OBJECTIVE: To assess the effect of hardiness, coping, and appraisal on medication non-adherence and posttraumatic growth (PTG) among adolescent renal transplant recipients using Folkman & Greer’s Model of Appraisal and Coping Processes. METHODS: Thirty-three adolescents completed orally-administered questionnaire packets containing measures of the above stated constructs. Twelve-month serum immunosuppressant levels were obtained from medical records to assess non-adherence. RESULTS: Sixty-one percent of adolescent renal transplant recipients report taking immunosuppressant medications late. They also report moderate levels of PTG. The inverse relationship between PTG and immunosuppressant doses taken late trended towards significance. Hardiness, coping, and appraisal were all significantly related to PTG; coping and appraisal were also related to self-reported immunosuppressant doses taken late. Hardiness was negatively correlated with serum immunosuppressant SD (an indicator of possible non-adherence). Coping was found to mediate the relationship between appraisal and PTG but not the relationship between appraisal and immunosuppressant doses taken late or the relationship between hardiness and immunosuppressant SD or PTG. A trend toward negative religious appraisal mediating the relationship between maladaptive coping and immunosuppressant doses late was also found. Lastly, gender was not found
to moderate the relationship between hardiness and PTG. CONCLUSIONS: This is one of the first studies to assess PTG and medication non-adherence among adolescent renal transplant recipients. Participants in this study reported moderate levels of PTG and, consistent with the literature, relatively high levels of medication non-adherence. Hardiness, coping, and appraisal were found to have direct and indirect affects on PTG and non-adherence measures, suggesting multiple targets for intervention.

INDEX WORDS: pediatric transplant; renal; hardiness; appraisal; coping; religious coping; adherence; posttraumatic growth;
POSTTRAUMATIC GROWTH AND TREATMENT ADHERENCE AMONG ADOLESCENT RENAL TRANSPLANT RECIPIENTS: DECIPHERING THE MODERATING AND MEDIATING EFFECTS OF HARDINESS, COPING, AND APPRAISAL

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POSTTRAUMATIC GROWTH AND TREATMENT ADHERENCE AMONG ADOLESCENT RENAL TRANSPLANT RECIPIENTS: DECIPHERING THE MODERATING AND MEDIATING EFFECTS OF HARDINESS, COPING, AND APPRAISAL

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May 2007
DEDICATION

To all of the people that have positively influenced the trajectory of my life, I dedicate this dissertation. This accomplishment is not my own but is attributed to all of the helping hands and sage wisdom I have received along the way. I am eternally thankful for Grammie’s nurturance and admonitions to eat my peas, Mom’s gentle strength and perseverance through trials while insisting throughout that I follow my dreams, my sisters’ lifelong friendship and support, and my husband’s boundless love that is my utmost joy. Above all I am grateful to God that He has called me down this path and equipped me for what lies ahead. In Him all things are possible and to Him all glory goes.

Success

By Bessie Stanley

To laugh often and much;

To win the respect of intelligent people and the affection of children;

To earn the appreciation of honest critics and endure the betrayal of false friends;

To appreciate beauty, to find the best in others;

To leave the world a bit better, whether by a healthy child, a garden patch or a redeemed social condition;

To know even one life has breathed easier because you have lived.

This is to have succeeded.
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CHAPTER 1

INTRODUCTION

Purpose of the Study

Pediatric chronic illness is pervasive, affecting an estimated 10-15% of children living in the United States by the time they turn 18 years of age (Davidoff, 2004; Gortmaker & Sappenfield, 1984). The consequences of living with chronic illness are numerous, including not only substantial financial cost and compromised physiological functioning but also potential psychosocial sequelae. A serious, chronic condition affecting over 16,000 children and adolescents within the United States that requires lifelong treatment and management to ensure survival is end-stage renal disease (ESRD) (U.S. Renal Data System, 2004). Although the literature shows substantial improvement in quality of life among adolescents with ESRD who receive renal transplants as compared with ongoing hemodialysis or peritoneal dialysis (Laine et al., 1998), transplanted adolescents still experience a multitude of physiological and psychosocial stressors and complications (discussed in greater detail in later sections). Examining these stressors within a theoretical framework is necessary for improving our conceptual understanding of the problem and developing effective interventions to improve treatment outcomes.

The theoretical model of stress and coping first introduced by Lazarus & Folkman (1984) has been the foundation upon which much stress and coping research has been conducted. In brief, the model suggests that, following a stressful event, individuals
engage in appraisal and coping strategies from which particular outcomes (i.e., event and emotion) arise. When situations such as chronic illness occur where immediate resolution is not feasible, resilient personality characteristics, alternative appraisals (e.g., resolution, acceptance), and more effective coping strategies (e.g., developing self-reliance, seeking social support) may be necessary to derive meaning from the experience so that positive emotion outcomes may arise. In this investigation I evaluated this theoretical model in a group of adolescents with ESRD who had received a renal transplant, focusing on treatment adherence (a major problem in adolescents with ESRD) and posttraumatic growth (positive psychological change following highly challenging life experiences) as the outcomes of interest.
CHAPTER 2
LITERATURE REVIEW

_Chronic Illness_

Chronic illness affects a large number of children and adolescents living in the United States. Chronic illness is defined as illness or impairment that is expected to last for an extended period of time (usually 3+ months) and require medical attention and care above and beyond what would be expected for a child or adolescent of the same age (Pless & Pinkerton, 1975). Additionally, chronic illness may be defined as any health disorder for which there is no cure (Weiland, Pless, & Roghmann, 1992).

Advances in medical technology and practice in recent years have markedly decreased mortality rates, resulting in an increase in the prevalence of children and adolescents living with chronic illness (American Academy of Pediatrics Committee on Children With Disabilities and Committee on Psychosocial Aspects of Child and Family Health, 1993; Newacheck & Taylor, 1992). It is estimated that 10-15% of children in the United States will develop some type of chronic illness by the age of 18 (Davidoff, 2004; Tarnowski & Brown, 2000); at least half (i.e., approximately 7% of all children) will experience limitation of activity due to chronic illness (Statistics, 2007). As of 2003, there were an estimated 18 million children and adolescents in the United States living with some type of chronic illness or impairment (Bureau, 2003).

Chronic illness and its effect on children and their families has replaced acute illness as the most serious issue in pediatric medicine (Hobbs, Perrin, & Ireys, 1985). The burden of chronic illness is carried not only by individual patients and their families...
but also by society as a whole. Compared with healthy children and adolescents, those with chronic illnesses utilize a larger percentage of health care resources, are more susceptible to acute illnesses, and are more likely to require hospitalization for exacerbation of their chronic or acute illness (Adams, Streisand, Zawacki, & Joseph, 2002; Cadman, Boyle, Szatmari, & Offord, 1987; Morad, Kandel, Hyam, & Merrick, 2004). Children and adolescents with chronic illness are also likely to have poor school attendance and experience school-related difficulties (Statistics, 2007). More frequent absences, in conjunction with cognitive impairments secondary to illness, medication side-effects, and/or intensive treatments that are sometimes necessary, may result in lower graduation rates, less advancement in secondary education, and fewer occupational opportunities. For example, in a large study involving adolescents with chronic renal failure, only 26% of the students graduated from high school at the expected age (Rosenkranz et al., 1992). Ultimately, many children with chronic illnesses are less prepared to be productive adults than youths with chronic illness; in a study assessing the social adjustment of 45 young adult renal patients who began treatment for ESRD as children, patients had fewer school qualifications and higher rates of unemployment than controls (Reynolds, Morton, Garralda, Postlethwaite, & Goh, 1993).

In addition to physical effects, multiple psychosocial effects impact these children and adolescents and the families with whom they live. Although some studies suggest chronically ill children and adolescents are not at increased risk for psychosocial difficulties (Bussing & Aro, 1996), others indicate that children and adolescents with chronic illnesses are at increased risk for a number of poor outcomes including psychiatric disorders, social adjustment problems, and poor body image (Bennett, 1994;
Bilfield, 2006; Cadman et al., 1987; Lavigne & Faier-Routman, 1992; Lewis & Vitulano, 2003; Reynolds, Garralda, Jameson, & Postlethwaite, 1988; Simoni et al., 1997; Wallander & Varni, 1995; Wolman, Resnick, Harris, & Blum, 1994). While many adolescents with chronic illnesses report psychosocial functioning similar to their well peers (Brem, Brem, McGrath, & Spirito, 1988; Bussing & Aro, 1996), others exhibit impaired psychological functioning, most notably, depression, anxiety, and Posttraumatic Stress Disorder (PTSD) features (Cadman et al., 1987; Drotar, 1999; Sabbeth & Stein, 1990; Tarnowski & Brown, 2000).

Adolescents with chronic illness also are at increased risk for experiencing adjustment problems such as difficulty adapting to new experiences and interacting with new people (Wallander & Varni, 1995). Despite increased risk, the majority of children and adolescents with chronic illnesses do not have identifiable mental health or behavioral problems, but they do have twice the prevalence compared to children without a chronic health condition (Health, 1993). For example, Bilfield (2006) found the rate of psychosocial concerns identified among children with chronic illnesses in pediatric primary care to be 17% greater than children without chronic illnesses. It is important to note that in addition to these negative psychosocial sequelae, some pediatric populations also experience positive psychological growth (Stabler, 1993).

Boice (1998) proposes that psychological effects of chronic illness are determined by five factors: (1) type and degree of physical impairment, (2) visibility of the illness, (3) uncertainty about the course and nature of the disease, (4) irregularity and unpredictable effects, and (5) high cost of treatment or great pain. The literature to date has focused on these and additional factors including family environment (LePontois,
Moel, & Cohn, 1987; McCubbin, Thompson, Thompson, Elver, & McCubbin, 1998; Soliday, Kool, & Lande, 2001), age of child (Watson, 1997), severity of illness (Reynolds et al., 1988), functional impairment (Fielding & Brownbridge, 1999), dependence on others for daily activities (Cadman et al., 1987), intelligence of the child (Perrin, Ayoub, & Willett, 1993), temperament of the child (Varni, Rubenfeld, Talbot, & Setoguchi, 1989), and genetic factors (Lewis & Vitulano, 2003).

A meta-analysis examining correlates of adjustment among children with physical disorders revealed that child characteristics showed the strongest correlation to adjustment, followed by parent/family risk factors (Lavigne & Faier-Routman, 1993). Additional significant correlates to adjustment were disease/disability risk factors but not stressors (including SES and community factors). Several other studies have found that children with concomitant disability are often at greater risk for psychosocial difficulties than those without functional impairment (Cadman et al., 1987; Weiland et al., 1992). In a review by the American Academy of Pediatrics, severity of illness was found to have a surprisingly small association with psychological adjustment, supporting the notion that other disease, treatment, and personal factors should be considered (Health, 1993).

It is important to note that not all chronic illnesses carry with them equivalent burdens (Bennett, 1994). Some illnesses may be minimally disruptive and easily managed (e.g., mild asthma) while others may be much more invasive and difficult to manage (e.g., Type I diabetes). Even with the same illness, course and treatment response varies. For example, adolescents with ESRD may be on dialysis for years, or they may receive a pre-emptive transplant. While some may experience a good response to treatment with relatively few complications, others may respond poorly, experiencing
multiple rejection episodes, hospitalizations, and side effects to medication. It can be methodologically problematic to consider all illnesses the same. Thus, understanding the characteristics and prognostic implications of illnesses is essential when considering questions of functioning.

*End Stage Renal Disease (ESRD)*

ESRD is a serious, chronic condition affecting a significant number of adolescents that requires lifelong treatment and management to ensure survival. ESRD is the final stage of kidney failure and is commonly defined as renal disease with less than 10% of both kidneys are functioning. The incidence rate for adolescent ESRD (categorized by the United States Renal Data System [USRDS] as 10-14 and 15-19 year olds) in the United States increased from 9.5 and 20.1 adolescents per million population in 1980 to 13.3 and 28.2 adolescents per million population in 2004, respectively (USRDS, 2006). Incident patient counts (i.e., new cases reported within a given year) in 1980 were 613 and, in 2004, were 965. Improvement in and availability of various modes of dialysis and renal transplantation has resulted in increased longevity of patients, with an estimated 16,394 adolescents living with ESRD in 2002 (USRDS, 2006).

ESRD in adolescents is most often caused by glomerulonephritis and secondary glomerulonephritis; in younger children, it is more often caused by a primary diagnosis of a cystic, hereditary, or congenital disease (USRDS, 2006). Glomerulonephritis occurs when the individual filtering units in the kidney, known as glomeruli, are damaged and leak blood and protein into the urine (Diseases, 2003). As kidney functioning deteriorates, alternative means must be taken to remove waste products of metabolism and excess water from the blood. Although no standard exists, serum Blood Urea
Nitrogen levels (or BUN) of 100 to 150mg/dL generally merit initiation of treatment (Evans, Greenbaum, & Ettenger, 1995).

There are two main types of treatment for ESRD, dialysis and transplantation. Dialysis often serves as a temporary treatment option until a patient can be transplanted. However, as waiting times for available donor kidneys grow longer, patients may be on dialysis for an extended period of time (Evans et al., 1995). The average time between beginning dialysis and receiving a transplant increased between the 1995-1999 and 2000-2004 USRDS tracking periods, with 51% of white children and 39% of black children receiving transplants within the first 12 months of dialysis during 1995-1999, decreasing to 42% and 29%, respectively, during 200-2004 (USRDS, 2006). Among the 937 adolescents diagnosed with ESRD in 2002, 587 received hemodialysis, 204 received peritoneal dialysis, 137 received a transplant, and 9 were undetermined (USRDS, 2006).

