2}$)</td>
<td>-0.223***</td>
<td>0.060</td>
<td>-0.341</td>
<td>-0.105</td>
</tr>
<tr>
<td>Patient Partner Effect ($b_{P1}$)</td>
<td>-0.086</td>
<td>0.078</td>
<td>-0.239</td>
<td>0.067</td>
</tr>
<tr>
<td>Spouse Partner Effect ($b_{P2}$)</td>
<td>0.131</td>
<td>0.092</td>
<td>-0.049</td>
<td>0.311</td>
</tr>
<tr>
<td><strong>c’ effects (X → Y)</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Actor Effect ($c_{A1}$)</td>
<td>0.042</td>
<td>0.088</td>
<td>-0.130</td>
<td>0.214</td>
</tr>
<tr>
<td>Actor Effect ($c_{A2}$)</td>
<td>0.042</td>
<td>0.088</td>
<td>-0.130</td>
<td>0.214</td>
</tr>
<tr>
<td>Patient Partner Effect ($c_{P1}$)</td>
<td>0.151</td>
<td>0.126</td>
<td>-0.096</td>
<td>0.398</td>
</tr>
<tr>
<td>Spouse Partner Effect ($c_{P2}$)</td>
<td>0.053</td>
<td>0.116</td>
<td>-0.174</td>
<td>0.280</td>
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**Time on**

<table>
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<tr>
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<th>Lower</th>
<th>Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient Intimacy</td>
<td>0.011</td>
<td>0.009</td>
<td>-0.007</td>
<td>0.029</td>
</tr>
<tr>
<td>Partner Intimacy</td>
<td>0.011</td>
<td>0.009</td>
<td>-0.007</td>
<td>0.029</td>
</tr>
<tr>
<td>Patient FOR</td>
<td>-0.037***</td>
<td>0.010</td>
<td>-0.057</td>
<td>-0.02</td>
</tr>
<tr>
<td>Partner FOR</td>
<td>-0.037***</td>
<td>0.010</td>
<td>-0.057</td>
<td>-0.017</td>
</tr>
</tbody>
</table>

Note. $X$ = Felt Gratitude, $M$ = Intimacy, $Y$ = Fear of Recurrence, $a$ = Actor Effect, $p$ = Partner Effect, $1$ = Patient Effect, $2$ = Spouse Effect, Actor effects have all been constrained to be equal for patients and spouses, *p<0.05 **p<0.01 ***p<0.001; For paths $b$ and $c’$, estimates are on a log scale due to the use of poisson regression.
Figure 5. *APIM Dyadic Multilevel Mediation Model where the Effect of Expressed Gratitude on Fear of Recurrence is Mediated by Relationship Intimacy with Significant Pathways Highlighted*

Note. Because Patient and Spouse Intimacy are outcome variables of the \( a \) paths and Patient and Spouse Fear of Recurrence are outcome variables of the \( b \) and \( c' \) paths, this model includes covariance between their errors. In this model, all actor effects (i.e., pathways \( a_{A1} \) and \( a_{A2} \), \( b_{A1} \) and \( b_{A2} \), and \( c'_{A1} \) and \( c'_{A2} \)) are constrained to be equal. Non-significant pathways are greyed out.
Tests of mediated effects were carried out using the mediation package in R (R Core Team, 2013), recently developed by Tingley, Yamamoto, Hirose, and Keele (2013) to accommodate multilevel mediation analyses with a count outcome. This package was used to estimate the average direct effect, average mediation effect, total effect, and proportion mediated effect. This more general approach to mediation analysis is based on the potential outcomes framework (Imai, Jo, & Stuart, 2011; Rubin, 2005) which emphasizes that the value of the outcome (Y) is determined based on conditions in which the treatment (X) = 0, the treatment (X) = 1, the mediator (M) is determined when X = 0, and when the mediator (M) is determined when X = 1.

