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Psychosocial contributors to psychological and physical health-related outcomes in adults with poor prognosis cancer and their caregivers

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Psychosocial contributors to psychological and physical health-related outcomes in adults with poor prognosis cancer and their caregivers

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by

James John MacDonald

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ABSTRACT OF THE DISSERTATION

Psychosocial contributors to psychological and physical health-related outcomes in adults with poor prognosis cancer and their caregivers

by

James John MacDonald
Doctor of Philosophy in Psychology
University of California, Los Angeles, 2022
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General Abstract

Background: Psychosocial correlates of mental and physical health related outcomes in poor-prognosis cancers are relatively understudied in comparison more favorable prognosis cancers. Relevant theory in stress and coping and social cognitive processes posit associations among cognitive appraisals, coping processes and adjustment to stressors and that these processes occur in a social context. Diagnosis of poor-prognosis cancer represents a profound health threat and activates cancer-related appraisals, including assessments of treatment goals and survival, as well as coping processes in attempts to mitigate the impact of the stressor. A cancer diagnosis typically involves additional individuals that serve in a supportive role, termed caregivers. Two studies were designed to examine facets of illness perceptions, coping, and mental and physical health-related outcomes to inform theoretical understanding of these constructs and to identify potentially malleable treatment targets in adults diagnosed with poor-prognosis cancer and their caregivers.

Method: Adults diagnosed with lung (*n* = 52) or pancreatic (*n* = 36) cancer and their primary caregivers (*n* = 48) were enrolled from 2017 to 2020 in two separate studies focused on the experience of each respective cancer. Patients and caregivers in both studies reported sociodemographic and medical characteristics as well as completed measures of depressive symptoms, anxiety, life disruption from pain, and approach- and avoidance-oriented coping processes. In Study 1, patients completed a measure of prognosis and treatment perceptions. Study 1 examined the association of prognosis and treatment perceptions with depressive symptoms, anxiety, and life disruption from pain as and the moderating capacity of coping processes in these hypothesized associations using multiple regression analysis. Study 2 examined the interdependence of patient and caregiver coping processes and depressive symptoms, anxiety, and life disruption from pain using Actor Partner Interdependence Modeling.

Results: Participants were adults who were diagnosed lung (*n* = 52) or pancreatic (*n* = 36) and their primary caregivers (lung *n* = 20, pancreatic *n* = 28). Both patients and caregivers were mostly older adults (patient *M* age = 66, caregiver *M* age = 62) who were white, well-educated, and financially secure. Nearly two-thirds of caregivers were women (*n* = 30, 62.5%), while about half the patients were women (*n* = 48, 54.5%). The overall sample was nearly 3 years post-initial diagnosis. Average depressive symptoms and anxiety were below clinical cutoffs, and average life disruption from pain was “within normal limits,” for both patients and caregivers. Rates of clinically elevated depressive symptoms in patients were lower than other advanced cancer samples and comparable to rates found in people with more favorable prognosis cancers. Patients diagnosed with pancreatic cancer reported clinically elevated anxiety at rates comparable to more favorable prognosis cancers, and lung cancer patients reported anxiety comparable with the general population. Caregivers reported levels of clinically elevated depressive symptoms and anxiety that were comparable to other advanced cancer samples and substantially greater than rates in the general population. Caregivers reported significantly higher rates of anxiety than patients, and patients diagnosed with pancreatic cancer and their caregivers reported greater anxiety than those diagnosed with lung cancer. Depressive symptoms, anxiety, and life disruption from pain did not differ as a function of gender. About one-third of patients reported a terminal illness perception, and there was discordance between perceived prognosis and treatment intent in about half the sample. Terminal (vs non-terminal) illness perception was associated with greater depressive symptoms and anxiety, but not with life disruption from pain. In patients, greater use of active coping was associated with lower depressive symptoms and buffered the association between terminal prognosis perception and greater depressive symptoms. Greater use of emotional processing coping was also associated with lower anxiety symptoms and buffered the association between terminal prognosis perception and greater anxiety symptoms. Greater acceptance coping was also associated with lower depressive symptoms. In caregivers, greater emotional expression coping was associated with lower depressive symptoms and less life disruption from pain. In both patients and caregivers, greater avoidance-oriented coping was associated with greater depressive symptoms and life disruption from pain and was also associated with greater anxiety in caregivers. Interdependence was observed between patient avoidance and caregiver depressive symptoms, though no other evidence of interdependence between patient and caregiver coping and outcomes was observed.

Conclusions: Both patients and caregivers reported clinically elevated depressive symptoms and anxiety at higher rates than the general population. Patients diagnosed with pancreatic cancer and their caregivers were particularly vulnerable to psychological distress. Approach-oriented coping processes related to the cancer experience of active coping, emotional processing, and acceptance coping were associated with favorable outcomes in patients, and active coping and emotional processing buffered the impact of terminal prognosis perception on depressive symptoms and anxiety, respectively. Emotional expression coping was beneficial in caregivers. Avoidance-oriented coping was maladaptive in both patients and caregivers and was interdependent between patients' avoidance and caregivers' depressive symptoms. Interventions may promote emotional expression in caregivers, and promote active coping, emotional processing, and acceptance in patients, and reduce experiential avoidance in patients in caregivers. Future research should focus on differential effects of prognosis perceptions and coping on mental and physical health-related outcomes at distinct points along the cancer trajectory, incorporate cultural considerations, and focus on adapting existing interventions to use in the context of poor-prognosis cancer.

The dissertation of James John MacDonald is approved.

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2022

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VITA

EDUCATION

Master of Arts, Psychology**,** University of California, Los Angeles 2017
Thesis: *Prospective Prediction of Depressive Symptoms in Patients Undergoing Diagnostic Evaluation for Uveal Melanoma*

Bachelor of Arts, Psychology**,** Cornell University 2013

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SELECTED PROFESSIONAL PRESENTATIONS

Hoch, M. M., **MacDonald, J. J.,** Jorge, A., McCannel, T. A., Beran, T., & Stanton, A. L. (May, 2020). Coping, illness perceptions, and depression in uveal melanoma: Examining common sense and coping resource models. Poster presented at the 2020 annual meeting of the Society of Behavioral Medicine (virtual conference due to COVID-19)

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General Introduction

Diagnosis and treatment of chronic diseases are significant sources of stress for patients and their loved ones and often require substantial psychological resources to cope. According to stress and coping theory (Lazarus & Folkman, 1984; Taylor & Stanton, 2007), adjustment to chronic illness and other stressors is influenced by cognitive appraisals and coping processes, as well as a number of contextual factors. Accordingly, extensive research has identified psychosocial risk and protective factors for psychological and physical health-related outcomes during stressful experiences. Cancer as a paradigm within which to explore stress and coping has drawn interest from researchers and clinicians due to its substantial psychological and physical burden for patients and caregivers, as well as the heterogeneity observed in individuals' adjustment after cancer diagnosis (Stanton, Revenson, & Tennen, 2007). Although a vast body of research explores the causes and consequences of biopsychosocial processes in adjustment to cancer, a limitation of existing research is that it has been conducted primarily with adults with breast or prostate cancer, which are the most commonly diagnosed cancers in the U.S. and are widely known by the public (Linsell, Burgess, & Ramirez, 2008; Fitzpatrick et al., 2009). Less is known about psychosocial risk and protective factors for psychological and physical health-related outcomes in adults with cancers that typically are diagnosed when they are more advanced and are less common, including lung and pancreatic cancer. The proposed two studies will examine disease-related perceptions, coping processes, and mental and physical health-related outcomes in individuals who have been diagnosed with lung or pancreatic cancer and their caregivers in order to inform relevant theory and identify potentially malleable targets for intervention in this population.