In dialysis, the blood is filtered to remove waste products and extra water. There are two primary types of dialysis. Peritoneal dialysis utilizes the lining of the abdominal cavity (the peritoneum) as a filter. Dialysate (a solution containing dextrose) is poured into the peritoneal cavity via a catheter. The solution draws extra fluid and waste from the blood into the peritoneal cavity, where it is then drained and the cleaning process initiated again. Continuing Ambulatory Peritoneal Dialysis (CAPD) requires that a patient undertake this process 4 to 5 times per day, whereas Continuous Cycler-Assisted Peritoneal Dialysis (CCPD) uses an automated cycler to instill and drain dialysate fluid via continuous exchanges throughout the night while the patient sleeps (Evans et al., 1995). In hemodialysis, blood is drawn from the body into a dialyzer, a machine containing thousands of fibers that filter out wastes and extra fluid, and then returned into
the body. This process takes approximately 3-4 per hours and must be repeated 3 times per week in an outpatient clinic setting. Among these different treatments, hemodialysis is the most common choice of dialytic treatment among adolescents (USRDS, 2006).

Transplantation involves replacing the damaged kidney with a healthy kidney obtained either from a living donor or a deceased donor. Those awaiting a deceased donor must be placed on the United Network for Organ Sharing (UNOS) waiting list. Factors such as tissue match, blood type, length of time on the waiting list, immune status and the distance between the potential recipient and the donor are all considered in determining when a patient will receive an organ. Approximately 1,000 pediatric renal transplants are performed worldwide each year, with experienced centers reporting 1-year renal graft survival rates greater than 90% (Laine et al., 1998).

Although hemodialysis is the most common treatment when ESRD is initially diagnosed, evidence suggests that renal transplantation results in improved survival and quality of life (Benfield, 2003; Evans et al., 1995; Wolfe et al., 1999). Wolfe et al (1999) examined longitudinal data obtained from the USRDS to determine mortality rates of patients on dialysis compared with those who had received a cadaveric transplant. The unadjusted annual death rates per 100 patient-years at risk for pediatric patients (ages 0-19) on dialysis, patients on the waiting list, and transplant recipients were 3.6, 2.2, and 0.9, respectively. The rate of death among the transplant recipients was initially higher than among the patients on the waiting list (2.8 times as high during the first 3 days following transplantation), but the death rate quickly decreased and became lower than the death rate for patients on the waiting list following the 5th day after transplantation. The authors estimated the projected years of life for these patients without transplantation
to be 26 years versus 39 years for those with transplantation. Among those transplanted, graft (i.e., transplanted organ) survival rates were found to be highest among living donors, with a reported half-life of 13.1 years from a living-related donor and 10.8 years from a deceased-donor transplant (Rees, Shroff, Hutchinson, Fernando, & Trompeter, 2007). Despite these benefits of transplantation compared to dialysis, over 30% of children and adolescents who receive a solid organ transplant present with substantial physical and psychological complications, markedly elevated levels compared to healthy peers.

ESRD often results in significant physiological complications including delayed puberty (Blum, 1992), stunted growth (Davis, Tucker, & Fennell, 1996; Reynolds, Garralda, Jameson, & Postlethwaite, 1986), urinary incontinence (Reynolds et al., 1986), memory/concentration problems (Brickman, Yount, Blaney, Rothberg, & De-Nour, 1996), hypertension (Davis et al., 1996), cardiovascular disease (Benfield, 2003), anemia (Davis et al., 1996), impaired bone metabolism (Davis et al., 1996), neurological problems (Fennell, 2000), and increased susceptibility to infection (Benfield, 2003), among others. Following renal transplant, physiological complications that often occur include anemia, urinary tract infection, hypercholesterolemia, hyperlipidemia, acute rejection, reduced bone mass, and cytomegalovirus (Berber et al., 2006). Some of these complications are due to medications, whereas others are attributable to a compromised immune system and resultant infections. Side effects of immunosuppressant medications such as tacrolimus (Prograf) include nephrotoxicity, neurotoxicity, diabetes mellitus, hypertension, and gastrointestinal upset (Fireman, 2004; Smith, 2002). In addition to these physiological manifestations of the illness, children and adolescents with ESRD
may also be subject to accompanying treatment-related and psychosocial stressors (Snethen, Broome, Bartels, & Warady, 2001). As Davis, Tucker, & Fennel (1996) explain, children diagnosed with ESRD are expected to “develop age-appropriate adaptive functioning skills while simultaneously coping with invasion of privacy, physical trauma, operative scars, corticosteroid side effects, dietary restrictions, growth failure, and difficulty adjusting to their peers” (p.161).

Research on the psychosocial functioning of children and adolescents with ESRD indicates that these stressors may very well have detrimental effects on psychological health. For example, among a sample of children and adolescents who underwent liver, heart, or kidney transplantation, 16% met all symptom criteria for a diagnosis of PTSD, with an additional 14% meeting 2 of 3 symptom clusters at least one year following their surgery (Mintzer et al., 2005). In another study, young adult renal patients diagnosed with ESRD as children were found to be less socially mature than a group of healthy controls, as evidenced by higher rates of living with their parents, having fewer intimate relationships outside their families, fewer school qualifications, and more unemployment (Reynolds et al., 1993). In a retrospective study, young-adult survivors of ESRD reported lower self-esteem and more self-reported psychological problems in childhood than a control group, although adult lifetime psychiatric morbidity was found to be the same for both groups (Morton, Reynolds, Garralda, Postlethwaite, & Goh, 1994).

Problems in psychological adjustment have been attributed to a variety of factors, including family expressiveness (Davis et al., 1996) and severity of illness, with patients on dialysis experiencing more psychological difficulties than those with less severe renal dysfunction and healthy controls (Garralda, Jameson, Reynolds, & Postlethwaite, 1988).
Other research suggests that treatment modality may be implicated. Results of a study comparing adolescent ESRD patients who had received a transplant or were receiving hemodialysis or CAPD showed a number of advantages for transplant and CAPD over hemodialysis (Brownbridge & Fielding, 1991). More specifically, those with transplants experienced fewer practical difficulties associated with treatment and had less functional and social impairment than those on dialysis. Those on CAPD had lower depression scores, exhibited less behavioral disturbance, and reported less social disturbance than children and adolescents on hemodialysis.

Another study involving parental ratings of behavioral and emotional adjustment for children and adolescents who had received a transplant compared with those who were on hemodialysis indicated an improvement in child behavior, family functioning, and parental psychiatric functioning among those who had received a transplant (Reynolds, Garralda, Postlethwaite, & Goh, 1991). Child ratings from the same study likewise indicated improved self-rated mood, self-concept, and social functioning. A meta-analysis by Cameron, Whiteside, Katz, & Devins (2000) supports the treatment modality hypothesis, indicating that successful renal transplantation was associated with significantly greater well-being and less distress than CAPD and hemodialysis. Further, CAPD was characterized by greater well-being than hemodialysis. However, the degree to which modality-specific physical and psychosocial sequelae develops or resolves over time or as treatments change has not been conclusively determined. Other studies evaluating treatment modalities, however, indicate no differences (Sayag, Kaplan De-Nour, Shapira, Kahan, & Boner, 1990).
Although the majority of research on psychosocial functioning among adolescents with ESRD has focused on negative outcomes, a number of studies assessing adults have found positive outcomes. For example, despite an increase in subjective stress and disruption of family life, some parents of children on hemodialysis reported an increase in social support as a result of their child’s illness (Reynolds et al., 1988). Among a large sample of adult renal patients, over 50% reported identifying some positive meaning in their illness (Caress, Luker, & Owens, 2001). These studies indicate how important it is to examine functioning from a broader perspective, exploring not only the negative but also the positive aspects.

*Appraisal and Coping Processes Model*

The theoretical Model of Stress and Coping first introduced by Lazarus & Folkman (1984) has been the foundation upon which much stress and coping research has been conducted. A recent revision by Folkman & Greer (2000) incorporates a more detailed presentation of meaning-based coping and its function in sustained coping processes and was thus the focus for this research study (see Figure 1).

![Figure I: Folkman & Greer’s Appraisal and Coping Processes Model (Folkman & Greer, 2000)]
Precipitating circumstances or events serve as the initiating and/or maintaining force for stress and coping processes to occur. The event may be a one-time occurrence (e.g., an assault) or episodic in nature (e.g., chronic illness). It also may be short in duration or prolonged over time. The nature of the event is important to assess objectively as well as subjectively to get an estimate of the associated level of adversity or severity of stress. In addition to event details, person characteristics (e.g., hardiness, optimism, resilience) are important in that they may determine the appraisal and coping style engaged in by the person. Research on personality characteristics and coping is extensive, although the literature on children and adolescents remains more limited.

The two processes making up the heart of the model are appraisal and coping. Folkman and Greer (2000) define appraisal as “the individual’s evaluation of the personal significance of a given event and the adequacy of the individual’s resources for coping (p. 12).” Appraisal of a threat consists of an evaluation of its personal significance (primary appraisal) and an evaluation of the options for coping (secondary appraisal). It is in primary appraisal that a person determines whether a given situation is interpreted as a harm, a threat, or a challenge. It is in secondary appraisal that a person determines how much control he or she has in the situation. Appraisal influences emotional responses and subsequent coping strategies. For example, in a study of children with chronic abdominal pain, different patterns of stress appraisal were associated with active, passive, and accommodative coping, all of which were related to symptoms and disability (Walker, Smith, Garber, & Claar, 2007).

Coping may be defined as “the thoughts and behaviors a person uses to regulate distress (emotion focused coping), manage the problem causing distress (problem-
focused coping), and maintain positive well-being (meaning-based coping)” (Folkman & Greer, 2000, p. 13). Coping strategies influence not only the actual outcome of but also the individuals’ appraisal of the event. Emotion-focused coping may be associated with less perceived control in a situation and consists of strategies such as cognitive reframing, distancing, or avoidance. Problem-focused coping may be associated with greater perceived control and consists of strategies such as information seeking, problem solving, and taking direct action to solve a problem. In Folkman and Greer’s (2000) model, meaning-based coping arises when there is no resolution or an unsatisfactory resolution to a problem (as in the case of a chronic illness), resulting in the prolongation of distress. As an outcome variable, meaning-based coping “helps the person relinquish untenable goals and formulate new ones, make sense of what is happening, and appraise benefit where possible” (Folkman & Greer, 2000, p. 13). Research on meaning-based coping has emerged in recent years in a variety of topical areas (e.g., trauma, violence) and with a variety of names. I will explore this construct in more detail in later sections, relating it to “posttraumatic growth (PTG).”

Though personal characteristics such as a person’s beliefs, values, and commitments tend to be relatively stable, variability in appraisal and coping processes may occur as a result of inconsistent external circumstances and situational demands (Lazarus & Folkman, 1984). As such, individuals may employ different coping strategies at different times and in different settings. Authors suggest that coping may be considered a proximal variable in that it may be amenable to change and modifiable via targeted interventions (Chesney, Chambers, Taylor, Johnson, & Folkman, 2003), while other research suggests it is more accurately a distal variable in that ingrained, habitual coping
styles may emerge as early as mid-adolescence (Steiner, Erickson, Hernandez, & Pavelski, 2002).

Folkman and Greer (2000) theorize that there are two types of outcomes: event and emotion. Event outcome is conceptualized as a favorable resolution, unfavorable resolution, or no resolution. Favorable resolution is directly linked to a positive emotion outcome, whereas unfavorable or no resolution is linked to distress and the potential for meaning-based coping. The majority of research on stress and coping has typically focused on negative outcomes including sadness, guilt, anger, irritability, fatigue, muscle tension and aches, gastric symptoms, general physical discomfort, and an increased risk of developing psychiatric problems, especially anxiety and depression (for review see Tedeschi & Calhoun, 2004). Based on this model, it makes sense that individuals with chronic illness for whom no resolution is possible may experience significant distress and/or meaning-based coping. However, it also is possible that patients may perceive both a lack of resolution and favorable event outcomes. More specifically, receiving a kidney transplant, satisfactory physical functioning, and adherence to treatment regimens may be perceived as favorable event outcomes among patients who would otherwise be experiencing more deleterious health or aversive treatment without having received a transplant.

The bulk of research exploring illness and psychological stress has focused on dysfunction and maladaptive outcomes, emphasizing psychiatric symptoms such as anxiety and depression while neglecting variables associated with psychological well-being (Folkman & Greer, 2000). While it may seem counterintuitive that people can experience psychological well-being in the face of severe illness, an increasing number of
studies are showing it is possible (Chesney et al., 2003; Folkman, Moskowitz, Ozer, & Park, 1997; Kennedy, Taylor, & Duff, 2005; Kobasa, Maddi, & Kahn, 1982; Zautra, Reich, & Guarnaccia, 1990). Exploration of adaptive coping and the ways in which people can move beyond adversity to derive benefit from a challenging situation is gaining recognition and increased research attention. This concept, referred to as posttraumatic growth, will be explored in the next several pages as each of the components of Folkman and Greer’s (2000) model is presented in more detail.

**Hardiness**

Kobasa et al. (1982) first introduced hardiness as a “personality-based tendency to diminish the impact of stressful life events by optimistic cognitive appraisals and decisive coping actions” (p. 3), thereby enabling individuals not only to manage stressful circumstances but also to turn them into developmental opportunities. The authors proposed that hardiness is comprised of three components: commitment, control, and challenge. **Commitment** involves having a sense of meaning and purpose in what one does and being deeply involved rather than alienated or disengaged. **Control** involves believing that one has the power to influence the surrounding course of events within reasonable limits. **Challenge** involves perceiving change as an opportunity for growth rather than a threat to one's sense of security or survival.