Using this framework, the average direct effect (ADE) = \(E\{Y (X1, M (X)) - Y (X0, M (X))\}\), which represents the expected value of the outcome Y when the treatment, X, has changed but the mediator is held constant at the value of treatment = X. That is, what is the effect of the treatment (X) on the outcome (Y) that is not through the mediator? The average indirect effect (AIE) = \(E\{Y (X, M(X1)) - Y (X, M(X0))\}\), which represents the expected value of the outcome, Y, that is due to the change in the mediator variable from the value that would be realized for the mediator in the X = 0 treatment condition compared to the value that would be realized for the mediator in the X = 1 treatment condition, while the treatment condition is held constant. That is, what is the effect of the treatment (X) on the outcome (Y) that occurs only through the mediator? The AIE and ADE add up to produce the total effect.

To clarify these equations, below is an example using the current variables with expressed gratitude as the treatment variable (X), intimacy as the mediator (M), and FOR as the outcome (Y). The ADE is interpreted as the expected difference in the
potential value of FOR (Y) when expressed gratitude goes from not being expressed (X0) to being expressed (X1), while intimacy remains constant at the same level of expressed gratitude (M(X)). That is, the expected value of FOR that is due only to expressed gratitude, holding intimacy constant. The AIE is the expected difference in the potential value of FOR when intimacy took the value it would realize when gratitude was expressed (M(X1)) as opposed to the value it would take when gratitude was not expressed (M(X0)), while expression of gratitude itself is held constant (X). That is, the expected value of FOR that is due only to the effects of the expressed gratitude that occur through intimacy. These equations refer to the “potential value” of the outcome because the same outcome for an individual cannot actually be observed under both treatment conditions. That is, on the same day, one person cannot report both expressing gratitude and not expressing gratitude to their partner (i.e., these are counterfactual conditions).

Finally, the proportion of mediated effect is an estimate of the proportion of the total effect that is due to the mediator. Although the proportion of mediated is calculated by the mediation package, it is not always an interpretable quantity. One situation in which the portion of mediated effect cannot be interpreted is in the context of inconsistent mediation (MacKinnon, Fairchild, & Fritz, 2007; MacKinnon, Krull, & Lockwood, 2000). Inconsistent mediation occurs when one mediation effect (e.g., the a path) has a different sign from another mediated effect (e.g., the b path) or the direct effect (c’ path). The current data show a pattern of inconsistent mediation because the indirect effect is negative in sign and the direct effect is positive in sign. The presence of inconsistent mediation is one in which X may not be a direct predictor of Y, but
significant mediation can still be found (MacKinnon et al., 2007). Therefore, the proportion of mediated effected was not able to be interpreted in the current analyses.

**Felt gratitude.** Examination of the actor-mediated actor effect (i.e., one’s own reports of FOR regressed on one’s own reports of felt gratitude and relationship intimacy) revealed a statistically significant and negative AIE, indicating a decrease in FOR that occurred specifically through the experience of increased intimacy (indirect effect = -0.049, p < .01, rate ratio = 0.952; see Table 7). The rate ratio indicates a change of .952 units on the FOR count when the mediator takes the value it would realize when there is a one unit shift in felt gratitude, holding felt gratitude constant. That is, for every one unit increase in daily felt gratitude, there is a 5% decrease in the expected daily FOR count that is due only to daily intimacy for both patients and spouses.

The actor-mediated partner effect, utilizing the significant a path spouse partner effect found in Hypothesis 1 (i.e., the effect of patient felt gratitude on spouse intimacy) and the significant b path spouse actor effect (i.e., the effect of spouse intimacy on spouse FOR, controlling for patient felt gratitude), also produced a negative AIE, and was statistically significant (indirect effect = -0.023, p < .01, rate ratio = 0.978; see Table 7). The rate ratio indicates that for every one unit increase in patient daily felt gratitude, there is a 2% decrease in the expected spouse daily FOR that is due to daily spouse intimacy.
Table 7