Lung cancer is the nation's leading cause of cancer-related mortality for men and women, with more than 236,740 diagnoses and 130,180 deaths anticipated in 2022 (ACS, 2022). Pancreatic cancer is the third leading cause of cancer death in the United States, with more than 62,210 diagnoses and 49,830 deaths anticipated in 2022. Lung and pancreatic cancer are insidious in that they often produce few symptoms before they are in advanced stages. As such, less than 16% of lung cancers and 10% of pancreatic cancers are diagnosed at early stages, which precludes the potential to benefit from early systemic treatment and surgical resection (Siegel, Miller, Fuchs, & Jemal, 2022). The five-year survival rate across all stages of lung and pancreatic cancer is 22% overall and 11% overall, respectively, representing two of the three lowest all-stage survival rates of any cancer (ACS, 2022).

Adults diagnosed with locally advanced or metastatic lung or pancreatic cancer who are ineligible for surgical resection may opt for palliative systemic treatment to relieve symptoms and prolong life (Tempero et al., 2017), though these cancers are deemed incurable when diagnosed in late stage or upon metastatic recurrence. Treatment advances have allowed patients diagnosed with such poor-prognosis cancers to live longer while actively managing cancer as a chronic illness (Garon et al., 2015; McCorkle et al., 2011). Individuals living with a diagnosis of poor-prognosis cancer for an extended period experience a number of unique issues. The disease itself, aggressive systemic treatment, the significant threat of mortality, and uncertainty about treatment and progression of disease are factors that confer high risk for psychological distress and impairing physical symptoms in patients with lung or pancreatic cancer (Jacobsen, Nipp, & Ganz, 2017). Research has, in fact, demonstrated that patients diagnosed with lung or pancreatic cancer evidence decrements across physical, emotional, social, cognitive, and role functioning domains of quality of life when compared to healthy individuals and people with other cancers (Bauer et al., 2018; Jia et al., 2010; Polanski et al., 2016).

The impact of cancer is experienced not only by the patient, but also by caregivers, who face substantial burden which affects physical, social, and emotional health (Northouse, Katapodi, Schafenacker, & Weiss, 2012; Stenberg, Ruland, & Miaskowski, 2010). Burden is particularly high for caregivers of individuals with lung or pancreatic cancer given the often functionally impairing effects of disease and treatment, prognostic uncertainty, and low survival. Caregivers play a critical in role in supporting patients through cancer and have a considerable impact on the experience of cancer for the diagnosed individual (Nijboer et al., 1998). However, the impact of cancer in a loved also has the potential for longer-standing disruption of the caregiver’s life (Lambert, Jones, Girgis, & Lecathelinais, 2012). Given the burden of disease for individuals with lung or pancreatic cancer and their caregivers, it is crucial to identify psychosocial factors that can promote psychological and physical health following diagnosis with lung or pancreatic cancer for both patients and caregivers. Recognition of the crucial role of caregivers and the shared coping experience between diagnosed individuals and caregivers is essential in this regard, and research is necessary to elucidate contributors to domains of psychological and physical well-being in these understudied populations.

Heterogeneity in the cancer experience is determined in part by psychological and behavioral processes that promote or hinder adjustment to disease. Among these are individuals’ cognitive processes related to their understanding of the disease, or the disease of a loved one, and coping processes that are employed. “Illness perceptions” is a term used to refer to individuals’ thoughts, beliefs, and psychological representations of the experience of a disease (Broadbent et al., 2015). Perceptions of illness have been recognized as crucial contributors to psychological and physical health-related outcomes of disease, as well as illness-related coping processes (Richardson et al. 2017). For patients with a life-threatening disease, prognosis is an important domain of illness perception given its potential to cause existential distress (Tang et al., 2016). Medical care providers often avoid frank conversations with patients about disease prognosis due to treatment uncertainty and worry over contributing to loss of hope that may lead the patient and family to decline palliative treatment which may prolong life and relieve suffering (Lamont & Christakis, 2001). When information is presented to patients, it may not be received as objectively as it is presented (Davis et al., 2010).

Subjectivity in the transmission and interpretation of prognostic information has spurred research on individual preferences for prognostic information as well as the association of the accuracy of individuals' understanding of their prognosis with psychological and quality of life outcomes. Accurate perceptions of prognosis have been defined in the literature as the concordance between individuals' understanding of their health status as terminally ill (or not) and the chance of cure when compared to objective terminal status and likelihood of cure determined by disease stage. That is, metastatic cancer is "objectively" terminal with a 0% chance of cure. However, conflicting evidence exists regarding the association between perceptions of prognosis and psychological and physical health-related outcomes potentially due to the ambiguity in patient interpretations of prognosis, a phenomenon that continues to become more salient as treatments become increasingly efficacious (Leblanc, Temel, & Helft, 2018). Therefore, perceptions of prognosis are theoretically relevant in their association with important mental and physical health-related outcomes, across stages of lung and pancreatic cancer given low survival rates and high perceived threat to survival regardless of stage. Accordingly, Study 1 aimed to investigate the associations of prognosis perceptions in lung and pancreatic cancer with depressive symptoms, anxiety, and life disruption caused by pain.

In addition to identifying psychological predictors of adjustment, research is needed to elucidate how they work together. Coping constitutes attempts to manage the demands of a stressor, and coping processes often are conceptualized as employed either to approach or avoid the source of stress. Examples of avoidance-oriented coping strategies include attempts to deny the reality of the stressful situation or avoid reminders of the stressor in attempts to suppress negative thoughts and feelings related to the stressor. Approach-oriented coping strategies refer to attempts to manage stress by engaging with the source of stress intentionally through cognitive, emotional, and behavioral processes such as problem solving and active acceptance. Avoidance-oriented coping is typically associated with poorer psychological adjustment (Stanton, Revenson, & Tennen, 2007) and approach-oriented coping is typically associated with more favorable psychological adjustment to stress (Stanton et al., 2011), although findings are not entirely consistent. Additionally, approach- and avoidance-oriented coping processes are posited by models of self-regulation in response to stress as intermediary variables between cognitive processes, including illness perceptions, and outcomes such as psychological distress and physical well-being (Leventhal, Meyer, & Nerenz, 1980).