Hardiness has been conceived of as a reasonable measure of mental health, inversely related with such factors as anxiety, depression, somatization, interpersonal sensitivity, and severity of physical illness (for a review see Maddi & Khoshaba, 1994). In fact, hardiness has been shown to have a protective effect in the relationship between stress and illness, independent of other known buffers such as exercise and social support.
(Kobasa et al., 1982; Kobasa, Maddi, Puccetti, & Zola, 1985; Wiebe & McCallum, 1986). Hardy individuals may view life events as less stressful (Rhodewalt & Zone, 1989), may cope more effectively with these events (Soderstrom, Dolbier, Leiferman, & Steinhardt, 2000), and may be more conscientious about health practices (Wiebe & McCallum, 1986) than less hardy individuals.

Although hardiness was initially conceived of as a moderator between stress and health (Kobasa et al., 1982; Rhodewalt & Zone, 1989), the literature suggests that it has a stronger direct effect on health than an indirect buffering effect (Funk, 1992). For example, in a study involving military and governmental personnel, hardiness was found to have a stronger inverse relationship with depression and anger and a stronger positive relationship with coping and social support than religiosity (Maddi, 2006). In another study, coping strategies and health practices mediated the relationship between hardiness and health (Williams, Wiebe, & Smith, 1992). Individuals who scored higher on hardiness engaged in behavior positively associated with health and greater approach or problem-focused coping strategies, whereas individuals who scored lower in hardiness engaged in behavior negatively associated with health and greater avoidance or emotion-focused coping strategies. Consistent with prior research, commitment and control components correlated most consistently with coping variables. Florian, Mikulincer, & Taubman (1995) found similar results indicating that hardy individuals may present with greater confidence and be more inclined to use active coping, thus reducing their level of distress and related problems. As such, Tedeschi & Calhoun (2004) propose that individuals higher in hardiness may be less inclined to experience PTG because they interpret circumstances and events as less aversive than those lower in hardiness.
Research among Navy cadets also seems to reinforce this theory, as indicated by a negative association between hardiness and peritraumatic dissociation (Eid, 2006). This issue will be explored in greater detail in a later section.

Although most often conceived of as a personality trait, intervention studies have successfully altered hardiness through modification of individuals’ beliefs and actions, suggesting it may actually be a more malleable variable than once believed (Huang, 1995; Maddi, Kahn, & Maddi, 1998). For example, when compared with relaxation/meditation and placebo/social support groups, hardiness training was more effective in increasing self-reported hardiness, job satisfaction, and social support while decreasing self-reported strain and illness severity among a group of managers (Maddi et al., 1998). Hardiness interventions have thus far been implemented among refugees (Weine et al., 2003), business organizations (Steinhardt, Dolbier, Gottlieb, & McCalister, 2003; Weir et al., 1997), health care recipients (Webster & Austin, 1999), nurses (Judkins, 2006), persons with HIV (Nicholas & Webster, 1996), and families (Walsh, 1996). These results suggest that hardiness may be an important intervention target among adolescents with ESRD.

Appraisal

An abundance of research has been conducted on the relationship between appraisal and coping in the context of stressful situations. Although different definitions of appraisal exist and different terms are sometimes used (e.g., cognitive processing), the underlying construct appears to be relatively stable. In addition to Folkman and Greer’s highly efficient and utilitarian definition (previously quoted), Lazarus' (1999) definition of appraisal as “an evaluation of the significance of what is happening for our well-being
and the well-being of those about whom we care” (p.654) carries with it the importance of appraisal of vicarious events that may not happen directly to an individual. This is important in the context of children and adolescents with ESRD who may see their parents struggling with financial and time constraints involved with their care.

Cognitive appraisal of a stressor may be regarded as the first in a series of steps leading to a particular outcome. According to Lazarus and Folkman’s (2000) theoretical model of appraisal and coping processes, appraisals of threat signify potential for harm or loss, whereas appraisals of challenge represent opportunity for growth or change. Whether a situation is seen as a threat or an opportunity will, doubtlessly, impact the coping strategies that are employed and interpretation of resultant outcomes. For example, Franks (2006) found, in his meta analysis of people living with cancer, that those who appraised their illness as a threat were more likely to use problem-focused coping, those who appraised it as a harm/loss were more likely to use avoidance coping, and those who appraised it as a challenge were more likely to use approach coping strategies. As such, appraisal is an important factor in response to stress (Epel, McEwen, & Ickovics, 1998).

Appraisal happens instantaneously but is susceptible to continuous revisions. As such, it is best conceived of as an on-going process. Leventhal, Nerenz, & Steele (1984) proposed that patients quickly develop perceptions of their illness, also called “illness representations,” and that these perceptions may affect adaptation to illness. Illness representations are comprised of five components: (1) identity (symptoms the patient associates with the illness); (2) cause (perception of what has given rise to the illness); (3) time-line (perceptions regarding likely duration of the illness); (4) consequences
(perceived effects and outcome of the illness) and (5) cure control (patient’s perception of their ability to control or recover from the illness). This notion of illness representations across a wide range of illness types was supported by a meta-analytic review (Hagger & Orbell, 2003). Indeed, appraisal is a construct of interest in research involving a wide range of illnesses including multiple sclerosis (Pakenham, 2006), cancer (Kazak et al., 2004; Manne et al., 2004), kidney disease (Caress et al., 2001), congestive heart failure (Park, 2006), diabetes (Beveridge, 2006), and spinal cord injury (Kennedy et al., 2005), among others.

Lazarus (1999) describes the difficulty of appraisal, suggesting that, "In appraising we negotiate between two seemingly opposing frames of reference. One is that we try to assess our situation realistically in order to cope with is as effectively as possible...the other is that we try to put the most favorable spin possible on our plight in order not to undermine hope” (p. 655). Making sense of traumatic experiences requires cognitive processing not only at a cognitive level but also at an emotional level (Williams, Davis, & Millsap, 2002; Wortman & Silver, 1989). The reality of the traumatic experience must be integrated into an individual’s existing schema of self and life in such a way that does not lead to continued suffering (Janoff-Bulman & McPherson Frantz, 1997). Successful appraisal of a situation ideally will result in finding acceptable meaning in trauma, on both an emotional and cognitive level (Wortman & Silver, 1989), and focusing on a variety of mental evidence to support this positive meaning (Clark, 1993).

Conversely, unsuccessful appraisal of a situation may be characterized by intrusive thoughts, repression, feelings of guilt and shame, and less assimilation,
resolution, and acceptance (Williams et al., 2002). Unsuccessful, or maladaptive, appraisals have been associated with numerous negative outcomes (Affleck, Tennen, & Gershman, 1985; Caress et al., 2001; Epel et al., 1998). For example, in a longitudinal study of heart attack survivors, cognitive appraisal (more specifically, causal attribution and perceived benefits) was found to be predictive of mortality eight years after the initial attack. More specifically, those who blamed others for their heart attack or attributed it to stress responses (e.g., nervousness) were at greater risk for death. Those who cited benefit from the attack were less likely to have another attack and had lower levels of morbidity, even after controlling for initial physician prognosis (Affleck, Tennen, Croog, & Levine, 1987). In another study among women exposed to repeated laboratory stressors, those who engaged in more adaptive cognitive appraisal were found to have lower cortisol levels, indicating less intense physiological response to the stress than those who engaged in less adaptive cognitive appraisals (Epel et al., 1998).

In addition to physical outcomes, the importance of appraisal in influencing psychological outcomes was evidenced in a study by Caress et al. (2001) who found that, among renal transplant patients, those who perceived “challenge” and “value” from their experience had a more positive outlook than other patients who did not have the same perceptions. In another study, survivors of melanoma who had lower appraisals of threat and higher appraisals of challenge and of their ability to cope evidenced better adjustment and well-being, accounting for more variance than hardiness or illness variables (Hamama-Raz, 2006). In yet another study, individuals with congestive heart failure who appraised their condition as threatening were prone to higher levels of depression than those who did not appraise their condition as threatening (Park, 2006). Additional
research supports this conception of appraisal as protective of psychological functioning, indicating that people who engage in appraisal and cognitive processing may be more likely to derive meaning from adversity (Bower, Kemeny, Taylor, & Fahey, 1998; Calhoun, Cann, Tedeschi, & McMillan, 2000; Caress et al., 2001; Clark, 1993) and may experience greater PTG than those who do not engage in cognitive processing (Linley & Joseph, 2004; Manne et al., 2004; Park, Armeli, & Tennen, 2004; Williams et al., 2002). In a study looking at specific types of appraisal, cognitive restructuring (i.e., changing the interpretation of a perception from negative to neutral or positive, thereby making that perception less stressful) was positively associated with PTG while denial and regrets were minimally associated (Williams et al., 2002).

The majority of studies assessing appraisal have focused on adults, largely neglecting children and adolescents despite the fact that adolescents have cognitive sophistication approaching that of adults. As Millstein & Litt (1990) point out, adolescents in the formal operational stage of cognitive development understand that “personal behavior may have a direct impact on their health, and they are able to understand the various physical, psychological, affective and social repercussions of being ill” (p.460). As such, adolescent appraisals should be considered, especially in situations where they are increasingly responsible for carrying out necessary behavior (e.g., treatment adherence among the chronically ill). For example, a study of adolescents with diabetes indicated that, as adolescents grew older, they shared less illness ownership and congruence regarding perceived stressful events with their mothers (Beveridge, 2006). This is also important given that appraisal often influences coping strategies (Park, 1998).
Coping

Coping is a dynamic and multifaceted construct that has received increased attention in recent years and has been explored in a multitude of ways. The bulk of the research on coping has traditionally employed a two-factor paradigm, the most prominent of which have been active versus passive coping or problem-focused versus emotion-focused coping (Billings & Moos, 1981). Increasingly, however, research suggests that such paradigms are too simplistic and fail to capture the complexity of coping and its resultant outcomes (Ayers, Sandler, West, & Roosa, 1996; Carver, Scheier, & Weintraub, 1989; Connor-Smith, Compas, Wadsworth, Thomsen, & Saltzman, 2000; Patterson & McCubbin, 1987). As such, multiple dimensions of coping are being explored in conjunction with specific outcomes. Connor-Smith et al. (2000) developed a questionnaire for use among adolescents that included five distinct coping responses: primary control engagement coping (e.g., problem solving), secondary control engagement coping (e.g., cognitive restructuring), disengagement coping (e.g., avoidance), involuntary engagement (e.g., rumination), and involuntary disengagement (e.g., emotional numbing).

It is important to reiterate at this point that in Lazarus and Folkman’s original stress and coping model and subsequent revisions, coping and appraisal were conceived of as distinct constructs. The distinction between these constructs has blurred, with modern conceptions of coping including more cognitively-based coping approaches, otherwise categorized as secondary control coping. Secondary control coping strategies may be conceived of as maintaining control over one’s reaction and response to a stressor, whereas primary control strategies involve changing objective conditions.
(Langer, Chen, & Luhmann, 2005). Appraisal of a situation as a challenge rather than as a harm or threat will inevitably be influenced by individuals’ general cognitive strategies, whether or not they are deliberate attempts to cope.

An observed association between particular coping strategies and outcomes such as distress or impaired psychological functioning may indicate a shared, underlying variable, or it may indicate a causal relationship whereby psychological functioning affects coping or coping affects psychological functioning. Research to date appears to support the latter (Norberg, Lindblad, & Boman, 2005). It is important to keep in mind that coping strategies themselves are not necessarily adaptive or maladaptive, but rather they must be examined in context. Coping strategies must be evaluated with consideration to the particular demands of the situation factors and personal factors. As such, it is important to explore coping as a malleable variable that may be targeted for change to optimize outcome.

Adolescent coping strategies have been explored among a variety of illnesses including chronic pain (Eccleston, Crombez, Scotford, Clinch, & Connell, 2004), HIV (Lewis & Brown, 2002), epilepsy (Reeve & Lincoln, 2002), inflammatory bowel disease (MacPhee, Hoffenberg, & Feranchak, 1998), cancer (Nichols, 1995), cystic fibrosis (Lewis & Vitulano, 2003), gross motor impairment (Wallander & Varni, 1995), sickle cell disease (Gil, Williams, Thompson, & Kinney, 1991), diabetes (Grey, Boland, Yu, Sullivan-Bolyai, & Tamborlane, 1998), juvenile rheumatoid arthritis (Frank et al., 1998), and end-stage renal disease (Snethen, Broome, Kelber, & Warady, 2004). These studies suggest that adolescents who consistently encounter the demands of living with a chronic illness tend to develop a pattern of coping to eliminate or minimize the stressful demands
(Austin, Patterson, & Huberty, 1991). This tendency to develop habitual coping styles has been found among healthy individuals as well, with tendencies emerging as early as mid-adolescence (Steiner et al., 2002).

While some research suggests that diagnostic group membership is not associated with adaptation to and coping with chronic illness among children (Frank et al., 1998), this is not conclusive. For example, other research suggests that children on peritoneal dialysis utilize self-reliance more as a coping process than those children on hemodialysis who required tri-weekly trips to the hospital for treatment (Brem et al., 1988). Other factors such as severity, duration of illness, and intensity of treatment regimen may be important in determining the coping strategies employed by children with chronic illnesses (Eiser, 1993). For example, among children undergoing medical procedures for cancer, coping strategies were found to differ by length of time since diagnosis and number of procedures a child experienced (Smith, Ackerson, & Blotcky, 1989).