Results for Hypothesis 3: Tests of Mediation Effects

<table>
<thead>
<tr>
<th>Effect</th>
<th>Estimate</th>
<th>Lower</th>
<th>Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Actor-Mediated Actor</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Effects</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Felt Gratitude</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Mediated Effect</td>
<td>-0.049*</td>
<td>-0.080</td>
<td>-0.028</td>
</tr>
<tr>
<td>Average Direct Effect</td>
<td>0.079</td>
<td>0.032</td>
<td>0.150</td>
</tr>
<tr>
<td><strong>Expressed Gratitude</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Mediated Effect</td>
<td>-0.056*</td>
<td>-0.100</td>
<td>-0.025</td>
</tr>
<tr>
<td>Average Direct Effect</td>
<td>0.027</td>
<td>-0.115</td>
<td>0.163</td>
</tr>
<tr>
<td><strong>Actor-Mediated Partner</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Effects</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Felt Gratitude</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Mediated Effect</td>
<td>-0.023*</td>
<td>-0.041</td>
<td>-0.009</td>
</tr>
<tr>
<td>Average Direct Effect</td>
<td>0.036</td>
<td>-0.030</td>
<td>0.126</td>
</tr>
</tbody>
</table>

Note: *p<0.05; Estimates are on a log scale due to the use of poisson regression.
**Expressed gratitude.** Examination of the actor-mediated actor effect (i.e., one’s own reports of FOR regressed on one’s own reports of expressed gratitude and relationship intimacy) produced a negative AIE, indicating a decrease in FOR through the experience of increased intimacy, and was statistically significant (indirect effect = -0.056, p < .01, rate ratio = .946; see Table 7). That is, for a typical day on which gratitude was expressed to the partner (compared to a day when it wasn’t expressed), there is a 5% decrease in the expected daily FOR count that is due to daily intimacy for both patients and spouses.
Chapter 4

DISCUSSION

FOR is one of the foremost concerns reported by both cancer patients and their intimate partners (Baker et al., 2005; Simard et al., 2013), appears to persist over time and despite medical prognosis (e.g., Hodges & Humphris, 2009), and is associated with higher levels of depression and anxiety and decreased quality of life (Diemling et al., 2006). In a recent review article outlining the literature to date on FOR, Simard et al. (2013) called for “more research … to explore, support and evaluate the development and effectiveness of different kinds of interventions targeting FCR [fear of cancer recurrence] and shed light on possible therapeutic processes.” The present study begins to answer this call by exploring the potential role of gratitude, a construct that has been shown to increase individual well-being (Wood et al., 2008) and is instrumental in the development and maintenance of close relationships (Algoe et al., 2008), in attenuating the experience of FOR, through the process of enhancing relationship intimacy.

More specifically, the current study utilized a dyadic daily diary design to examine the within-couple effects of partner-directed gratitude on relationship intimacy and fear of recurrence in couples coping with breast cancer. Our findings provide evidence that daily partner-directed gratitude is associated with reductions in daily reported FOR through increasing relationship intimacy. These findings highlight the role of relationship functioning in helping individuals and their partners cope with medical illness, and in particular, of gratitude as it serves to enhance feeling close and connected with one’s partner. In line with Manne and Badr’s (2008) relationship intimacy model of couples’ psychosocial adaptation to cancer, these data also provide evidence that greater levels of daily intimacy can aid in psychosocial adaptation to cancer for both patients and their partners.
**Gratitude and Intimacy**

We hypothesized that felt and expressed daily gratitude would be predictive of patient and partner’s reports of relationship intimacy. Consistent with research in non-patient populations (e.g., Algoe et al., 2013), we found a significant relationship between partner-directed gratitude and relationship intimacy, above and beyond the influence of same-day positive affect. Regarding actor effects, where a person’s own experience of gratitude is linked with their own feelings of intimacy, these findings were significant for both felt and expressed gratitude, suggesting that both the private experience of gratitude, as well as the overt expression to one’s partner, can serve to enhance one’s own feelings of closeness. However, when examining partner effects, where a person’s experience of gratitude is linked with their partner’s feelings of intimacy, we found that while patient reports of felt gratitude predicted spouse’s reports of intimacy, spouse reports of felt gratitude were not predictive of patient’s intimacy. Additionally, we did not find any significant partner effects when examining expressed gratitude. These findings are largely consistent with the daily diary findings of Gordon et al. (2011), who also found significant actor effects for both felt and expressed gratitude, but only found partner effects for felt gratitude. Gordon et al. hypothesized that in the context of long-term relationships, expressions of gratitude may be misconstrued or overlooked. The average length of relationship for couples in the current study is 24.2 years (SD = 13.95). While relationship length may be a factor in distinguishing the effects of felt vs. expressed gratitude, only future research directly comparing couples with shorter and longer relationships would be able to identify this as a factor underlying differences between felt and expressed gratitude.