The majority of research related to the associations of illness perceptions, coping, and mental and physical health outcomes has been driven from the perspective of Leventhal's Self-Regulatory Model (SRM), which posits that cognitive representations of illness inform coping strategies that are employed (Leventhal, Meyer, & Nerenz, 1980). Accordingly, coping processes have primarily been examined as a mediator of this relationship. For example, perceived longer chronicity of illness may contribute to higher use of avoidant coping based on an understanding that the illness is not immediately changeable, which in turn is associated with poor psychological adjustment (Hopman & Rijken, 2015). However, a recent systematic review of studies examining illness perceptions and coping across physical health conditions concluded that there is lack of clarity regarding the operationalization of coping in this context. The authors additionally posit that if illness perceptions are conceptualized as an outcome of the appraisal process, then the relationship between illness perceptions and coping on psychological and physical outcomes may be more appropriately represented by the Transactional Model of Stress and Coping (Lazarus & Folkman, 1984). Thus, coping processes may condition the influence of specific perceptions of illness on psychological and physical health outcomes. Pertaining to prognosis perceptions, scant research has addressed the potential influence of coping processes on the association between prognosis perceptions and depressive symptoms and anxiety (Nipp et al., 2017). It is possible that use of specific coping strategies conditions the influence of perceptions of prognosis on mental and physical health outcomes. As such, Study 1 examines coping processes as moderators of the relationship between prognosis perceptions and psychological and physical health-related outcomes.

Finally, given that patients rarely cope with cancer on their own, identifying psychosocial factors that influence outcomes in the context of patients and caregivers coping dyadically is crucial. Models of interpersonal processes in stress and coping and accompanying evidence suggest that patients' and caregivers' distress and coping operate interdependently, such that individual distress and coping influence both personal and caregiver outcomes. Research related to interdependence of distress in cancer patients and caregivers has been conducted primarily in breast and prostate cancer, and focused on relationship-related predictors and outcomes (Regan et al., 2015). As such, Study 2 will test a model of interdependence of coping on psychological and physical health-related outcomes in patients with lung or pancreatic cancer and their caregivers.

The proposed studies are designed to illuminate illness-related cognitive and behavioral processes that may serve as risk or protective factors for important health-related outcomes in adults diagnosed with lung or pancreatic cancer. Findings will contribute to the development of supportive resources that are specifically targeted toward patients experiencing prognosis-related distress and engaging in maladaptive coping processes. Results will also contribute to identifying risk and protective factors for psychological and physical well-being that will inform the development of supportive resources for patients and caregivers coping together with illness. Additionally, findings will extend existing research on the role of prognosis perceptions in patients' well-being through inclusion of individuals with varying cancer stages and examination of important moderators. Finally, results will extend knowledge of the dyadic experience of cancer by examining coping processes in individuals with cancer and their caregivers as interdependent processes that influence psychological and physical health-related outcomes.

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Associations of prognosis perceptions with psychological and physical health in adults with lung or pancreatic cancer:

Moderating roles of approach- and avoidance-oriented coping processes

Study 1 Abstract

Objective: Illness representation models posit that perceptions of illness influence psychological and physical health outcomes. Coping processes have been tested as intermediaries of this relationship; examination of the potential moderating role of coping processes is lacking, however. Perceptions of medical status, including prognosis and treatment intent are particularly relevant in life-threatening diseases such as cancer, although research on adults diagnosed with poor-prognosis cancers is limited. In adults with pancreatic or lung cancer, populations for whom prognosis is a salient illness-related construct, we aimed to investigate the association between medical status indicators and mental and physical health-related outcomes and to explore the potential moderating role of cancer-related coping processes in this hypothesized association.

Method: Over approximately three years from 2017 to 2020, adults who had received a diagnosis of lung cancer (*n* = 52) or pancreatic cancer (*n* = 36) were enrolled in two separate studies focused on the experience of each respective cancer. Participants in both studies completed measures of perceived medical status (i.e., perceived prognosis and treatment goal), cancer-related coping processes, depressive symptoms, anxiety, and life disruption from pain. Group comparisons between adults with lung or pancreatic cancer were made on major variables, and cross-sectional regression models examined the associations between perceived medical status indicators and mental and physical health-related outcomes. Approach and avoidance-oriented cancer-related coping processes were examined as potential moderators of the hypothesized association between medical status indicators and outcomes.

Results: On average, the 88 participants were 66 years old and had been diagnosed with lung or pancreatic cancer for nearly three years (*M* = 34.40 months, median = 23 months, *SD* = 32.64, range = 1-196). Two thirds of the sample reported a non-terminally ill medical status (*n* = 54, 61.3%) and one third reported curative treatment intent (*n* = 27, 30.7%). Discordance between perceived prognosis and treatment intent was evident in 40.9% of the overall sample (*n* = 36); 32 of those 36 participants (88.9%) reported non-terminally ill status and a treatment intent other than cure. Average depressive symptoms and anxiety were below clinical cutoffs, and average life disruption from pain was "within normal limits." Clinically elevated depressive symptoms were reported by 15.9% of the overall sample with no difference by cancer type (χ^2 (1) = 1.71, *p* = .191), 9.1% reported clinically elevated anxiety, with more pancreatic cancer than lung cancer patients reporting clinically elevated anxiety (χ^2 (1) = 3.91, *p* < .05), and 36.4% of the overall sample reported life disruption pain above normal limits with no significant difference between cancer types (χ^2 (1) = 2.55, *p* = .111). Of the 6 moderator analyses conducted, the two statistically significant moderator analyses revealed that greater use of active coping buffered the association between terminal prognosis perception and greater depressive symptoms (*b* = 1.27, *p* = .034), and greater use of emotional processing coping buffered the association between terminal prognosis perception and greater anxiety (*b* = 0.61, *p* = .043). There were no significant associations between prognosis perception and coping with pain interference. There was a main effect of greater avoidance-oriented coping on depressive symptoms (*b* = 1.10, *p* = .038), but not on anxiety or pain interference.

Conclusions: Levels of depressive symptoms, anxiety, and pain interference were comparable to more favorable prognosis cancers in this sample of adults with poor-prognosis cancers. Findings indicate that perceiving prognosis as terminal is associated with greater depressive symptoms

and anxiety, but not pain interference. Specific approach-oriented coping processes protect against greater depressive symptoms and anxiety. Results suggest the potential therapeutic benefit of promoting active coping and emotional processing coping for adults who perceive their cancer prognosis as terminal.

Introduction

Defined as the likely outcome or course of disease, or the chance of recovery (NCI, 2020), prognosis holds particular relevance for individuals living with potentially life-threatening disease. Prognosis for the range of cancers can vary widely and is determined by a number of disease and host (i.e., the individual) factors (e.g., cancer type, stage, grade; genetic and biological characteristics of the cancer cells; specific behaviors such as smoking; co-morbid conditions; response to treatment). As such, prognosis is highly personalized and multi-determined (Mackillop, 2003). Not only is prognosis an important component of cancer care medically, but it also is a crucial component of patients' understanding of their illness and is likely to influence illness-related behaviors, psychological well-being, and physical health-related outcomes (Applebaum et al., 2014).

Illness Perceptions and Adjustment to Illness

Recent efforts to improve the quality of cancer care at the end of life have precipitated an increased focus on the patient's experience, including the impact of the communication with oncologists and the individual's understanding of disease on the important decision making that influences receipt of aggressive oncologic treatment at the end of life, quality of life, and quality of death (Fried et al., 2002; Mack et al., 2010; Temel et al., 2011; Weeks et al., 1998; Wallston, Burger, Smith, & Baugher, 1988). Accordingly, prognosis is conceptualized as an illness perception integral to overall illness understanding which carries implications for mental and physical health outcomes (Applebaum et al., 2014). Illness perceptions are the individual's thoughts, beliefs, and psychological representations of the experience of a disease (Broadbent et al., 2015). Foundational theories of illness representations posit that perceptions of illness are generated by experience of symptoms or deviations from normal functioning, leading to comparisons of new threat-related information to the past self, beliefs, and information, which ultimately informs mental representations of illness and corresponding affective and behavioral responses (Leventhal, Meyer, & Nerenz, 1980).