Another factor related to selective utilization of coping strategies that appears relatively robust in the literature is age of the child/adolescent. In his review of the literature, Eiser (1993) found no age-related differences in utilization of problem-focused coping among children and adolescents with chronic illness, but he did find that emotion-focused coping generally seemed to increase with age for both medical and non-medical stressors. Spirito, Stark, Gil, & Tyc (1995) reported that adolescents were less inclined to use blaming others and wishful thinking than younger children but were more inclined to resignation. He also found that boys reported using cognitive restructuring and self-blame more than girls, whereas girls reported using emotion regulation and social support more than boys. In addition to age, Snethen et al. (2004) found that sex, transplant status, and
religious views were significantly related to the coping strategy utilized by adolescents with end stage renal disease. More specifically, males were found to utilize humor more than females, transplant recipients were more likely to engage in demanding activities than those on dialysis, and those who reported involvement in some sort of religion were found to seek more spiritual support than those who did not report involvement in religion.

The type of coping strategy employed by adolescents with chronic illness has been found to have an impact on their physical and psychological functioning. Coping strategies used by children and adolescents with sickle cell disease were strongly predictive of both medical outcome (i.e., emergency room visits) and psychological distress (Gil et al., 1991). Among adolescents with chronic pain, emotional coping was found to be an essential component in their experience of distress (Eccleston et al., 2004). One study comparing adolescents with chronic abdominal pain and well children found that accommodative coping (i.e., acceptance and positive reappraisal) was reported more frequently by children than either active or passive coping, though children with chronic abdominal pain reported less frequent use of this type of coping (Walker et al., 2007). Other factors may also affect coping style, as evidenced by a study conducted among adolescents with ESRD where transplant status, religious views, age, and sex was associated with the coping style used (Snethen et al., 2004).

Religious Coping

According to results from a national survey published in the Journal of the American Medical Association (JAMA) in 1998, religious practices such as prayer are the most prevalent complementary and alternative therapy endorsed in the United States
This is not surprising given that 82% of Americans believe in the healing power of personal prayer, 73% believe that praying for someone else can help cure their illness, and 77% believe that God sometimes intervenes to cure people who have a serious illness (Yankelovich Partners, 1996). It is not uncommon for people to seek support from a higher power when faced with overwhelming threats, a tendency viewed by some as a secondary control strategy and a natural form of coping when personal control is believed to be minimized (Heckhausen & Schulz, 1995).

Religious coping may be defined as “the use of cognitive or behavioral techniques, in the face of stressful life events, that arise out of one's religion or spirituality” (Tix & Frazier, 1998, 412). Examples of religious coping include prayer, repentance, and seeking strength and comfort from God in stressful situations. Researchers in the area emphasize that religious coping should be differentiated from other more general measures of religiosity such as church attendance and self-reported importance of religion because these measures tend to be less specific and may be more susceptible to social desirability bias (Pargament, Ensing, Falgout, Olsen, & et al., 1990).

General results suggest that utilization of religious coping during times of stress leads to positive consequences, although not all studies provide consistent findings (for review see Pargament et al., 1990). For example, some studies examining the association between religious coping and PTSD have found that religious coping is associated with more PTSD symptoms (Pargament, Smith, Koenig, & Perez, 1998) while other studies suggest it is associated with fewer PTSD symptoms and better adjustment (Park & Cohen, 1993). This potential for religious coping to be associated with greater distress is explained by Tix & Frazier (1998) who suggest that, “Religious coping may be more apt
to promote positive, meaning-based psychological outcome (i.e., life satisfaction) than to prevent negative, symptom-based ones (i.e., distress)” (p.420). Religious coping may not necessarily cause distress but rather those who are more distressed may seek out religious coping to a greater degree.

Although religious coping has been looked at in a number of ways (e.g., intrinsic/extrinsic), it is best conceived of as a multidimensional construct comprised of both positive and negative patterns of coping (Pargament et al., 1998). Pargament et al. (1998) delineate these two patterns, suggesting that the former includes benevolent religious reappraisals, collaborative religious coping, seeking spiritual support, spiritual connection, religious purification, seeking help from clergy, religious helping, and religious forgiveness. Negative patterns of coping are posited to include punitive religious reappraisals, demonic religious reappraisals, reappraisals of God’s powers, spiritual discontent, self-directed religious coping, and interpersonal religious discontent.

It is important to note that different assessments of religiosity are related to different outcomes. In some studies, intrinsic religiousness as indicated by activities such as prayer has been found to be associated with positive outcomes more often than extrinsic religiousness as indicated by activities such as religious attendance (Calhoun et al., 2000; Park & Cohen, 1993). Other studies, however, suggest that religious participation alone may be related to PTG (for review see Pargament, 1997). In general, studies of positive and negative religious coping have consistently revealed positive and negative outcomes, respectively. In a study conducted among medically ill hospitalized older patients, negative religious coping behaviors were related to poorer physical health, worse quality of life, and greater depression than those who utilized positive religious
coping behaviors (Koenig, Pargament, & Nielsen, 1998). In a study conducted among college students coping with a significant negative life event, better adjustment was related to a number of coping methods, such as benevolent religious reappraisals, religious forgiveness/purification, and seeking religious support. Poorer adjustment was associated with reappraisals of God's powers, spiritual discontent, and punishing God reappraisals. These results held up even after controlling for the effects of demographics and global religious measures (e.g., frequency of prayer, church attendance, and religious salience; Pargament, Koenig, & Perez, 2000).

Religious coping has been found to predict unique variance above and beyond factors such as cognitive restructuring, social support, and sense of control for a wide range of physical and psychological variables (Pargament, 1997; Tix & Frazier, 1998). For example, among parents of children diagnosed with cancer, religious coping accounted for 19% of the variance in parental psychological distress (Cardella & Friedlander, 2004). There is evidence to suggest that religious coping is associated with better adjustment longitudinally (Tix & Frazier, 1998) and that it may be more important than social support for adjustment to some illness diagnoses such as cancer (Nairn & Merluzzi, 2003).

In a review of the literature, Shaw (2005) identified eleven empirical studies that reported links between religion, spirituality, and PTG, results of which indicated that religion and spirituality are usually (although not always) beneficial to people in dealing with the aftermath of trauma, and that traumatic experiences may lead to a deepening of religion or spirituality. The directionality of the relationship between religiosity and PTG is, however, unclear. It may be that persons experiencing PTG seek out religious
experiences, or that religious participation serves as a prompt for individuals to experience PTG (Tedeschi & Calhoun, 1996). Some research suggests that increased religiousness occurs as the result of stressful experiences (Park, Cohen, & Murch, 1996).

Although the vast majority of research on spirituality and religion in the pediatric literature examines parental beliefs and behavior, children’s experience of spirituality and coping has been explored among a limited number of health-related conditions including psychiatric problems, hospitalization, disability, cancer, and terminal illness (for reviews see Barnes, Plotnikoff, Fox, & Pendleton, 2000) and Mahoney et al., 2006). As Barnes et al. (2000) suggest, “spirituality and religion may inform children's lives; play a part in children's moral formation, socialization, and induction into a sacred worldview; and provide the child with inner resources” (p. 900). In one prospective study where adolescents were followed up 1 month and 1 year after an accidental injury or the diagnosis of a chronic disease, religious coping was found to reduce posttraumatic stress symptoms (Zehnder, Prchal, Vollrath, & Landolt, 2006). Another study found differences in minority adolescents’ use of religious coping and health outcomes, namely that religious coping was associated with both psychological and physical health among Mexican-Americans, psychological health among Asian-Americans, and neither psychological or physical health among African-Americans (Vaughn & Roesch, 2003). Despite this realization, there is a paucity of research examining children and adolescent’s use of religious coping when dealing with extreme stressors.

Treatment Non-adherence

After physiological and psychological functioning, a primary outcome of interest in health-related research is non-adherence. (It is important to note that the terms “non-
adherence” and “non-compliance” are often used interchangeably in the literature, although some researchers prefer the term “non-adherence” believing that it connotes more collaboration between the health care provider and patient and is less authoritarian in nature (Sawyer & Aroni, 2003). Adherence is generally defined as an active, voluntary, collaborative involvement of the patient in a mutually acceptable course of behavior to produce a desired preventative or therapeutic result (Meichenbaum & Turk, 1987). Within pediatrics, non-adherence is defined as “those instances when a child either actively or passively, but purposely, does not perform a behavior that has been requested by a parent or other adult authority” (Kalb & Loeber, 2003, 643). The authors point out that all children are non-adherent at one time or another, but it is when the non-adherence becomes persistent that problems arise.

Adherence refers not only to taking medications as prescribed but also to a wide array of health-promoting behaviors including other treatment regimens and specific strategies to ease, monitor, and/or manage a disease and its symptoms, including attending scheduled appointments and having necessary laboratory work done in a timely manner (Penkower et al., 2003; Sawyer & Aroni, 2003). Adherence is a multidimensional construct, the particularities of which vary depending on medical diagnosis and treatment regimen. Adherence for someone with a renal transplant requires very different behavior than adherence for someone with a torn anterior cruciate ligament (ACL). Renal transplant patients not only need to maintain a structured medication regimen, but they also must have routine laboratory tests and clinic visits; they may also need to adhere to a diet to ensure they do not gain excess weight when taking steroids. Despite the complexities of adherence, it is still often reported in the literature as a dichotomous
variable (i.e., adherent/non-adherent). Increasingly, however, weighted algorithms are being constructed in an attempt to more accurately depict medically relevant and more realistic follow-through of medical recommendations (e.g., taking ≥80% of medication as prescribed and still being considered medically compliant (Sawyer & Aroni, 2003).

While not all non-adherent medical behavior leads to dire consequences, the potential for adverse outcomes remains high. Physical outcomes of non-adherence may include progression of disease, exacerbation of disability, unnecessary prescriptions of more potent and/or toxic drugs, more frequent medical emergencies, and ultimate failure of treatment (Abbott & Gee, 1998). The monetary cost of poor adherence is substantial as well, consisting not only of medical expenditures but also of lost productivity. Among children and adolescents, this may also present as failure to thrive academically.

The issue of non-adherence is especially problematic among adolescents. Adolescents have consistently been found to have significantly higher rates of non-adherence when compared with adults. For example, rates of medication non-adherence are presumed to be up to four times greater in adolescents than adults (Rianthavorn, Ettenger, Malekzadeh, Marik, & Struber, 2004). Similarly, adolescents are at a greater risk of non-adherence than younger children, with rates of non-adherence as high as 64% (Blowey et al., 1997; Ettenger et al., 1991; Meyers, Thomson, & Weiland, 1996; Morgenstern et al., 1994; Rianthavorn et al., 2004; Sketris, Waite, Grobler, West, & Gerus, 1994; Wolff, Strecker, Vester, Latta, & Ehrich, 1998).

The rationale as to why non-adherence among adolescents is so problematic typically focuses on issues such as advancing independence, autonomy, and competence to take on responsibilities that were once handled by parents (e.g., taking medications as
prescribed) (Rianthavorn et al., 2004). Adolescents are required to develop a number of skills including increased cognitive sophistication, abstract thinking, and the ability to control and take responsibility for their own behavior. Adolescents may have difficulty imagining the future consequences of present actions, especially when they perceive themselves as invulnerable. As such, they may exhibit poor impulse control and increased rebellion, especially when required to do things their peers are not required to do (Kalb & Loeber, 2003).

Another potential reason adolescents may be non-adherent is “reasoned noncompliance” (Nevins, 2002). This is defined as a belief that a drug is too strong or the side effects are too problematic, such as the weight gain and cushingoid appearance (i.e., fat deposit over upper thoracic vertebrae) commonly associated with immunosuppressive medications. Adolescents may arbitrarily reduce doses or frequency of their medication hoping to reduce unacceptable cosmetic side effects or other inconveniences seen as inhibition of their quality of life.

Non-adherence is attributable not only to patient and family factors (e.g., age of patient, emotional/social support, style of communication), but also to interrelational factors (i.e., behavior of health-care providers and their interaction with patients and families), disease and treatment factors (e.g., prognosis, complexity of treatment regimen, medication side effects), and systemic factors (i.e., the organization of health care including cohesiveness of treatment delivery system, continuity of care, waiting time for a graft; for reviews see Meichenbaum & Turk, 1987; Wolff et al., 1998). Other important factors associated with non-adherence identified among children and adolescents with ESRD include female sex, familial instability, low SES, low family cohesiveness, high
patient scores on measures of anxiety and depression, low patient scores on measures of social desirability, deceased donor, and lack of acceptance of diagnosis (Feinstein et al., 2005; La Greca & Schuman, 1995; Lurie et al., 2000). Among renal transplant patients, the association between psychiatric symptoms such as depression and anxiety and treatment non-adherence among adults (Kiley, Lam, & Pollak, 1993; Rodriguez, Diaz, Colon, & Santiago-Delpin, 1991) is not as consistently found among children, with some studies finding support for the relationship between psychiatric symptoms and non-adherence (Brownbridge & Fielding, 1994) and other studies finding a lack of support (Penkower et al., 2003; Simoni et al., 1997).

In their meta-analysis of non-adherence in pediatrics, Meichenbaum & Turk (1987) challenge the status quo by concluding that “although many health care providers attribute non-adherence to patient characteristics, the search for stable factors that comprise the non-adherent, uncooperative, or chronic defaulter patient has met with little success…a more robust relationship has emerged between the degree of patient satisfaction with both the health care provider and the treatment regiment and the level of adherence” (p. 35). As such, examining the quality of health care provider and patient interaction may also be important.