In general, partner effects are an indicator of an active interdependent system (Kenny & Cook, 1999). They signal that the things individuals think and feel
are partly determined by close others. The present findings indicate that when a patient reported feeling more grateful towards her partner, her partner reported feeling more intimate and close with her, suggesting that her thoughts and emotions contributed to her partner’s intimacy. How might this happen? Likely, there is an unmodeled chain of events connecting one person feeling grateful to another person experiencing greater intimacy. Although we have not captured those events through these data, we can see that the partner is picking up on the patient’s gratitude, possibly by recognizing the patient’s appreciation for something the partner did, which ultimately leads them to feel more connected to their partner. These findings are consistent with Algoe et al. (2008) who found that the feelings of gratitude by sorority Little Sisters towards their Big Sisters during a week of gifts being bestowed upon them significantly predicted both their own and their Big Sisters’ feeling about the relationship a month later. Further investigations are warranted to better understand the chain of events that can connect one partner’s feelings of gratitude with another partner’s perceptions about the quality of the relationship.

**Gratitude and FOR**

We predicted that felt and expressed daily gratitude would reduce reports of daily FOR. When examining gratitude as a sole predictor of FOR, we had mixed findings regarding the daily association of gratitude and FOR. We did not find any significant actor effects. Regarding partner effects, we found a significant patient partner effect in which felt gratitude reported by spouses significantly predicted same day FOR reported by patients. Notably, this was a positive association in which higher levels of felt gratitude by spouses predicted higher levels of FOR by patients, the opposite direction of our prediction. In light of the lack of significant actor effects and other partner effects between gratitude and FOR, we need to take caution in our interpretation of this result. One possible
explanation may be that feeling grateful toward one’s partner can have a paradoxical effect in which one is reminded of their connection to their loved ones, making the consequences of cancer stand out as being particularly negative. However, it is unclear why we would not see this same pattern of results in the association between patients reports of gratitude and spouses reports of FOR.

It is important to note that the lack of a significant direct effect between partner-directed gratitude and FOR does not definitively indicate the absence of a significant relationship between gratitude and FOR through another variable. Mackinnon and Fairchild (2009) identify several reasons why the X → Y relationship is not necessary for the occurrence of significant mediation and demonstrate that mediation can exist even in the absence of such a significant relation. For example, the statistical test of X on Y has less power than the test of the links (i.e., the indirect effect) in the mediation model. This mismatch in power can lead to a lack of significant total effects in the presence of indirect effects in mediation analyses (Kenny & Judd, 2014). Moreover, if the sign of the mediated effect, ab, differs from the sign of the direct effect (c’), as it does in the current study, the overall relation of X to Y (c) can be zero, leading to a situation known as inconsistent mediation. Additionally, if there are subgroups of individuals for whom the mediated effect is of opposite sign, the pooled data would be zero even when mediation exists in the data. With regard to the present data, the number of participants is too low to explore or identify specific subgroups within this dataset, and would require a larger sample size.

**Mediation of Gratitude on FOR through Intimacy**

We predicted that felt and expressed daily gratitude would lead to lower levels of daily FOR, mediated by greater levels of daily relationship intimacy. We found evidence of significant mediation via both felt and expressed gratitude. Specifically, we found significant within-couple actor effects in which one’s own
reports of felt and expressed gratitude was associated with greater levels of same day self-reported intimacy, which was in turn associated with lower levels of same day self-reported FOR. The average indirect effect (AIE) indicated significant actor mediated actor effects for both patients and partners using a constrained model across patients and partners. We were not able to interpret the proportion of mediated effects or total effects due to the presence of inconsistent mediation, in which the direction of the mediated pathway was the opposite sign of the direct pathway. There were no significant average direct effects (ADE), indicating that neither experienced nor expressed gratitude was a significant predictor of FOR when holding intimacy constant.