Perceptions of illness are recognized as crucially contributing to the experience of illness across a multitude of chronic diseases, and discrete dimensions of illness perception have been described (i.e., cause, consequences, understanding, identity, chronicity, controllability, emotional impact; Petrie, Jago, & Devcich, 2007). Theoretically predictable associations among illness perceptions, coping, and mental and physical health outcomes have been articulated (Hagger & Orbell, 2003). In cancer, perceptions along these dimensions have demonstrated consistent relationships with health behaviors and psychological well-being (Richardson et al., 2017). For example, research has demonstrated a positive association between perception of personal control over an illness (i.e., controllability) and physical and social quality of life (Scharloo et al., 1998).

Illness perceptions in cancer have been studied primarily in adults with breast or prostate cancer, diagnoses that typically carry more favorable prognosis; limited research is available on adults living with poor-prognosis cancer (Hoogerwerf et al., 2012; Price et al., 2012). Poor-prognosis cancer typically presents patients with more profound physical challenges, from the cancer itself and from toxic treatments, which are associated with psychological distress (Fitzgerald et al., 2015). Additionally, adults with poor-prognosis cancer face more emotional challenges from the high likelihood of foreshortened life, and in some cases rapid decline and death (McCarthy et al., 2000). Although recent advances in oncologic treatment have prolonged the lives of individuals diagnosed with poor-prognosis cancer (e.g., Garon et al., 2015; LeBlanc et al., 2018), the prognoses of lung and pancreatic cancer remain relatively poor, and significant uncertainty accompanies diagnosis across stages (Temel, Shaw, & Greer, 2016; Temel, Petrillo, & Greer, 2022). As such, research to elucidate the relationships between adults' understanding and appraisals of disease with psychological and physical health-related adjustment to poorer-prognosis cancers is warranted. The proposed research promises to provide insights into predictors of psychological and physical outcomes that will enable identification of individuals at highest risk for poorer adjustment to cancer diagnosis, tailoring of interventions to the specific needs of patients with lung or pancreatic cancer, and, ultimately, the provision of optimal support for their psychological and physical well-being.

Prognosis Perceptions and Adjustment to Cancer

Theory and research in cancer prognosis heretofore have centered on prognostic awareness, defined as concordance with medical providers' perceptions (i.e., "accuracy"). A recent systematic review defined prognostic awareness as an awareness of metastatic or advanced disease, or the terminal nature of the disease for which the aim of treatment is no longer cure (Applebaum et al., 2014). More accurate prognostic understanding is posited to allow patients to make more informed treatment decisions and prepare for the future (Epstein et al., 2016). Inherent in this conceptualization of prognostic accuracy is the assumption that the disease outcome is certain. Prior research has involved only patients with an objectively terminal diagnosis, as defined by advanced, metastatic disease. However, as treatment continues to advance across cancers, prognosis is a moving target, and many patients continue to live with poor-prognosis cancer as a chronic illness (McCorkle et al., 2011). For example, while the incidence of late-stage lung cancer diagnosis has remained stable over the past four decades, the 5-year survival rate has increased from 10% to 20% for lung cancer (Lu et al., 2019). The 5-year survival rate for pancreatic cancer has remained low (< 5%) over the past 4 decades, reflecting a relatively lack of advancement in treatment as compared with other cancers typically diagnosed at late stage (Shaib, Davila, & El-Serag, 2006). The majority of late-stage lung and pancreatic cancer diagnoses are considered incurable, despite varying lengths of survival.

Conflicting findings are evident on the association of prognosis perceptions and mental and physical health outcomes. Awareness that the disease is terminal has been associated with lower quality of life (QOL), higher depressive symptoms, and higher anxiety (Cripe et al., 2012; El-Jawahri et al., 2014; El-Jawahri et al., 2015; Greer et al., 2014; Nipp et al., 2017; Shin et al., 2016; Thompson et al., 2020), as well as with higher QOL, lower depressive symptoms, and lower anxiety (Chan, 2011; Kao et al., 2013; Lee et al., 2013). These contradictory findings could suggest that important intrapersonal, interpersonal, and contextual factors condition the relationship between perception of prognosis and psychological outcomes. Indeed, more accurate prognosis perception (i.e., a match between perceived disease prognosis and objective disease prognosis) was associated with higher anxiety in adults who reported low, but not high, acceptance of their prognosis in one study (Tang et al., 2016). In addition to pointing to the importance of identifying factors that condition the relationship of prognosis perceptions with mental and physical health outcomes, the finding also suggests a distinction between cognitive awareness of prognosis and emotional acceptance of prognosis.

Lung and pancreatic cancer are associated with stigma (i.e., being perceived as tainted and different from the majority based on an undesirable attribute), which confers risk for greater psychological distress (Chambers et al., 2012; Wong et al., 2019). In addition, both lung and pancreatic cancer are typically diagnosed at later stages, are associated with more physical burden of disease and treatment and have worse prognosis than more commonly diagnosed cancers such as those of the breast or prostate. Individuals diagnosed with lung or pancreatic cancer, therefore, may experience greater emotional distress or concern regarding prognosis due to preexisting illness representations of these cancers as “worse” than others or as “a death sentence” (Wong et al., 2019). Accordingly, individuals’ perceptions of disease prognosis in these cancers may be relevant even in cases that are not deemed objectively incurable (i.e., earlier-stage diagnoses). A limitation of the prognosis perception literature is an exclusive focus on prognostic understanding accuracy in objectively terminally ill patients (i.e., patients with stage IV or unresectable disease). This study aims to expand existing knowledge of the association between prognosis perceptions and mental and physical health outcomes for patients with lung and pancreatic cancer across stages.

Coping Processes and Adjustment to Illness

Coping processes are cognitive, behavioral, and emotional efforts to manage demands from a stressor that are perceived to tax or exceed one’s resources (Lazarus & Folkman, 1984; Stanton, Kirk, Cameron, & Danoff-Burg, 2000). A central conceptualization of coping involves approach- and avoidance-oriented functions. Approach-oriented coping involves active efforts to manage the stressor or stressor-related emotions, which includes processes such as acceptance, positive reframing, problem-solving, and processing and expressing one’s emotions (Roth & Cohen, 1986; Stanton, Kirk, Cameron, & Danoff-Burg, 2000). Cancer-related approach-oriented coping strategies, studied most frequently in adults diagnosed with breast or prostate cancer, generally predict favorable psychological and physical health-related outcomes (Hack & Degner, 2004; Roesch et al., 2005; Stanton, Danoff-Burg, et al., 2000). Limited research has also demonstrated that greater approach-oriented coping is associated with fewer depressive symptoms in lung cancer patients (Faller et al., 1999), whereas lower approach-oriented coping is associated with greater depressive symptoms (Walker, Zona, & Fisher, 2006).