Beyond mere correlates of non-adherence, several researchers have attempted to create typologies or profiles of non-adherent patients in an attempt to better distinguish the differences among individuals. For example, three typologies of non-adherence in pediatric cystic fibrosis patients were identified: those who are non-adherent because of inadequate knowledge, those who have “psychosocial resistance,” and those who make deliberate decisions to deviate from their treatment regimen due to quality of life issues
Among adult renal transplant recipients, three distinct profiles of non-adherent patients were identified: accidental non-compliers, invulnerables, and decisive non-compliers (Greenstein & Siegal, 1998). In another study involving the same population, four categories were identified: overall compliant, noncompliant with diet, noncompliant with medication, and overall noncompliant (Kiley et al., 1993). In yet another study of adolescent heart, liver, and kidney recipients, four adherence classification categories were developed based not only on self-reported medication adherence but also immunosuppressant lab values (Simons, in press).

Adolescents were deemed “Genuinely Adherent” if their serum lab values were all within range, their standard deviation of drug levels was below 3, and they reported missing or taking their medication late <10% within the past 7 days. “Deniers/Medically Complicated” adolescents were those who had a high or low drug level and/or standard deviation of drug levels above 3 but who reported missing or taking their medication late <10% within the past 7 days. “At-risk” adolescents were those whose serum lab values were all within range and whose standard deviation of drug levels was below 3 but who reported missing or taking their medication late >10% within the past 7 days. Lastly, “Genuinely Non-Adherent” adolescents were those whose serum lab values were not within range and/or whose standard deviation of drug levels was above 3 and who reported missing or taking their medication late ≥10% within the past 7 days.

Appropriately identifying patients as non-adherent has traditionally been met with difficulty. For example, parent and child reports of child functioning, whether physical or psychological, are often discordant (e.g., Grills & Ollendick, 2003; Tillman et al., 2004; Winkelstein et al., 2000). Likewise, expert assessments of non-adherence by physicians...
and nurses have not been concordant with laboratory values generally recognized as representing adherent behavior (Blowey et al., 1997; Shemesh et al., 2004; Simoni et al., 1997). For example, in a study among pediatric renal dialysis patients, levels of adherence among participants was generally low, with phosphorus and calcium levels within the recommended range 39% and 43% of time, respectively, although clinician rating of adherence averaged 83%. Among transplant patients, laboratory measures commonly used to assess non-adherence include immunosuppressant levels of tacrolimus (Prograf®), cyclosporine (Gengraf®), and sirolimus (Rapamune®) (Chisholm, 2005). It is generally assumed that laboratory values are the most objective rating of the presence of non-adherence, although many researchers suggest that multiple informants should still be used (La Greca & Schuman, 1995; Shaw, Palmer, Blasey, & Sarwal, 2003).

It might be assumed that non-adherence among organ transplant recipients would be low given the critical shortage of viable organs but research clearly indicates that this is not the case, with estimated rates of non-adherence ranging from 20 to 50% among adult and pediatric solid organ transplant recipients (Blowey et al., 1997). Even higher rates have been reported among adolescent renal transplant recipients, such as in the study conducted by (Ettinger et al., 1991) where 21% of patients took less than 80% of their prescribed cyclosporine doses and 26% took drug holidays (i.e., successive days of not taking medication). Shaw et al. (2003) found that, among renal transplant recipients who had been on cyclosporine for at least 6 months, 50% evidenced noncompliance and 13% of the recipients lost their graft because of noncompliance. In another study, non-adherence as determined by serum immunosuppressant levels was found among 32.5% of renal transplant recipients (Penkower et al., 2003). In a study conducted among
adolescent renal transplant recipients, rates of non-adherence were found to be 13.6% for medication, 22.7% for blood work, and 50% for missed clinic appointments (Beck et al., 1980; Cochat, De Geest, & Ritz, 2000; Ettinger et al., 1991). Overall non-adherence among adolescent renal transplant recipients is estimated to be between 43% and 64% (Greenstein & Siegal, 1998), over twice the rate of non-adherence found among adults (Kiley et al., 1993). Upwards of 78% of allograft loss among renal transplant recipients is attributable to non-adherence with the post-transplant regimen (Meyers et al., 1996).

Some studies conducted among adolescents with renal transplants indicate that more education about topics such as medication management, immunosuppression, and disease status might be helpful in improving adherence (Beck et al., 1980), while other studies suggest that motivation may be more important than knowledge about medications for improving adherence (Lurie et al., 2000; Shaw et al., 2003). Further, adherence has been found to be improved with direct parental involvement and voluntary maintenance of a medication calendar. Additional studies indicate lack of parental supervision and involvement are factors in non-adherence (Lurie et al., 2000). For example, lack of parental supervision was rated as a significant factor in non-adherence by 52% of pediatric liver transplant recipients (La Greca, 1990). There exists considerable speculation about when adolescents with a chronic illness are able to and should take greater responsibility for their medical treatment, especially in the context of high rates of non-adherence (Tedeschi & Calhoun, 2004).

Many studies conducted among illness populations examine treatment adherence or poor psychological functioning as outcomes of interest. Increasing evidence, however,
supports the notion that traumatic events such as experiencing significant illness may sometimes be precursors to growth (for a review see Tedeschi, Park, & Calhoun, 1998).

PTG

The term PTG, first introduced by Tedeschi, et al. in 1998, refers to “positive psychological change experienced as a result of the struggle with highly challenging life circumstances” (Tedeschi & Calhoun, 2004, p.3). It is both a process and an outcome, seen as developing out of a cognitive process initiated to make sense of and cope with traumatic events. PTG involves a qualitative change in functioning and/or development, not simply a return to baseline following a trauma. PTG has been studied in the context of a multitude of life crises and stressors including bereavement, rheumatoid arthritis, HIV infection, cancer, bone marrow transplantation, heart attacks, coping with medical problems of children, transportation accidents, house fires, sexual assault and sexual abuse, combat, refugee experience, and being taken hostage (for a review, see Tedeschi & Calhoun, 2004).

The term PTG has many synonyms in the literature, words and phrases construing the same conceptual construct but without linguistic consistency across researchers. Terms used synonymously include perceived benefits, positive aspects, transformation of trauma, stren conversion, positive psychological changes, construing benefits, stress-related growth, positive by-products, discovery of meaning, positive emotions, thriving, positive reinterpretation, drawing strength from adversity, and transformational coping (Janoff-Bulman & McPherson Frantz, 1997). The authors admit that the choice is in part semantic but they also provide a rationale as to why PTG may be the preferable term. They suggest that the term PTG more accurately differentiates severe events from lower level stressors and that transformative changes in people’s lives are real, not merely
illusory as suggested by some of the alternative terms. They also suggest that PTG is both an ongoing process and outcome, not merely a transitory coping mechanism and that it does not preclude the experience of simultaneous stress.

Core values are often challenged and questions about meaning and purpose in life are often raised following traumatic experiences (Park et al., 2004). People may experience profound changes, such as a reorienting of one's life in alignment with reconsidered priorities. Other changes may be smaller but equally important, such as handling stress more effectively, improved relations with loved ones, improved self-care, development of a more salient identity, appreciating more the everyday aspects of life, increased courage to take chances, and feeling closer to God (Tedeschi & Calhoun, 2004). The general paradox of PTG is that sometimes out of loss there can be gain (Tedeschi & Calhoun, 2004). The presence of PTG does not preclude the simultaneous experience of pain or distress, nor is it accompanied by the perspective that trauma itself is desirable. In reality, it is not so much the trauma itself that is responsible for growth but what happens in the aftermath of trauma. As such, PTG has been found to be distinct from such traditional measures of psychological adjustment such as well-being and distress (Tennen & Affleck, 1998). It is also thought to be distinct from specific coping strategies in that individuals must continually and consciously remind themselves of positive personal changes as a means of coping, whereas growth experiences may not arise from intentional behaviors (Bonanno, 2004; Tedeschi & Calhoun, 2004). It is further thought to be distinct from resilience or hardiness (a potential pathway to resilience) in that PTG involves movement beyond pre-trauma levels, not merely
maintenance of status quo throughout trauma (Lev-Wiesel & Amir, 2003; Peltzer, 2000; Salter & Stallard, 2004; Weiss, 2002).

Affective experience is essential in converting cognitive processing of trauma from mere intellectual reflection into a transformative life experience. As Tedeschi and Calhoun (2004) state, “PTG is most likely a consequence of attempts at psychological survival, and it can coexist with the residual distress of the trauma” (p.4). In fact, several studies indicate that the experience of posttraumatic stress disorder (PTSD) symptoms and PTG are not mutually exclusive (Salter & Stallard, 2004). For example, in one study of children involved in a motor vehicle accidents, 42% reported experiencing PTG with 37% concomitantly reporting symptoms consistent with a diagnosis of PTSD (Tedeschi & Calhoun, 2004). Although it appears that a certain level of distress is necessary to set the process of growth in motion and, in some cases, to enhance and maintain it over time, PTG has been associated in some studies with a reduction of distress over time (Tedeschi & Calhoun, 2004).

Because the literature is still relatively young, few factors have consistently emerged as predictive of or continually associated with PTG. Personality characteristics thought to affect the likelihood of people experiencing PTG following traumatic events include optimism, extraversion, and openness to new experience (Tedeschi & Calhoun, 2004). Additionally, supportive relationships with others, opportunities to disclose, and persistent cognitive processing are further proposed to lead to PTG. It also has been suggested that PTG may be more likely among adolescents or adults than young children or older adults because it requires changing of an established set of schemas the likes of which young children may not yet have established and to which older adults may be
more adherent (Linley & Joseph, 2004). In a review of the literature on positive change following adversity and trauma, Linley & Joseph (2004) found a number of variables were consistently associated with PTG, including cognitive appraisal (threat, harm, and controllability), problem-focused coping, acceptance and positive reinterpretation coping, optimism, religion, cognitive processing, and positive affect. They found inconsistent support for the associations between PTG, sociodemographic variables (sex, age, education, and income), and psychological distress variables (e.g., depression, anxiety, PTSD).

Minimal research has been conducted on the relationship between PTG and physical well-being, although the research that has been done is promising. Heart attack victims who reported deriving benefit from the attack were found to have lower rates of mortality than those who did not perceive any derived benefit (Epel et al., 1998). Women who reported growing psychologically from traumatic experiences in their lives had quicker cortisol habituation to stressors than those who did not report growing psychologically (Bower et al., 1998). Among men with HIV, those who engaged in cognitive processing and who reported finding meaning in an AIDS-related bereavement showed less rapid declines in CD4 T cell levels and lower rates of AIDS-related mortality, even when controlling for health status at baseline, health behavior, and other potential confounds (Snethen et al., 2001). Taken together, these findings suggest PTG may serve as a protective factor in relation to consequent health outcomes.

PTG has not been explored among adolescents with ESRD although the rationale for doing so is compelling. An exploratory study among 35 adolescents with ESRD revealed that, despite the plethora of stressors that accompany living with ESRD,
adolescents reported a more positive perspective regarding their experiences than has previously been described in the literature (Boyer, Hitelman, Knolls, & Kafkalas, 2003). Among their recommendations for future research, Tedeschi and Calhoun (2004) suggest that PTG should be increasingly explored among adolescents and that greater emphasis should be made on understanding the higher order mechanisms by which it occurs. One potential way to explore these higher order mechanisms may be through moderational and mediational analyses.

*Moderation/Mediation*

The purpose of moderation and mediation is to more fully understand the treatment effects between independent and dependent variables. Mediation is used to identify the intermediary process that leads from the independent to the dependent variable (i.e., how the treatment effect is produced). Moderation is used to identify individual differences or contextual variables that influence the strength and/or direction of the relationship between the independent and dependent variable (Muller, Judd, & Yzerbyt, 2005). While general linear regression estimates the relationship between independent and dependent variables, using a mediational and moderational framework allows for a better understanding of the mechanism of the effect.

A variable may function as a moderator insomuch as it interacts with the predictor (i.e., independent) variable in determining the outcome (i.e., dependent variable) (Jose & Huntsinger, 2005). Some authors suggest that moderators are helpful in determining whether main effect relationships generalize across varying contexts (Boyer et al., 2003). For example, if one finds a main effect predictor of stress on adjustment, one can say that higher levels of stress lead to worse adjustment. If, in the same analysis,
one finds a main effect predictor of social support on adjustment, one can say that higher levels of social support lead to better adjustment. In the same analysis, if one finds a non-significant interaction (stress x social support), one can argue that the two main effects are general (i.e., they are generally true for this sample of participants across a variety of situations). If, however, one obtains a significant interaction, it will qualify the main effect findings, suggesting important differences based on either the level of stress or social support.

A variable may function as a mediator insomuch as it accounts for the association (i.e., co-variation) between the predictor and the outcome variable. A mediator changes in response to the predictor variable and, in turn, effects a change in the outcome variable (Baron & Kenny, 1986). Baron & Kenny (1986) delineated four statistical conditions that must be met for a variable to mediate a relationship between a predictor and an outcome variable: (a) the predictor variable has a significant relationship with the outcome variable, (b) the predictor variable has a significant relationship with the mediator variable, (c) the mediator variable has a significant relationship with the outcome and, (d) the relationship between the predictor and criterion variable is significantly reduced when the mediator is included in the model. For example, (a) higher levels of stress may be associated with higher levels of depression, (b) higher levels of stress may be associated with rumination, (c) rumination may be associated with higher levels of depression and, (d) the association between stress and depression is significantly reduced or entirely removed when rumination is also included in the model. For another example, Thompson & Gustafson (1996) suggest that coping be regarded as a mediator variable facilitating adaptation to disease and its demands.
Inconsistencies between moderation and mediation abound in the literature. For example, in a study conducted on coping by Chinese American and European American adolescents, coping behavior was found to be partially mediated by stress to negative adjustment but it also moderated the effect of stress on negative adjustment for Chinese American adolescents but not European American adolescents (Tix & Frazier, 1998). In another study, adjustment was moderated by religious affiliation while certain religious coping styles were mediated by a variety of factors including social support and perceived control (Boyer et al., 2003). Many studies are conducted with some uncertainty as to whether a particular variable will mediate or moderate the effects of a relationship between a predictor and outcome variable (e.g., Lang, Goulet, & Amsel, 2003). In areas of inquiry where questions remain unanswered, as in the case with PTG and adherence among adolescents with ESRD, approaching the data from a multitude of ways with a variety of analyses may be appropriate. From this viewpoint, it will be possible to determine whether predictor variables of interest act as either intermediate links in causal chains (i.e., mediators) or as variables that alter the strength of the association between the predictor and criterion variables (i.e., moderators).