Utilizing the significant spouse partner effect of felt gratitude on intimacy, we also found a significant actor mediated partner effect, in which patient’s reports of greater felt gratitude was associated with higher levels of spouse intimacy, which in turn predicted lower levels of spouse FOR. This suggests that when patients feel grateful, spouses are significantly impacted through their own experience of intimacy and FOR. This finding highlights the interdependent nature of partners in close relationships and the importance of examining relationship processes through reports of both partners to be able to examine the impact they may have on one another. In this model, we again found a significant AIE, but no significant direct effect. This overall pattern of results underscores the role of intimacy in the effect of gratitude on FOR.

This study is one of the first to provide support using an intensive longitudinal design for the relationship intimacy model of couples’ psychosocial adaptation to cancer (Manne & Badr, 2008) in which relationship closeness is proposed to have a direct impact on functioning and adaptation to cancer. To date, little is known about the specific link between intimacy and FOR. However, recent
work by Moreira and Canavarro (2013) provides evidence of a cross-sectional link between intimacy and anxiety in partners of BC patients. Specifically, they found that partners who reported greater levels of intimacy also reported lower levels of depression and anxiety, and higher levels of quality of life. Interestingly, they also found that that intimacy was greater in partners of BC patients compared with a comparison group of partners of healthy women. However, Moreira and Canavarro did not examine this link in the patients themselves, and the associations in partners were found using cross-sectional reports. In a non-cancer population, Coan et al. (2006) found that greater relationship quality diminished the fear response of individuals subject to the threat of shock. Specifically, those who reported higher levels of relationship quality reaped more benefit from holding their partners hand (vs. a strangers or no hand holding) when they were informed that they could be shocked. Similar to these findings, our results also support the theory that enhanced relationship functioning may serve as an important protector for individuals facing fear-inducing situations.

Although we did not examine specific mechanisms of the intimacy-FOR link, recent work suggests that the neurobiology of attachment may play a role in the use of close relationships for negative emotion regulation (Coan, 2008). In child-parent attachment relationships, secure attachment allows children to utilize their parents as a secure base to learn to regulate their anxiety as they begin to explore the world (Bowlby, 1969). Similarly, adult attachment relationships allow individuals to socially regulate their negative affect. Indeed, brain circuits responsible for human bonding relationships are also responsible for affective regulation (Coan, 2010). Social Baseline Theory (Beckes & Coan, 2011) specifies that humans are hardwired to desire close proximity to other humans because it leads to perceived reductions in risk and personal cost, even in terms of brain resources. Attachment style was not measured in
the present study, but future research should explore it as a potential moderator of the association between intimacy and FOR, in which securely attached individuals may show greater attenuation of FOR when they feel close with their partner.

**Study Strengths and Limitations**

The present study benefited from several strengths. First, we obtained data from both partners of a dyad regarding their feelings of gratitude, intimacy, and fear of recurrence. Eliciting reports from both members of a couple is critical to properly examine relationship processes and permits examination of the interdependence that occurs between two people within a dyad (Kenny & Cook, 1999). Particularly in the context of individual’s facing significant health adversities, where illness can impact the entire family and disrupt family life, it is important to obtain reports from both members to best understand ways in which gratitude and intimacy can impact both patients and their partners who are part of a relationship system. Furthermore, the use of daily diary data permitted us to examine within-person processes that unfold over time and in an ecologically valid way (Bolger, Davis, & Rafaeli, 2003) rather than relying on an individual ‘snapshot’ in time. Finally, the current study applied an approach to dyadic multi-level mediation analysis that is relatively novel to psychology through the utilization of the general mediation approach that accommodates a count nature of the outcome variable (Imai et al., 2010).