Avoidance-oriented coping involves strategies to avoid thoughts and feelings associated with the stressor through withdrawal, disengagement, or denial (Roth & Cohen, 1986). Avoidance is associated with adverse psychological and physical health-related outcomes in breast or prostate cancer patients (Bauer et al., 2016; Roesch et al., 2005; Stanton & Snider, 1993). In lung cancer patients, avoidant coping strategies also are related to greater distress (Quinn, Fontana, & Reznikoff, 1987) and depressive symptoms (Faller et al., 1999). To our knowledge, no research examines avoidance, or coping processes more generally, in pancreatic cancer patients, though in patients with advanced gastrointestinal cancer, higher avoidant coping is related to greater distress (Miller et al., 1996).

As supported in emotion regulation theory and research, emotional approach and avoidance may serve distinct roles depending on the context and duration of the stressor. Experiential avoidance, or avoidance of the inner experience of distressing thoughts, emotions, and memories (Hayes et al., 1996), may provide relief from distress in the short term, though research has shown that avoidance is associated with an increase in the experience of unpleasant thoughts, feelings, and sensations in the longer term (Gross, 2002; Wegner et al., 1987) and predicts interference in social and emotional support and fewer close relationships with others (Gross & John, 2003). Avoidance of thoughts and feelings related to poor-prognosis cancer may prompt more intrusive thoughts (e.g., Bauer et al., 2016), which may lead to hypervigilance to the threat of death posed by poor-prognosis cancer and enhance the influence of prognostic awareness on distress. On the other hand, actively approaching distressing thoughts and feelings as a means of emotion regulation has been shown to ameliorate distress across a range of psychological disorders and in individuals with cancer (Blackledge & Hayes, 2001; González-Fernández & Fernández-Rodríguez, 2019). In cancer, greater use of emotional approach coping is associated with better physical health-related outcomes and lower psychological distress (Reese et al., 2017; Stanton et al., 2000a)

Coping Processes, Illness Perceptions, and Adjustment to Illness

Appraisal-based coping models posit that the influence of illness perceptions on psychological and physical health-related outcomes depends on coping processes (Lazarus & Folkman, 1987). The majority of extant research has tested and found support for coping as a mediator of the association between illness perceptions and both psychological outcomes (Gould, Brown, & Bramwell, 2010) and physical health outcomes (Hagger & Orbell, 2003). Specific links between illness perceptions and coping processes have also been demonstrated. For example, perceptions of greater chronicity, higher emotional impact, and more negative consequences of illness have been associated with avoidance-oriented coping in cancer (Hopman & Rijken, 2015).

Studies examining coping processes as moderators of the association between illness perceptions and psychological and physical health outcomes are few. There is some evidence, however, that supports coping as a variable that conditions the influence of psychosocial risk and protective factors on mental and physical health outcomes. Specifically, the small body of studies examining the impact of the “goodness-of-fit” between the nature of the stressor and elected coping strategies has demonstrated that coping conditions the influence of illness perceptions on psychological adjustment. For example, psychological distress is higher when a person copes with uncontrollable stressors with efforts aimed at change (e.g., problem-solving) and lower when there is a better match between coping and stressors perceived as uncontrollable (e.g., actively processing and expressing emotions; attempting to avoid stressor-related thoughts and feelings; Folkman, 1991; Forsythe & Compas, 1987). In an experiment with undergraduates who underwent a salivary "test" for a fictitious disease, use of problem solving was associated with higher positive affect when disease control was perceived as high but not when it was perceived as low (Wiley, Cleary, Karan, & Stanton, 2016). These findings suggest that coping as a moderator of the relationship between illness perceptions and outcomes is plausible. Given that the research has primarily been conducted with non-clinical samples or individuals with breast cancer, prostate cancer, or other health conditions, further examination of coping processes as moderators is warranted.

The research base pertaining specifically to perceptions of prognosis, coping, and psychological and physical health-related consequences is limited. The influence of prognostic perceptions is posited to depend, in part, on personal characteristics, including coping processes employed by the individual (Walczak et al., 2013). Thus, the ways in which adults with lung or pancreatic cancer cope with their disease may influence the impact of perceptions of prognosis on psychological and physical adjustment to disease. Furthermore, due to the nature of poor-prognosis cancer as potentially less controllable than early-stage cancer (Browning et al., 2009; Price et al. 2012), coping via efforts to manage emotions and cognitions surrounding the stressor may carry relatively elevated importance compared to coping directed toward changing the stressor itself (Stanton et al., 2000; Stanton & Low, 2012).

A single study has examined prognosis perceptions and coping in association with psychological adjustment to disease. Patients with incurable lung or gastrointestinal cancer and accurate prognostic understanding who coped using approach-oriented coping strategies (i.e., positive reframing and active self-care) had better quality of life and lower depressive symptoms, whereas those who coped through cancer-related avoidance (e.g., denial, behavioral disengagement) had worse quality of life and greater depressive symptoms, suggesting that coping moderates the impact of prognosis perceptions (Nipp et al, 2017). This study did not assess emotional approach coping, however, and only assessed prognostic perception accuracy. Therefore, the proposed research is designed to extend knowledge regarding the association between perceptions of prognosis and coping processes by examining the roles of approach- and avoidance-oriented coping processes. Because no research has addressed the relationship of prognosis perceptions and cancer-related coping through emotional approach (i.e., coping through processing and expressing emotions) with psychological adjustment to disease, emotional approach coping is of specific interest.

In sum, multiple gaps exist in the understanding of associations among illness perceptions, coping, and psychological and physical health outcomes. Theory and research related to coping processes as moderators have been limited to a goodness-of-fit conceptualization, leaving room for more research to expand on knowledge of how coping operates as a moderator. The breadth of coping processes studied also has been limited, as demonstrated by a recent meta-analytic review of the literature in illness representations, coping, and illness outcomes in people with cancer (Richardson et al., 2017). Specifically, too few studies examining coping processes other than positive reappraisal, problem-focused coping, and avoidance/denial existed to conduct meta-analysis (Richardson et al., 2017). Additionally, existing studies have generally employed measures of coping through emotional expression and other palliative strategies that are confounded with psychological distress, thus muddying the connection between coping and psychological and physical-health related adjustment (see Stanton, Danoff-Berg, Cameron, Ellis, 1994; Stanton, Kirk, Cameron, & Danoff-Burg, 2000). As such, research pertaining to the relationship between illness perceptions and additional coping processes is necessary. Accordingly, the proposed study examined whether approach- and avoidance-oriented coping processes moderate the relationships of perceived terminal disease status and curative intent of treatment on health-related adjustment in individuals with lung or pancreatic cancer.

Aims of the Proposed Study

The current study seeks to expand the research base on the psychological experience of individuals with lung or pancreatic cancer, populations that have received minimal attention in the literature to date. Perceptions of disease prognosis in lung and pancreatic cancer are theoretically important regardless of disease stage or objective prognosis, yet the existing research on prognosis perceptions is limited only to patients with terminal disease. Additionally, coping processes are key predictors of psychological and physical health-related outcomes, yet have received very little examination in people living with poor-prognosis cancers. Accordingly, the overall aim of the current study is to elucidate the associations between illness perceptions regarding disease prognosis and treatment goal, approach and avoidance coping, and mental and physical health-related outcomes.