**Expected findings**

Overall, the purpose of this study was to examine associations between and possible moderating and mediating effects of hardiness, coping, and appraisal on treatment adherence and PTG among adolescent renal transplant recipients. Correlational and linear regression analyses were used to determine which relationships between these variables were most statistically pertinent and followed up with theoretically-oriented moderational and mediational analyses.
More specifically, hypotheses for this study were (1) among all adolescents, higher scores on hardiness, positively oriented cognitive processing subscales (i.e., cognitive restructuring, downward comparison, and resolution), coping, and positive religious coping would positively correlate with both PTG and treatment adherence. Inversely, adolescent’s higher scores on negatively oriented cognitive processing subscales (i.e., denial, regrets, victimization), negative coping strategies (i.e., avoidance and ventilating feelings) and negative religious coping would negatively correlate with both PTG and treatment adherence. (2) Coping would serve as a mediator between cognitive processing and treatment adherence, whereby adolescents who reported more positive cognitive processing strategies (i.e., cognitive restructuring, downward comparison, resolution) also would engage in more positive coping and would be more adherent to treatment. (3) Coping would serve as a mediator between cognitive restructuring and posttraumatic growth, whereby adolescents who engaged in positive cognitive restructuring would have higher overall adaptive coping scores and would report higher levels of posttraumatic growth. (4) Coping would serve as a mediator between hardness and treatment adherence, whereby adolescents who scored higher on hardness would also engage in more positive coping and would be more adherent to treatment. (5) Coping would serve as a mediator between hardness and PTG, whereby adolescents who scored higher on hardness would also engage in more positive coping and have higher levels of PTG. (6) Maladaptive coping strategies would serve as a mediator between negative religious appraisal and adherence, whereby adolescents who engaged in more negative religious appraisal would engage in more maladaptive coping strategies and be less adherent to treatment. (The maladaptive coping items assessed
using the ACOPE represent primary, active coping whereas the negative religious appraisal items represent secondary, passive coping). And lastly, (7) gender would moderate the relationship between hardiness and posttraumatic growth, whereby females would experience high levels of PTG regardless of their hardiness level but only males with high levels of hardiness would experience high levels of PTG.
CHAPTER 3

METHODS

Participants

The final sample consisted of 33 adolescents/young adults between the ages of 11 and 20 (M=15.9, SD=2.5) with renal transplants who were receiving follow-up care at a large pediatrics hospital in the southeastern United States. (The term “adolescent” will be used hereafter to describe the sample). The initial age eligibility was set at 11-18 years of age, but because several 19- and 20 year-old patients were still being seen at the hospital, they were included in the sample. Males comprised 61% of the sample. Fifty-four percent of the participants classified themselves as Caucasians, 43% as African-American, and 3% as Hispanic. The majority of the participants received deceased donor kidneys (69%), with an additional 27% and 6% receiving living related and living non-related donor kidneys, respectively. The majority of participants received transplants more than 12 months ago (n=24), with 27% (n=9) of participants receiving transplants within the past 12 months. Sixty-four percent of participants were attending public or private school, 18% received homebound schooling, 9% had graduated high school, 6% were attending college or technical school, and 3% were not currently in school. Nine percent of families were classified as living below the poverty threshold based on family income and number of persons in the household (FederalRegister, January 24, 2007).

Procedure

Eligibility criteria. To be eligible for participation in this study, adolescents were required to be receiving follow-up care for renal transplantation at the recruitment hospital, be 11-21 years of age, and (for those under the age of 18) have a parent present at the time of data collection to provide informed consent. Adolescents in special
education classes (per parent report) were also not eligible for participation. Informed consent and assent were obtained, as well as permission to review medical charts for specified data. Exclusionary criteria included inaccessible medical records, being in special education, and/or being non-English speaking. Parents and young adults were told they could receive a copy of the findings upon request, as well as referrals for psychological services as requested or needed.

Potential participants meeting criteria for inclusion were identified via a clinic roster and confirmed by a renal transplant nurse. The investigator approached potential participants when they arrived for their appointment in clinic. If the parent/guardian was not present, a letter describing the study and a parent/guardian informed consent/HIPAA authorization form were sent home with the adolescent. The investigator then called the parent/guardian to solicit willingness to participate and answer any study-related questions. Potential participants were approached only once and information was gathered on one occasion. Participants age 18 and older were not required to have parental consent to participate in the study. The overall response rate for the study was 78%, with 2 adolescents declining to participate and 7 adolescents who initially assented not responding to multiple follow-up attempts.

*Flyer recruitment.* A flyer including a brief description of the investigation was posted in several locations throughout the clinic with the investigator’s contact information listed for anyone interested in obtaining more information and/or participating in the investigation.

*Packet administration.* The adolescent questionnaire packets were administered orally over the phone once the informed consent/HIPAA authorization forms were
received. The questionnaire packet included the following measures: demographics, Lang and Goulet Hardiness Scale (LGHS), Cognitive Processing of Trauma Scale (CPOTS), A-Cope, Brief RCOPE, Medical Adherence Module (MAM), and PTG Inventory (PTGI). This investigation was cross-sectional. Data for this study were obtained over a 6-month period from September 2006 to February 2007. Each questionnaire packet took approximately 40-60 minutes to complete.

**Measures**

*Demographic and Medical Information Questionnaire.* This measure was created specifically for the purposes of this study. Participants were asked to provide basic demographic information including: age, gender, race/ethnicity of patient, level of education completed, estimated family income, current household composition, and number of stressors experienced within the past 12 months.

*Hardiness* The Lang and Goulet Hardiness Scale (LGHS; Williams et al., 2002) is a 45-item measure of what the authors contend are the three interdependent attitudes comprising hardiness: (1) a sense of personal control over the outcomes of life events and hardships, (2) an active orientation toward meeting the challenges brought on by loss or hardship and, (3) a belief in the ability to make sense of one’s existence following a hardship. The three subscales are comprised of 16, 13, and 16 items, respectively. A total score or the three factorially derived subscale scores may be used for statistical analyses, the former of which was used for this investigation to minimize the number of statistical tests conducted. Participants were asked to respond to each statement using a 5-point Likert response format from 1 (*strongly disagree/statement is definitely false*) to 5 (*strongly agree/statement is definitely true*). Test-retest reliability ranged from $r = .73$ to $r$
= .76. Internal consistency for the entire scale and each of the subscales ranged from $\alpha = .65$ to $\alpha = .84$, indicating sufficient internal reliability. This scale has not been used with adolescents but analyses of readability using Flesch-Kincaid criteria indicate the scale requires a 5th grade reading level.

*Appraisal* The Cognitive Processing of Trauma Scale (CPOTS; Patterson & McCubbin, 1987) is a 20-item measure of 6 aspects of cognitive processing following traumatic experiences: (1) Positive Cognitive Restructuring, (2) Downward Comparison, (3) Resolution, (4) Denial, (5) Regrets, and (6) Victimization. These subscales may generally be regarded as positively oriented (1-3) and negatively oriented (4-6). Factor analysis of this scale initially supported a 5-factor solution, although the authors encouraged researchers to explore the victimization subscale with populations other than college students. Results must be interpreted at the subscale level as no total score is calculable. Participants were asked to rate the extent to which they agreed with each of the statements using a 7-point Likert response format from 0 (*strongly disagree*), to 6 (*strongly agree*). In previous studies, test-retest reliability of the 6 subscales ranged from $r = .70$ to $r = .85$ with all $p$ values $<.001$. Internal consistency among items on each of the subscales ranged from $\alpha = .72$ to $\alpha = .85$. Evidence of face validity, construct validity, and criterion validity was demonstrated. This scale has not been used with adolescents but analyses of readability using Flesch-Kincaid criteria indicate the scale requires a 5th grade reading level.

*Coping* The A-Cope (Zelikovsky, 2005) is a 54-item measure of the frequency of adolescent coping behavior. It consists of 12 factors: Ventilating Feelings, Seeking Diversions, Developing Self-Reliance and Optimism, Developing Social Support,
Solving Family Problems, Avoiding Problems, Seeking Spiritual Support, Investing in Close Friends, Seeking Professional Support, Engaging in Demanding Activity, Being Humorous, and Relaxing. Maladaptive coping items (i.e., Avoiding Problems and Ventilating Feelings) were reverse scored and summed with the other subscales to create a total coping score. A maladaptive coping score was also calculated and utilized in analyses. Participants were asked to indicate how often they utilized a particular coping strategy when feeling tense or facing a problem or difficulty using a 5-point Likert response format from 1 (never) to 5 (most of the time). The subscales of the A-Cope have fair to good internal consistency, ranging from $\alpha = .50$ to $\alpha = .75$. Overall reliability data of the A-Cope is not available, although the slightly modified Young Adult-COPE has $\alpha = .82$ with test-retest correlations of $r = .83$. The A-Cope has been shown to have fair predictive validity.

Religious Coping The Brief RCOPE is a 14-item scale comprised of two subscales, positive religious coping and negative religious coping. Participants were asked to rate how often they engaged in a particular coping thoughts and behaviors using a 4-point Likert format from 1 (haven’t been doing this at all) to 4 (have been doing this a lot). The two factorially derived subscales were utilized for statistical analysis. Each subscale had high internal consistency with $\alpha = .90$ for the positive subscale and $\alpha = .81$ for the negative subscale. Confirmatory factor analyses support the two-factor structure of the scale. It is important to note that the negative religious coping items involved secondary coping strategies (i.e., cognitively based) whereas the positive religious coping items involved both primary (i.e., behaviorally based) and secondary coping strategies. As such, the negative religious coping may be conceptualized as appraisal and will be
referred to as such throughout the remainder of this document. Divergent and discriminant validity were shown. Although the Brief RCOPE was not created for adolescents, the author of the scale (Kenneth I. Pargament, Ph.D.) indicated in personal correspondence that the scale could reasonably be used within this population. Analysis of readability using Flesch-Kincaid criteria indicates that the scale requires a 4th grade reading level. Several questions related to religious denomination, frequency of attendance at religious services, and frequency of prayer also were asked.

**Adherence** At this time there is no widely accepted measure of treatment adherence for adolescent renal patients. Review of the literature revealed a number of measures that assess a variety of biological markers (e.g., BUN levels) in conjunction with self-reported, parent-reported, and physician reported adherence. The Medical Adherence Module (MAM) developed by Zelikovsky (2005) was obtained from personal correspondence and includes comprehensive assessment of participant-reported medication adherence, clinic attendance, and dietary attendance. The 23-item module was completed via interview format. The module assesses not only participant behavior but also participant knowledge of health care recommendations (e.g., name, type, and dosing of medication) and barriers to adherence. One question regarding recent changes in medication, diet, or physical health status was added to ensure validity of responses. For this study, self-reported immunosuppressant doses missed or taken late were analyzed.

Serum immunosuppressant levels of tacrolimus (sirolimus and cyclosporine when tacrolimus was not prescribed) were obtained through medical record review for a period up to 12 months prior to data collection. Available serum levels since transplantation were used for participants transplanted within the year. Only outpatient serum levels were
utilized to prevent possible confounding associated with inpatient hospital stays (e.g., variability in absorption rates due to acute illness, altered medication regimen). Serum level averages and standard deviations (SD) were calculated from results of the serum assay (higher averages and SD may indicate greater variability in medication taking, thus, lower rates of adherence (Chisholm, 2005).

Posttraumatic Growth Inventory (PTGI) The PTGI (Tedeschi & Calhoun, 1996) is a 21-item scale developed to assess growth experiences following trauma. Five factors define the major domains of PTG: (1) greater appreciation of life and changed sense of priorities, (2) warmer, more intimate relationships with others, (3) a greater sense of personal strength, (4) recognition of new possibilities or paths for one’s life and, (5) spiritual development. Participants were asked to respond to items using a 6-point Likert response format from 1 (I did not experience this change) to 6 (I experienced this change to a very great degree). The PTGI yields a total score and scores for the five factorially derived subscales, the former of which will be the focus of this investigation. Internal consistency of the PTGI total score was $\alpha = .93$. Although the PTGI was not created for use with adolescents, analysis of readability using Flesch-Kincaid criteria suggest the scale is sufficient for those with a 5th grade reading level.

Medical record review The medical record review included: (a) medical diagnosis, (b) age at diagnosis, (c) length of time since diagnosis, (d) current treatment regimen, (e) frequency and duration of hospitalizations within the past 12 months, (f) current medications, (g) tacrolimus/sirolimus/cyclosporine lab values, (h) any medical complications related to treatment within the past 12 months, and (i) co-morbid conditions.
Statistical Analyses

Power analyses. Power analyses were conducted prior to the onset of data collection. An estimated sample size of 30 (based on numbers obtained in previous published studies) with power set at 0.80 (a widely accepted level of power) indicated an effect size of 0.75 or greater could be detected. As identified by Cohen (1988) a small effect size is 0.29 or less, a medium effect size is 0.30 to 0.49, and a large effect size 0.50 or greater. Based on these criteria, large effect sizes could be detected.