Some limitations are also worth noting. Overall, we found that the FOR reported by both patients and spouses was low (1.64 and 1.76 out of a possible summed score of 9, respectively) and was relatively stable, with little within-person variation (SD = 1.04 for patients; 1.26 for spouses). The majority of the variation in FOR was at the between-person level (see Table 1). The limited variability in daily FOR coupled with the low sample size likely made it more difficult to identify
relationships between FOR and our predictor variables that exist in the population. Gotay and Pagano (2007) reported higher levels of FOR in a sample of short-term and long-term cancer survivors from varying types of cancer using the ACS cancer worry subscale. However, Gotay and Pagano used a cross-sectional measure asking individuals to rate their general feelings of FOR, rather than in-the-moment ratings each day. As the present study is the first to our knowledge to measure FOR in a non-cross-sectional way, it is difficult to make a comparison between the levels of FOR obtained here and those from prior reports. It is unclear whether the lower levels of FOR reported here indicates that the current sample represents a less distressed population. We recommend caution in applying these findings to other, more distressed, populations.

Additionally, the present sample was primarily a well-educated, high-income, Caucasian sample of couples in primarily long-term relationships, limiting the generalizability of these findings to other more diverse populations. Further research is warranted to determine whether these findings would apply to more diverse populations, including race, income, education, as well as type of and stage of cancer.

Despite the focus on within-couple effects, the non-experimental nature of the design make it difficult to draw causal claims from these data. It is important to note that to indicate a causal relationship between variables, it is important to have variables separated in time. Here, all three variables in our mediation model were measured at the same time, and our claims of the relationships among variables are largely driven by theory. However, it is important to note that the daily diary nature of these data, permitting us to examine these associations within-person over time, provides additional insight beyond a simple cross-sectional measure.

Another potential limitation, as discussed above, is that our study may have lacked statistical power necessary to detect a significant total effect between partner-
directed gratitude and FOR. Kenny and Judd (2014) demonstrated that the test of the indirect effect can have significantly greater power than the tests of the total effect, sometimes leading to a lack of significant total effects in the presence of indirect effects in mediation analyses. They cite that sometimes 75 times the number cases are needed to have equal power between the tests of indirect and direct effects. With our low sample size, power may be an explanation for this lack of a significant total and direct effects.

**Treatment implications**

These findings bear potentially significant implications for the assessment and treatment of couples coping with cancer. Specifically, our within-person findings point to the potential importance of gratitude as a strategy to increase relationship intimacy and decrease psychosocial concerns associated with cancer, such as FOR. Existing evidence from multiple gratitude-based interventions show that positive emotion can be experimentally increased (e.g., Emmons & McCullough, 2003; Boehm, Lyubomirsky, & Sheldon, 2011) and sustained over time (e.g., Seligman et al., 2005). Lyubomirsky and colleagues (2005) conducted a 6-week intervention in which participants who reported on things for which they were grateful showed increases in well-being. Emmons and McCullough (2003) randomly assigned participants to one of three conditions (gratitude, hassles, or events of the day) and participants completed weekly or daily paper-and-pencil surveys designed to elicit daily feelings of gratitude, annoyances, or simply reporting events of the day. They conducted one trial with a sample of patients with neuromuscular disease and found that gratitude was linked with decreases in negative affect and increases in positive affect, sleep, and life satisfaction. Future research should focus on examining the effectiveness of these interventions in a cancer population with outcomes including health-specific concerns.
In summary, these findings demonstrate that daily partner directed
gratitude plays an important role in helping couples to manage their daily psychosocial
concerns regarding cancer and survivorship through enhancing relationship intimacy.
With very little research on these links to date, these data suggest that feeling close,
connected, and understood by one’s partner aids in coping with threat of future illness.
These findings also lend support to the importance of studying couples and
relationship processes in the context of individual’s facing significant health
adversities. Illness of an individual does not occur in a vacuum, but rather often
impacts many family members, particularly one’s partner. Given the extent to which
illness can disrupt family life, it is important to examine the full context in which it
occurs. Finally, this work presents one of the first applications of the general
mediation framework for outcome data that are not continuous and normally
distributed in the context of dyadic daily diary data. Because ignoring a non-normative
structure of the outcome variable can yield inaccurate results, researchers interested in
mediation modeling may now avail themselves of newer statistical software programs
to accommodate these complex data.
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Appendix A