In the proposed study, perceptions of prognosis and treatment goal, cancer-related coping strategies, and psychological and physical health-related adjustment were assessed cross-sectionally in a sample of 88 lung or pancreatic cancer patients. A cross-sectional design is necessitated by feasibility concerns and is a reasonable choice when there is very limited extant research. In order to obtain an adequate sample size to perform the analyses, and to examine the two cancer populations of interest, data from two studies were combined. The goals of the two studies were somewhat distinct in primary aims and operationalizations of constructs. Certainly, cross-sectional designs limit conclusions about the directionality and temporality of relationships. However, the study offers an early exploration of the associations among prognosis perceptions and perceived treatment goal, coping, and psychological and physical health-related outcomes.

Lung and pancreatic cancer both are associated with high levels of negative psychological and physical symptoms. Individuals with lung or pancreatic cancer report high levels of depression (Hopwood & Stephens, 2000; Jia et al., 2010; Temel et al., 2010) and anxiety (Janda et al., 2017; Temel et al., 2010), and the prevalence of mixed anxiety/depressive symptoms was among the highest in lung and pancreatic cancer patients compared to individuals with other cancers (Brintzenhofe-Szoc et al., 2009). Physical symptoms are also highly prevalent in lung (Cooley, 2000) and pancreatic cancer patients (Bauer et al., 2018). Pain is among the most common, distressing, and functionally interfering symptoms of cancer and its treatment (Van Den Beuken-Van et al., 2016); pain has been reported as particularly prevalent and distressing in pancreatic cancer (Bauer et al., 2018). Accordingly, the current research focuses on the psychological outcomes of depressive symptoms and anxiety and the physical health-related outcome of functional interference due to pain.

Aim 1: To characterize perceptions of medical status (i.e., perceived prognosis and treatment goal), coping processes, and depressive symptoms, anxiety, and pain-related life disruption in a sample of adults with lung or pancreatic cancer. Comparisons were made to the existing lung and pancreatic cancer literature and to cancer samples with more favorable prognoses (e.g., breast and prostate cancer).

Aim 2: To investigate the relationships of perceived medical status (i.e., prognosis and treatment goal) in adults diagnosed with lung or pancreatic cancer with depressive symptoms, anxiety, and life disruption from pain.

Hypothesis: Perceptions of prognosis as terminal and non-curative treatment goal will be associated with more symptoms of depression and anxiety as well as more life disruption from pain.

Exploratory aim: To examine the relationships between medical status indicators (i.e., prognosis perceptions and treatment goal) and coping processes.

Aim 3: To examine coping processes as moderators of the relationships between perceived medical status (i.e., perceived prognosis and treatment goal) and psychological and physical health outcomes.

Hypothesis 2: The use of greater approach-oriented coping (i.e., active coping/planning, acceptance, emotional expression, and emotional processing coping) and less avoidance-oriented coping will attenuate the hypothesized association between perceived terminal prognosis (vs. non-terminal) and depressive symptoms, anxiety, and life interference from pain.

Hypothesis 3: The use of greater approach-oriented coping (i.e., active coping/planning, acceptance, emotional expression, and emotional processing coping) and less avoidance-oriented coping will attenuate the hypothesized association between perceived non-curative treatment (vs. curative) and depressive symptoms, anxiety, and life interference from pain.

Method

Participants

Power Analysis

Adults (N = 88) with pancreatic or lung cancer were enrolled in the study and completed study questionnaires. A priori power analyses showed that a sample size of 84 would provide 80% power to detect a significant effect at $p < .05$ with a moderate effect size ($R^2 = .15$, Cohen, 1988) in regression analyses including 4 predictors (e.g., gender, categorical prognosis perception, one coping process, and one interaction term). Based on this analysis, the accrued sample was deemed sufficient to detect reliable effects in the regression analyses.

Inclusion and Exclusion Criteria

Participants were eligible if they had received a diagnosis of any-stage lung or pancreatic cancer, were able to read and write in English, and had sufficient ambulatory status to attend outpatient medical visits. Patients were ineligible if they were unable to complete assessments in English, not sufficiently mobile to attend outpatient oncology clinic appointments, or had cognitive impairment that prevented informed consent, as determined by a diagnosis of dementia documented in the medical record.

Procedure

Adults diagnosed with pancreatic cancer were recruited primarily through the Agi Hirshberg Center for Pancreatic Diseases surgical clinic at UCLA, as well as outreach through the Hirshberg Foundation for Pancreatic Cancer Research, including emailed announcements and promotions at the Foundation’s public events (e.g., Los Angeles Cancer Challenge 5k race). Adults diagnosed with lung cancer were recruited through contact with participants in a prior study conducted by this group (Williamson et al., 2020) and through approach and screening of consecutive patients at a UCLA-affiliated oncology clinic by trained study staff, within scheduling constraints. Institutional Review Board approval was obtained for both studies.

Measures

Medical and demographic information

Relevant medical data (i.e., cancer type and stage, diagnosis duration, medical comorbidities) and demographic information (i.e., age, sex, race/ethnicity, education, socioeconomic status, marital/partner status) were self-reported.

Perceived Medical Status Indicators

Perceptions of prognosis were measured using the Prognosis and Treatment Perceptions Questionnaire (El-Jawahri et al., 2014). This questionnaire contains single items to assess dimensions of perception of medical status, treatment goal, and desire for information about treatment. Participants were asked to describe their preferences for information about details of cancer treatment as one of the following responses: “I prefer not to hear a lot of details,” “ I want to hear details only in certain situations, such as when tests are abnormal or when treatment decisions need to be made,” or “I want to hear as many details as possible in all situations relating to my cancer and its treatment.” Participants were also asked to describe their medical status by choosing one of four statements regarding their current relative health status and terminal nature of their cancer. The response options were: “relatively healthy,” “relatively healthy and terminally ill,” “seriously ill and not terminally ill,” and “seriously ill and terminally ill.”

Consistent with prior research using this tool with patients with advanced cancer (El-Jawahri et al., 2014; Thompson et al., 2020), we defined responses of, “relatively healthy,” and “seriously ill and not terminally ill,” as perceived medical status of “not terminally ill,” and “relatively healthy and terminally ill,” and “seriously ill and terminally ill,” as “terminally ill.” Finally, the PTPQ asked participants to identify a single, primary treatment goal from the following options: “to lessen my suffering as much as possible,” “To be able to keep hoping,” "For my family to be able to keep hoping," "To make sure I have done everything," "To extend my life as long as possible," "To cure my cancer," "To help cancer research," or "Other." We defined, "To cure my cancer," as a curative primary treatment goal and defined all other responses as non-curative primary treatment goal, consistent with prior research (Nipp et al., 2017; Thompson et al., 2020). We classified responses on the PTPQ as demonstrating consistency in prognostic perception if patients reported either 1) terminally ill medical status and non-curative treatment goal or 2) a non-terminal medical status and curative treatment goal (El-Jawahri et al., 2014). Perceived prognosis was included as a binary categorical variable in regression analyses (i.e., 0 = non-terminal; 1 = terminal).

Cancer-related Coping Processes

Coping processes were assessed with 32 items from the COPE scale (Carver, Scheier, & Weintraub, 1989) with items anchored to participants' experience of pancreatic or lung cancer. Each item was rated on a four-point scale: 1 ("I don't do this at all"), 2 ("I do this a little bit"), 3 ("I do this a medium amount"), and 4 ("I do this a lot"). Subscales were calculated by averaging responses with scores ranging from one to four.