Preliminary analyses. Exploratory analyses were performed to examine the distributions for normality and outliers and to assess for violations of the statistical assumptions that underlie the statistical methods. Descriptive statistics/frequencies including means, standard deviations, and ranges were computed for each measure. Preliminary Pearson product-moment correlations were performed to determine if there were significant associations among subscales for each of the predictor variables (i.e., hardiness, appraisal, coping, and religious coping) and to determine whether creation of composite ratings was justified. Although Type I error is a concern when running a large number of correlations with a small sample, the decision was made not to use a Bonferroni correction in an attempt to maintain statistical power and decrease the likelihood of committing a Type II error. Regression equations were calculated to assess significant linear relationships between independent and dependent variables of interest and to help determine which mediational and moderational analyses to perform. Multicolinearity effects were assessed by examining Tolerance and Variance Inflation Factor (VIF) statistics. Multicolinearity was not found when using Tolerance <.02 and VIF ≥ 4 as indicators.
Main analyses: To answer H1 (i.e., the association between predictor and criterion variables), Pearson product-moment correlations were computed for each of the predictor variables (i.e., hardiness, cognitive processing, coping, religious coping) to test for an association with adherence and PTG. To answer H2-H6, guidelines outlined by Baron and Kenny (1986) for mediational analyses were followed using linear regression analyses. Separate coefficients for each equation were estimated and tested. Sobel test statistics were calculated using Medgraph-I, a computer program designed to easily calculate cell means for the graphical display of mediational analyses (Jose, 2003). To answer H7, moderational hierarchical regression was performed whereby adversity, negative religious appraisal were entered into the regression equation first, followed by the interaction of adversity and negative religious appraisal. Statistically significant interactions were interpreted using ModGraph-I, a computer program designed to easily calculate cell means for the graphical display of moderational analyses (Jose, 2003).
CHAPTER 4
RESULTS

Overview

The analyses reported below are organized into several major sections. First, a series of analyses of variance (ANOVARs) and Pearson product moment correlation procedures were performed to examine whether predictor and criterion variables were associated with demographic and medical factors. Next, Pearson product moment correlations were conducted to determine the relationship between the criterion variables (i.e., PTG, self-reported immunosuppressant medications missed or taken late, serum immunosuppressant $SD$, serum immunosuppressant levels not within the desired therapeutic range) and predictor variables (i.e., hardiness, cognitive processing of trauma subscales, coping, religious coping). A series of regression analyses were performed to assess the contributions of hardiness, cognitive processing, coping, maladaptive coping, and religious coping on PTG and the adherence variables of immunosuppressant doses taken late and immunosuppressant $SD$ (the only adherence variables significantly correlated with the predictor variables). From these results, additional regression analyses were structured to examine the degree to which the data were consistent with the mediational and moderational models proposed.

Demographic and medical factors

One-way ANOVAs were performed to determine if the variables of interest differed as a function of sex, race (White, Non-White), poverty threshold (At or below,
Above), or transplant type (Deceased, Living Related, Living Unrelated). Significant differences were identified based on gender, whereby females reported higher levels of hardiness ($M = 175.0 \pm 13.1$ versus $163.8 \pm 13.2$, $F = 5.73$, $p < .05$), cognitive restructuring ($15.4 \pm 2.5$ versus $12.7 \pm 3.8$, $F = 5.04$, $p < .05$), and PTG ($75.0 \pm 9.1$ versus $63.8 \pm 18.5$, $F = 4.07$, $p < .01$) than males. Gender is controlled in subsequent analyses where PTG is assessed as the criterion variable of interest. Race and poverty threshold were not significantly related to variables of interest. A Kruskal-Wallis non-parametric test was performed to assess differences between transplant types (i.e., deceased donor, living related donor, living unrelated donor), given a non-normal distribution. No statistically significant differences were identified among the variables of interest. In addition, Pearson product moment correlation procedures were performed to examine the associations between age and time since transplant and the criterion and predictor variables. No significant associations were found ($r \leq .33$, ns).

**Correlations between predictor variables and criterion variables**

As identified in Table 1, PTG was positively correlated with gender, hardiness (total), cognitive restructuring, and coping. The correlations between PTG and downward comparison, resolution, and positive religious coping were non-significant. The same was true for correlations between PTG and denial, regret, victimization, and negative religious appraisal.

There were several outliers for self-reported immunosuppressant medications taken late, but these outliers were not removed from the data set because it was believed other variables in the model helped explain their variability. A log transformation was performed but it did not substantially alter the statistical results; as such, non-transformed
data are reported. Higher levels of self-reported immunosuppressant doses taken late were related to higher negative religious appraisal scores and with more maladaptive coping. Higher levels of self-reported immunosuppressant medications taken late were related to lower CPOTS subscale cognitive restructuring and ACOPE (total) scores. Higher serum immunosuppressant SD were associated with lower hardiness scores. Proportion of serum immunosuppressant values not within the therapeutic range and immunosuppressant medications missed were not significantly correlated with any of the predictor variables and were not examined further.

Overall, participants reported a substantial amount of PTG, as indicated by a mean score of 68.21 out of a possible 105 points ($SD=16.32$). Sixty-one percent (n=20) of participants reported taking their immunosuppressant medications late >10% of the time. Sixty-seven percent (n=22) of participants had serum immunosuppressant levels >3 standard deviations, with an average 23% of values deemed outside of therapeutic range (i.e., <5 and >17 ng/ml). The correlation between immunosuppressant doses late and PTG evidenced a trend towards significance ($r=-.31$, $p<.10$). A larger sample might reveal a significant relationship between these variables, whereby those who experience higher levels of PTG are less likely to report non-adherence.

**Regression analyses**

A series of regression analyses were performed to assess the contributions of hardiness, cognitive processing, coping, maladaptive coping, and religious coping on PTG and the adherence variables of immunosuppressant doses taken late and immunosuppressant SD (the only adherence variables significantly correlated with the predictor variables, see Table 2). Only those variables which were significantly
associated with the criterion variables at the bivariate level were entered into the analyses. For PTG, sex was entered into the first step of the regression equation and accounted for 12% of the variance. Hardiness, cognitive restructuring, and coping (total) were entered into the second step, and were found to explain an additional 59% of the variance in the model. A total of 71% of the variance in PTG was accounted for in the final model.

Among adherence measures, hardiness was the only variable to contribute significantly to immunosuppressant $SD$, accounting for 14% of the variance. More specifically, higher levels of hardiness were associated with lower immunosuppressant $SD$. Four variables, cognitive restructuring, maladaptive coping, coping total, and negative religious appraisal, were simultaneously entered into the regression equation for the prediction of immunosuppressant doses taken late to determine the extent of the unique contribution of each variable. The model was non-significant and was subsequently trimmed twice, each time removing the variable with the smallest contribution to improve the overall fit of the model. This resulted in a final model in which maladaptive coping and negative religious appraisal accounted for 38% of the variance in immunosuppressant doses taken late. Higher levels of maladaptive coping significantly contributed to more frequent immunosuppressant doses late in the model; a trend in the same direction was also identified for negative religious appraisal ($p<.10$).

*Coping as a Mediator Between Cognitive Restructuring and Immunosuppressant Doses Late*

Mediational analyses were conducted to determine whether coping mediated the relationship between cognitive restructuring and treatment adherence, as predicted by Folkman and Greer’s model of appraisal and coping processes. More specifically,
participants who reported higher levels of cognitive restructuring were predicted to also report fewer immunosuppressant doses late, in part because they engage in higher levels of adaptive coping. These relations were examined with a series of linear regressions as indicated by Baron & Kenny (1986). A precondition for mediation is that all variables entered into the model must be correlated. As such, only the CPOTS Cognitive Restructuring subscale was included as the predictor, and only the self-reported immunosuppressant dose taken late adherence variable was included as the criterion in these analyses. The zero-order correlations among the variables entering into these analyses are summarized in Table 2. Tolerance and VIF were reviewed to ensure the relationship between cognitive restructuring and coping was not collinear.

Tests of mediation outlined by Baron and Kenny (1986) indicated that, (a) cognitive restructuring affected both coping ($r=.54, p<.001$) and (b) immunosuppressant doses late ($r=-.35, p<.05$) but that (c) coping did not affect immunosuppressant doses late after controlling for cognitive restructuring ($\beta=-.24, \text{ns}$). In the event of mediation, a significant relationship between coping and immunosuppressant doses late should still exist. Alternately, the relationship between cognitive restructuring and immunosuppressant doses late should be substantially weakened for a partial mediation effect or no longer evident for full mediation effect. No support for mediation was thus found. The results of the regression analyses are summarized in Table 3. Sobel test statistics calculated to assess whether the association between the predictor and criterion had been significantly reduced by the inclusion of the mediating variable confirmed the lack of mediation (Sobel z-value=$-1.14, p=.25$). See Figure 2 below.
Coping was also hypothesized to mediate the relationship between cognitive restructuring and the other outcome of interest, PTG, via the same mechanism. The same procedure for assessing mediation was utilized to test this hypothesis, except that gender was entered into the first step of the regression equation to control for spuriously high results. Tests of mediation indicated that (a) cognitive restructuring affected both coping ($r = .51, p < .05$) and (b) PTG ($r = .67, p < .01$), (c) coping affected PTG after controlling for cognitive restructuring ($\beta = .46, p < .01$), and (d) the effect of cognitive restructuring became less significant ($\beta = .67, p < .01$) with the entry of coping. These results indicate partial mediation and imply that the impact of cognitive restructuring on PTG depends on the extent to which cognitive restructuring influences adaptive coping. Sobel $z$-statistics confirmed that the association between cognitive restructuring and PTG was significantly reduced by the inclusion of coping (Sobel $z$-value $= 2.51, p < .01$). The results of the regression analyses are summarized in Table 4 and Figure 3.

Figure 2: Coping as a mediator between cognitive restructuring and immunosuppressant doses late

*Coping as a Mediator Between Cognitive Restructuring and PTG*

Coping was also hypothesized to mediate the relationship between cognitive restructuring and the other outcome of interest, PTG, via the same mechanism. The same procedure for assessing mediation was utilized to test this hypothesis, except that gender was entered into the first step of the regression equation to control for spuriously high results. Tests of mediation indicated that (a) cognitive restructuring affected both coping ($r = .51, p < .05$) and (b) PTG ($r = .67, p < .01$), (c) coping affected PTG after controlling for cognitive restructuring ($\beta = .46, p < .01$), and (d) the effect of cognitive restructuring became less significant ($\beta = .67, p < .01$) with the entry of coping. These results indicate partial mediation and imply that the impact of cognitive restructuring on PTG depends on the extent to which cognitive restructuring influences adaptive coping. Sobel $z$-statistics confirmed that the association between cognitive restructuring and PTG was significantly reduced by the inclusion of coping (Sobel $z$-value $= 2.51, p < .01$). The results of the regression analyses are summarized in Table 4 and Figure 3.
Coping as a Mediator Between Hardiness and Immunosuppressant SD

The relationship between hardiness and immunosuppressant SD was hypothesized to be mediated by coping, whereby participants who scored higher in hardiness would be expected to have a lower immunosuppressant SD, in part attributable to also engaging in higher levels of adaptive coping. The hypothesis was not confirmed from the outset based on a lack of correlation between coping and immunosuppressant SD. Hardiness was found to have a direct affect on immunosuppressant SD, accounting for 14% of the variance. The results of the regression analyses are summarized in Table 5 and Figure 4.

Coping as a Mediator Between Hardiness and PTG

Coping was also hypothesized to mediate the relationship between hardiness and PTG via the same mechanism indicated above. When controlling for gender, tests of mediation indicated that (a) hardiness affected both coping ($r = .34, p < .05$) and (b) PTG
(r = .58, p<.01), (c) coping affected PTG after controlling for hardiness (β = .58, p<.01), and (d) the effect of hardiness became less significant (β = .37, p<.01) with the entry of coping. These results suggest partial mediation and imply that the impact of hardiness on PTG depends on the extent to which hardiness influences adaptive coping. Results of the Sobel test, however, indicated that the association between hardiness and PTG was not significantly reduced by inclusion of coping (Sobel z-test=1.47, p=.14). The results of the regression analyses are summarized in Table 6 and Figure 5.

Figure 5: Coping as mediator between hardiness and PTG

*Maladaptive Coping as a Mediator Between Negative Religious Appraisal and Immunosuppressant Doses Late*

It was hypothesized that participants who reported higher negative religious appraisal would be less adherent with their medication, in part as a function of their engagement in more maladaptive coping strategies (e.g., staying away from home, drinking alcohol). Results indicated that (a) negative religious appraisal affected both maladaptive coping (r = .56, p<.01) and (b) immunosuppressant doses late (r = .45, p<.01), (c) maladaptive coping affected immunosuppressant doses late after controlling for negative religious appraisal (β = .44, p<.05), and (d) the effect of negative religious appraisal became non-significant (β = .20, ns) with the entry of maladaptive coping. Sobel test statistics indicated a trend towards mediation (Sobel z-value=1.81, p=.07).
These results suggest that the impact of negative religious appraisal on immunosuppressant doses late depends on the extent to which negative religious appraisal influences maladaptive coping. The relationship between negative religious appraisal and immunosuppressant doses late was reduced (from 20% in Analyses 2 to 7% in Analyses 3) when maladaptive coping was entered into the second block and negative religious appraisal was entered into the third block of the regression equation. See Table 7 and Figure 6 for results.