DAILY DIARY MEASURES

Daily Partner-Directed Felt Gratitude:
“People feel many different things as a result of their partners' actions on any given day. For each item, indicate to what extent you feel this way TODAY as a result of YOUR PARTNER'S actions toward you throughout the day.”

Not at all Very Much
0 1 2 3 4 5 6

a. thankfulness
b. appreciation
c. gratitude

Daily Partner-Direct Expressed Gratitude:
“I thanked my spouse/partner for something he/she did that I appreciated.”

Y/N

Daily Relationship Intimacy:
“At this moment, how much intimacy/connectedness do you feel with your partner?”

Not at all An Extreme Amount
0 1 2 3 4 5 6

“At this moment, how much emotionally close do you feel with your partner?”

Not at all An Extreme Amount
0 1 2 3 4 5 6

“The choices below represent different degrees of happiness in romantic relationships. The middle choice, ‘happy,’ represents the degree of happiness of most relationships. Select the choice that best describes the degree of happiness, all things considered, of your relationship right now.”

Extremely unhappy
Fairly unhappy
A little unhappy
Happy
Very happy
Extremely happy
Perfect

**Daily Fear of Recurrence:**
“Please indicate to what degree you worried about each item today.”

Not at all  A little bit  Somewhat  Very much
0        1          2         3

a. I worried about future diagnostic tests.
b. I worried about another type of cancer.
c. I worried about my cancer coming back.

**Positive Affect:**
“Below are a number of words that describe different feelings. For each item, indicate to what extent you feel this way AT THIS MOMENT by clicking on the appropriate bubble.”

Very slightly/Not at all  A little  Moderately  Quite a bit  Extremely

a. Interested
b. Determined
c. Enthusiastic
d. Excited
e. Inspired
f. Cheerful
g. Lively
Appendix B

HUMAN SUBJECTS REVIEW BOARD APPROVAL LETTER

DATE: August 24, 2011

TO: Jean Philippe Laurenceau
FROM: University of Delaware IRB

STUDY TITLE: [174527-3] Couples Coping with Cancer

SUBMISSION TYPE: Continuing Review/Progress Report

ACTION: APPROVED

APPROVAL DATE: August 24, 2011

EXPIRATION DATE: September 10, 2012

REVIEW TYPE: Expedited Review

REVIEW CATEGORY: Expedited review category # 7

Thank you for your submission of Continuing Review/Progress Report materials for this research study. The University of Delaware IRB has APPROVED your submission. This approval is based on an appropriate risk/benefit ratio and a study design wherein the risks have been minimized. All research must be conducted in accordance with this approved submission.

This submission has received Expedited Review based on the applicable federal regulation.

Please remember that informed consent is a process beginning with a description of the study and insurance of participant understanding followed by a signed consent form. Informed consent must continue throughout the study via a dialogue between the researcher and research participant. Federal regulations require each participant receive a copy of the signed consent document.

Please note that any revision to previously approved materials must be approved by this office prior to initiation. Please use the appropriate revision forms for this procedure.

All SERIOUS and UNEXPECTED adverse events must be reported to this office. Please use the appropriate adverse event forms for this procedure. All sponsor reporting requirements should also be followed.

Please report all NON-COMPLIANCE issues or COMPLAINTS regarding this study to this office.

Please note that all research records must be retained for a minimum of three years.

Based on the risks, this project requires Continuing Review by this office on an annual basis. Please use the appropriate renewal forms for this procedure.

- 1 -

Generated on IRBNet
If you have any questions, please contact Jody-Lynn Berg at (302) 831-1119 or jberg@udel.edu. Please include your study title and reference number in all correspondence with this office.