Approach-oriented coping was assessed with 12 items from the COPE (Carver, Scheier, & Weintraub, 1989) as well as the 8-item Emotional Approach Coping scales (Stanton, Kirk, et al., 2000). Participants were asked to respond to items in reference to their experience with lung or pancreatic cancer. Items are measured on a 1- 4-point Likert scale (1 = I don't do this at all; 4 = I do this a lot), with higher scores indicating a greater tendency to use the specific coping strategy. The approach-oriented subscales from the COPE include positive reinterpretation and growth (4 items, e.g., "I try to grow as a person as a result of the experience," referred to as "reappraisal" from here forward; Cronbach's $\alpha = .81$), active coping (4 items, e.g., "I concentrate my efforts on doing something about it," Cronbach's α = .79), acceptance (4 items, e.g., "I accept the reality of the fact that it happened," Cronbach's α = .69). Due to differences in study administration, reappraisal coping was assessed in the pancreatic cancer sample and in a small subset of the lung cancer sample. The Emotional Approach Coping subscales include emotional processing (4 items, e.g., "I take time to figure out what I'm really feeling," Cronbach's α = .78) and emotional expression (4 items, e.g., "I allow myself to express my emotions," Cronbach's α = .87). The approach-oriented subscales from the COPE were analyzed separately to investigate differences between the specific strategies in their capacity to moderate the influence of prognosis perceptions on outcomes.

Avoidance-oriented coping strategies were assessed using 12 items from three COPE subscales (Carver, Scheier, & Weintraub, 1989): denial (4 items, e.g., " I refuse to believe that it has happened," Cronbach's α = .63), mental disengagement (4 items, e.g., "I go to movies or watch TV to think about it less," Cronbach's α = .59), and behavioral disengagement (4 items, e.g., "I just give up trying to reach my goal," Cronbach's α = .49). Each avoidance subscale's Cronbach's α was < 0.70; therefore, only the 12-item avoidance-oriented coping composite was used.

Depressive symptoms

Depressive symptoms were measured using a different scale in the pancreatic cancer subsample versus the lung cancer subsample due to differing emphasis on depressive symptoms in original aims from the two separate studies. The 20-item Center for Epidemiologic Studies-Depression scale (Radloff, 1977) measured depressive symptoms in the pancreatic subsample. The CES-D has well-established internal consistency and reliability ranging from .84 to .90 (Radloff, 1977). It has demonstrated good reliability and validity in studies with cancer patients

(Hann, Winter, & Jacobsen, 1999; Stanton et al., 2005). In the current study, Cronbach's α was .90. A total score of 16 or greater suggests clinically significant levels of depression (e.g., Andresen, Malmgren, Carter, & Patrick, 1994). In the lung cancer subsample, depressive symptoms were assessed using two items of the Patient Health Questionnaire – 4 (PHQ-4), a validated, 4-item scale containing two, 2-item subscales assessing cardinal depressive symptoms and anxiety symptoms (Kroenke, Spitzer, Williams, & Löwe, 2009; Löwe et al., 2010). Scores on the depressive symptoms subscale range from 0-6 with scores of 3 or greater suggesting clinically significant depression. Cronbach's α in the current study was .71. To allow for analysis of depressive symptoms across the sample, both total scores were rescaled to scores ranging from 0-10 using the following formula:

$$Rescaled\ score = \left(\frac{score - minimum}{maximum}\right) * 10$$

Eleven CES-D items that did not measure cardinal depression symptoms (i.e., depressed mood, anhedonia) were removed prior to scaling to maximize conceptual comparability of the two scales. The 20-item CES-D and the 9-item CES-D "cardinal symptom" measure were highly correlated ($r = .90$, $p < .001$).

Anxiety

Anxiety symptoms were assessed in both samples using the PHQ-4. The two-item anxiety subscale scores range from 0-6 with scores of 3 or greater suggesting clinically significant anxiety (Kroenke, Spitzer, Williams, & Löwe, 2009). Cronbach's α in the current sample was .80.

Pain interference

Life disruption from pain was measured using the PROMIS-Pain Interference scale (PROMIS-PI; Amtmann et al., 2010). The PROMIS measures are from the NIH-funded Patient-

Reported Outcomes Measurement Information System (PROMIS), a family of instruments designed to measure different aspects of physical, mental, and social health (Cella et al., 2010). Pain interference is assessed based on the prior 7 days and item scores are on a 5-point Likert scale with responses ranging from “Not at all” to “Very much.” The total score ranges from 6-30, with higher scores representing greater disruption due to pain in the prior 7 days. T scores were computed based established scoring guidelines (Cella et al., 2010) and utilized in analyses. Established cutoffs for “within normal limits” ($T < 55$) elevations including, “mild,” ($T = 55$-59), “moderate,” ($T = 60$-69) and, “severe,” ($T \geq 70$) pain interference were computed. The PROMIS-PI has been validated in healthy people (Revicki et al., 2009) as well as in ambulatory cancer care (Wagner et al., 2015). Cronbach’s α in the current sample was .97.

Analytic plan

Descriptive statistics were used to provide sociodemographic characterization of the sample and were computed for all continuous and categorical predictors and outcomes. We also used descriptive statistics to determine the proportion of patients demonstrating consistency between perceived medical status and treatment goal. Pearson’s correlations (continuous-continuous), *t*-tests (continuous-categorical), and chi-square tests (categorical-categorical) were computed to assess the zero-order relationships among independent variables and outcomes. Effect sizes were analyzed regardless of *p* value (Schäfer & Schwarz, 2019). We made comparisons of depressive symptoms, anxiety, interference from pain, and coping strategies by cancer type, prognosis perception, and treatment goal using *t*-tests.

Multiple regression analyses of cross-sectional data were conducted to investigate prognosis perceptions as correlates of depressive symptoms, anxiety, and life disruption from pain in separate equations. Preliminary analyses were conducted to determine inclusion of covariates (i.e., sociodemographic and medical variables) based on correlations with outcomes.

To test whether the protective psychosocial processes (i.e., high approach-oriented coping, low avoidance-oriented coping) moderate the association between perceived medical status (i.e., perceived prognosis and treatment goal) and dependent variables, each of the coping subscale scores was entered separately in regression analyses along with two-way interaction terms between the coping variable and the perceived medical status indicator variable. Separate models tested the interactions between coping processes and perceived prognosis or treatment goal, respectively. Continuous predictors (i.e., coping processes) were mean-centered and categorical predictors (i.e., perceived prognosis and treatment goal) were binary. If a significant interaction was detected, simple slopes were interrogated and interpreted. Significant interactions were probed with established procedures for evaluating simple effects (Aiken & West, 1991; Holmbeck, 2002; Hayes & Matthes, 2009). Simple slopes were analyzed at the 16th, 50th and, 84th percentile of the moderator variable (i.e., coping processes). These percentiles correspond to +/- 1 SD deviation in normally distributed samples, and are robust to skewed data in providing low, moderate, and high values of the moderator variable in interpreting significant interactions (Hayes, 2022). If a significant interaction was not detected, the interaction was dropped, the model re-run, and main effects were interpreted. For all analyses, missing data were listwise deleted.