Figure 6: Maladaptive coping as a mediator between negative religious appraisal and immunosuppressant doses late

Gender as a Moderator Between Hardiness and PTG

The method for testing moderation established by Baron & Kenney (1986) was used to assess for moderation. After hardiness was centered, an interaction term (Hardiness x Gender) was created. Next the variables were entered into the regression model as indicated, beginning with hardiness entered into the 1st step, Gender entered into the 2nd step of the regression, the interaction variable (i.e., Hardiness x Gender) entered into the 3rd step of the regression, with PTG as the criterion variable of interest. Results indicated a significant main effect for hardiness $F(1,31)=15.73, p<.001$, with no significant improvement in the model when gender or gender X hardiness interaction
term were added. Interpretation of the interaction term using ModGraph-I indicated no support for gender as a moderator between hardiness and PTG. See Figure 7 below.

Figure 7: Gender as a moderator between hardiness and PTG
CHAPTER 5
DISCUSSION

Although previous studies have explored appraisal and coping among adolescent ESRD patients, this study is the first to examine these variables in a broader theoretical context. Conceptualizing adolescent renal transplant recipients in the context of Folkman & Greer’s theoretical model of appraisal and coping processes (2000) provides more detailed insights into the interplay of the various factors involved in adherence and PTG. Consistent with the literature, adolescents in this study reported high rates of treatment non-adherence. Though troubling, these results also offer hope that potentially malleable variables such as coping and appraisal may be intervened upon to improve adherence outcomes. These same variables also appear to be important in facilitating PTG, an important psychosocial outcome not previously examined in this population. The notion that adolescents with ESRD may not only persevere through adversity but may actually experience positive changes as a result is novel, though it has been indicated in other pediatric populations such as children and adolescents with cancer. This study revealed that many adolescents do experience at least moderate PTG as a result of their experience of living with ESRD and receiving a transplant. It also suggests a trend towards significance in the relationship between PTG and non-adherence, whereby those who report higher levels of PTG also report lower levels of non-adherence. This is an important finding in that it provides different targets for intervention that may have systematic positive effects.
Another important finding from the study was the significant association between the predictor variables. Hardiness, coping, and cognitive restructuring were all significantly correlated but not collinear, indicating distinct mechanisms of action. All three predictor variables were also correlated with PTG, with coping and cognitive restructuring (but not hardiness) also associated with self-reported immunosuppressant doses taken late. The association between hardiness and PTG provided support that hardy individuals may appraise and cope with an event in more adaptive ways that leads to greater meaning-based outcome. This is contrary to Folkman & Greer’s supposition that hardy individuals would have less room to experience PTG. PTG was not associated with any of the adherence measures, which may be seen as consistent with Folkman and Greer’s suggestion that event and emotion outcomes are distinct and should be considered as such. This is inconsistent, however, with several studies conducted among adults that found a positive association between PTG and health outcomes such as cortisol levels and CD4 counts. There are several potential reasons for this non-significant finding (e.g., small sample, difficulty assessing adherence, variable length of time since transplant); this should remain an ongoing area of inquiry.

If PTG is a process as well as an outcome, as some researchers suggest, it may be an amenable target for intervention. PTG is fundamentally based on appraisal of a stressful situation in a way that leads to growth or successful adaptation. It appears from results of this study that the type of appraisal is more closely associated with cognitive restructuring \((r=.71)\) than other cognitive processing strategies (e.g., downward comparison, resolution, victimization). Results must be interpreted carefully given the similarity in wording found in the assessment of each of these constructs. For example, “I
am able to find positive things in this experience.” (an item used to assess cognitive restructuring) may be seen as similar to “I changed my ideas about what is important in life” (an item used to assess PTG). It is also worthwhile to mention that postdictive validity may occur between PTG and cognitive restructuring, whereby the experience of PTG influences the type of cognitive processing that is utilized.

Another important finding derived from this study was that the relationship between cognitive restructuring and adherence was not mediated by coping. Cognitive restructuring and coping were both negatively correlated with self-reported proportion of immunosuppressant doses taken late, but when entered into the model together the relationship became non-significant. Coping was, however, found to partially mediate the relationship between cognitive restructuring and PTG. Taken together, these two factors explain over 50% of the variance in PTG. It appears that those who utilize cognitive restructuring to make sense of their transplant experience (e.g., I am able to find positive things in this experience) engage in more adaptive coping scores and, resultantly, are able to experience growth in a number of domains. Interventions may thus be aimed at not only helping adolescent renal transplant recipients to appraise their living with ESRD in a more adaptive way but also in increasing their coping resources.

The association between religious coping and various outcomes, including PTG, has been shown with adult populations but has been relatively neglected in pediatric populations. A handful of studies have shown protective effects associated with religiosity and/or religious coping among pediatric patients and adolescents experiencing trauma, but none of the studies considered the potential negative effects associated with ineffective religious coping (e.g., abdicating responsibility, guilt, shame). This is clearly
an important consideration as indicated in this study where negative religious appraisal was associated with maladaptive coping strategies (e.g., staying away from home, taking drugs not prescribed by a physician, venting), self-reported immunosuppressant doses taken late, number of rejection episodes, and perceived adversity of taking medication. It may be that adolescents imitate the models of coping strategies employed by their parents. It may also be that adolescents experience disillusionment with a Higher Power who does not “cure” them or that they believe they are being punished for perceived wrong doing. Further exploration of the mechanisms of religious coping is needed, as it has not been thoroughly explored among adolescent pediatric populations.

 Appropriately operationalizing adherence proves to be difficult in this area of research, with little correspondence between self-report measures of adherence and more objective measures such as serum immunosuppressant values (Chisholm et al. 2005). This lack of correspondence was evidenced in this study as well, despite utilizing multiple adherence measures and informants. Tacrolimus values $<5$ and $>17$, tacrolimus $SD$, proportion of serum values out of range, adolescent self-report of immunosuppressant doses missed and late, adolescent proportion of medication correctly named, and HCP assessment of medication adherence were all assessed as possible indicators of adherence. Unfortunately, none of the existing paradigms for assessing adherence among adolescent renal transplant patients accounts for the different therapeutic ranges of medication based on time since transplant and other medications taken, resulting in an imperfect assessment of true adherence. Further, valid, comparable serum immunosuppressant levels are not always able to be obtained. Patients may take medication before having their labs drawn, preventing assessment of true trough levels.
They may also have serum immunosuppressant levels out of range as a result of medical complications (e.g., diarrhea, vomiting) or interactions with other medications, as well as readjustment of medication dosage by the medical team. All of these medical factors make it difficult to objectively assess “true” immunosuppressant levels and resultant adherence.

In addition to medical factors, many personal factors may make it difficult for adolescents to honestly report non-adherence to immunosuppressant medication. Although reassured that the information would not be revealed to their medical team and would not be entered into their medical charts, it is only realistic to assume that some participants minimized or denied non-adherence out of fear of retribution or for social desirability. It is also possible that participants interpreted “missed” and “late” medications differentially. Some participants may not believe they have “missed” their medication if they double up on a dose. Similarly, some participants may report a dose late if it is taken 30 minutes past the recommended time whereas others may not consider it late unless the time elapsed is greater than a few hours.

There are several limitations worth mentioning in this current study. The sample size, though consistent with other studies of its kind, is relatively small. A larger sample would have made it possible to detect small to medium effect size results. Several of the scales were not previously validated or used with adolescent pediatric populations. Although these scales produced interesting and seemingly valid results, they should be interpreted with caution. As previously discussed, adherence was assessed in a multitude of ways, with little correspondence between objective and subjective measures. Continued refinement of existing adherence measures should be made to more accurately
assess this construct. Although students in special education were not included in the study in an attempt to rule out significant cognitive dysfunction, cognitive functioning should also be assessed as it may greatly influence adolescents’ coping and adherence abilities.

Finally, the current sample was exclusively English speaking. It will be important in future studies to include non-English speaking participants. These adolescents and families experience a host of additional barriers that may make non-adherence especially problematic, including not being able to communicate with all members of the treatment team and having fewer available resources such as written resources in their native tongue. Further, inaccessibility of different treatments (such as transplant) and lack of financial assistance in pursuing medical care is an issue many undocumented residents in the United States face. As such, greater effort should be made to include participants of diverse backgrounds and ethnicities.

There are a number of areas for future research as indicated by this study. Synchrony between parent/guardian and adolescent coping and assessment would be informative in better understanding how these mechanisms are developed and maintained. The literature supports the importance of family factors such as conflict, cohesiveness, parental psychosocial functioning, and communication as important factors in treatment adherence, but there is little information as to whether adolescents mimic the behaviors and appraisals of their parents. Further development and testing of interventions to target cognitive appraisal and coping strategies among transplant recipients is warranted given the affect of these factors on meaning-based outcomes such as PTG and their potential effect on adherence. Continued refinement of adherence
assessment measures should be a priority. Lastly, longitudinal studies should be conducted to determine the course of event and meaning-based outcome over time.

In conclusion, Lazarus & Folmans’s (2000) Model of Appraisal and Coping Processes provides a suitable framework within which to explore treatment adherence and PTG among adolescent renal transplant patients. Results of this study indicate that coping mediates the relationship between cognitive restructuring and PTG but otherwise does not serve as the primary intermediary mechanism between the predictor and criterion variables of interest. Maladaptive coping strategies may mediate the relationship between negative religious appraisal and immunosuppressant $SD$, the only objective measure of non-adherence found to be significant in this study.
REFERENCES


http://www.usrds.org/reference.htm


http://www.usrds.org/reference.htm


Table 1.
*Intercorrelations, Means, and Standard Deviations for Predictor and Criterion Variables (N=33)*

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*Note: Correlations are two-tailed. All significant associations are in boldface. †p<0.10, *p<0.05, **p<0.01, ***p<.001. a = Sex was dummy coded 0=male, 1=female. b = Cognitive Processing of Trauma Subscale, Cognitive Restructuring. c= ACOPE subscale, Maladaptive (composite Avoidance, Ventilating Feelings). d = Average percent of immunosuppressant doses taken late.*
Table 2
Preliminary Regression Analyses: Prediction of PTG and Adherence

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</tr>
<tr>
<td>Immunosuppressant SD</td>
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<tr>
<td>Step 1:</td>
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</tr>
<tr>
<td>Hardiness, Total</td>
<td>-.37*</td>
<td>.38</td>
<td>.38</td>
<td>9.08***</td>
</tr>
<tr>
<td>Immunosuppressant Doses Late</td>
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<tr>
<td>Step 1:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACOPE, Maladaptive</td>
<td>.45**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative Religious Coping</td>
<td>.28†</td>
<td></td>
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</tbody>
</table>

Note: Sex was dummy coded (0=Male, 1=Female). β indicated is from the final step of the regression model. Significance level †p<0.10, *p<0.05, **p<.01, ***p<.001.
Table 3  
Tests for Mediating Effects of Coping in the Association Between Cognitive Restructuring and Immunosuppressant Doses Late

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Criterion</th>
<th>β</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive Restructuring</td>
<td>Coping</td>
<td>.54</td>
<td>.001</td>
</tr>
<tr>
<td>Cognitive Restructuring</td>
<td>Immunosuppressant Late</td>
<td>-.35</td>
<td>.05</td>
</tr>
<tr>
<td>Coping</td>
<td></td>
<td>-.24</td>
<td>ns</td>
</tr>
<tr>
<td>Cognitive Restructuring</td>
<td>Immunosuppressant Late</td>
<td>-.22</td>
<td>ns</td>
</tr>
</tbody>
</table>

Table 4  
Tests for Mediating Effects of Coping in the Association Between Cognitive Restructuring and PTG

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Criterion</th>
<th>β</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive Restructuring</td>
<td>Coping</td>
<td>.51</td>
<td>.01</td>
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<td>Cognitive Restructuring</td>
<td>PTG</td>
<td>.71</td>
<td>.001</td>
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<tr>
<td>Coping</td>
<td>PTG</td>
<td>.46</td>
<td>.001</td>
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<tr>
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<td></td>
<td>.44</td>
<td>.01</td>
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</table>

Note. Sex is also included in the path model.

Table 5  
Tests for Mediating Effects of Coping in the Association Between Hardiness and Immunosuppressant Late

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Criterion</th>
<th>β</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardiness</td>
<td>Coping</td>
<td>.34</td>
<td>.05</td>
</tr>
<tr>
<td>Hardiness</td>
<td>Immunosuppressant Late</td>
<td>-.37</td>
<td>.05</td>
</tr>
<tr>
<td>Coping</td>
<td></td>
<td>.05</td>
<td>ns</td>
</tr>
<tr>
<td>Hardiness</td>
<td>Immunosuppressant Late</td>
<td>-.39</td>
<td>.05</td>
</tr>
<tr>
<td>Hardiness</td>
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</tbody>
</table>
Table 6
Tests for Mediating Effects of Coping in the Association Between Hardiness and PTG

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Criterion</th>
<th>β</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardiness</td>
<td>Coping</td>
<td>.34</td>
<td>.05</td>
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<tr>
<td>Hardiness</td>
<td>PTG</td>
<td>.58</td>
<td>.001</td>
</tr>
<tr>
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<td>.01</td>
</tr>
<tr>
<td>Hardiness</td>
<td>PTG</td>
<td>.58</td>
<td>.001</td>
</tr>
</tbody>
</table>

Note. Sex is also included in the path model.