Results

Sample Characteristics

Participants were men (*n* = 40, 45.5%) and women (*n* = 48, 54.5%) who were diagnosed with pancreatic (*n* = 36, 40.9%) or lung (*n* = 52, 59.1%) cancer of any stage. On average, participants were 66 years old (*SD* = 10.33, range = 32 to 85) and the majority of the sample was at least college educated (*n* = 56, 63.6%), married (*n* = 62, 70.5%), and non-Hispanic white (n = 65, 73.9%). Half the sample reported a household income of at least $100,000 per year (*n* = 44, 50%). Sociodemographic characteristics for the overall sample as well as pancreatic cancer and lung cancer subsamples are reported in Table 1. The two samples did not differ on any sociodemographic characteristic (*p*s > .05). The pancreatic cancer sample was representative of the pancreatic cancer population on sociodemographic variables, in that primarily older, white individuals are diagnosed with pancreatic cancer (Bauer et al., 2018; ACS, 2022). Women participants were slightly overrepresented in the lung cancer sample (59.6% women in the current sample vs. 50.19% women anticipated to be diagnosed in 2022 (ACS, 2022)). Non-Hispanic white participants in the current sample were overrepresented as compared with national lung cancer incidence rates (71.2% non-Hispanic white in the current sample, highest incidence rate found in Black Americans [76.1 per 100,000] (ACS, 2022)). The lung cancer sample was similar to other lung cancer samples with regard to age (Lu et al., 2019)

The overall sample varied in terms of cancer stage reported and time since diagnosis. On average, the sample was nearly 3 years post-initial diagnosis (*M* = 34.40 months, median = 23 months, *SD* = 32.64, range = 1-196) with no significant difference between the pancreatic and lung cancer samples (M_{diff} = 5.2, t(85) = -.73, *p* = .467, 95% CI [-19.38, 8.96]). About one fifth of the overall sample reported stage 1/localized cancer (n = 19, 21.6%), another fifth reported locally advanced cancer (*n* = 20, 22.7%) and nearly half the sample reported metastatic/advanced cancer (*n* = 38, 43.2%). Other participants with valid responses reported that they had forgotten the stage (n = 1, 1.1%) or were not told the stage of their cancer (*n* = 6, 6.6%). (These participants all reported non-terminal perceived prognosis). Self-reported stage differed by cancer type ($\chi^2(3) = 20.642$, *p* < .001). A greater number of lung cancer participants than pancreatic cancer participants reported their stage as advanced/metastatic disease (55.8% vs. 25.0%). More pancreatic cancer participants reported locally advanced cancer (47.2% vs. 5.8%). Cancer stage was assessed "at diagnosis," and cancer spread was not assessed in the lung cancer sample. As such, reported stage may not accurately reflect stage at the time of study participation for all participants.

Table 1. Sociodemographic and medical characteristics.

Characteristic	Overall Sample (*N* = 88)		Pancreatic Cancer Sample (*n* = 36)		Lung Cancer Sample (*n* = 52)		
	n or *M*	% or *SD*	*n* or M	% or *SD*	*n* or *M*	% or *SD*	*p*
Age, years, *M* (*SD*)	66.74	10.33	67.22	8.62	66.4	11.47	.718
Gender, *N* (%)							.256
Male	40	45.5	19	52.8	21	40.4	
Female	48	54.5	17	47.2	31	59.6	
Race/ethnicity, *N* (%)							.971
Black	4	4.5	2	5.6	2	3.8	
AAPI	12	13.6	3	8.3	9	17.3	
Non-Hispanic white	65	73.9	28	77.8	37	71.2	
Hispanic	5	5.7	3	8.3	2	3.8	
Other	2	2.3	0	0	2	3.8	
Education *N* (%)							.101
High school or less	10	11.4	4	11.1	6	11.5	
Some college	16	18.2	3	8.3	13	25.0	
College or more	56	63.6	28	77.8	28	53.8	
Missing	6	6.8	1	2.8	5	9.6	
Employment status, *N* (%)							.191
Full-time	19	21.6	10	27.8	9	17.3	
Part-time	2	2.3	1	2.8	1	1.9	
Retired/not employed	42	47.7	20	55.6	22	42.3	
Disability/Medical leave	18	20.5	5	13.9	13	25.0	
Missing	7	8.0	0	0.0	7	13.5	
HH Income, *N* (%)							.615
< $25,000	7	8.0	4	11.1	3	5.8	
$25,000 - $49,999	11	12.5	5	13.9	6	11.5	
$50,000 – $74,999	8	9.1	2	5.6	6	11.5	
$75,000 – 99,999	16	18.2	6	16.7	10	19.2	
≥ $100,000	44	50.0	18	50.0	26	50.0	
Missing	2	2.3	1	2.8	1	1.9	

Relationship Status, *N* (%)							.891
Married	62	70.5	26	72.2	36	69.2	
Single	4	4.5	0	0.0	4	7.7	
Divorced	13	14.8	6	16.7	7	13.5	
Widowed	9	10.2	4	11.1	5	9.6	
Children, *N* (%)							.223
Yes	73	83	32	88.9	41	78.8	
No	15	17	4	11.1	11	21.2	
Stage at diagnosis, *N* (%)							< .001
Localized	19	21.6	7	19.4	12	23.1	
Locally advanced	20	22.7	17	47.2	3	5.8	
Advanced/Metastatic	39	44.3	10	27.8	29	55.8	
Forgot	1	1.1	0	0.0	1	1.9	
Not told	5	5.7	1	2.8	4	7.7	
Don’t want to know	0	0.0	0	0.0	0	0.0	
Missing	4	4.5	1	2.8	3	5.8	
Months from diagnosis, *M* (*SD*)	34.4	32.64	31.35	38.12 (1-196)	36.55	28.36 (2-117)	.467

Table note.. AAPI = Asian and Pacific Islander. HH income = household income.

Aim 1: Major variables as a function of cancer type

Major descriptive variables were examined and compared by cancer type. Descriptive statistics are reported in Table 2.

Prognosis perceptions and treatment goal

Descriptive statistics on the major independent variables and outcomes were examined and comparisons between pancreatic cancer sample and the lung cancer sample were made. Descriptive statistics and significance levels for tests of difference between pancreatic and lung cancer samples are presented in Table 2. Across the entire sample, the majority of participants reported wanting to hear as many details as possible related to cancer and treatment ($n = 64$, 72.7%). Information preferences did not differ by cancer type ($\chi^2(2) = 2.01$, $p = .366$). About half the participants reported that they had 4-5 or more conversations with their oncologist about their prognosis ($n = 47$, 53.5%) while the remainder of the sample reported having 3 or fewer conversations ($n = 36$, 41%). Number of conversations with an oncologist about prognosis did not differ between pancreatic and lung cancer samples ($\chi^2(4) = .743$, $p = .946$). Nearly one third of participants reported a terminally ill medical status (*n* = 28, 31.8%) while nearly two thirds reported a non-terminally ill medical status (*n* = 54, 61.3%). There was no significant difference between pancreatic and lung cancer samples on perceived prognosis ($\chi^2(1) = .84$, $p = .358$). Nearly two thirds of participants reported a non-curative treatment goal (*n* = 56, 63.6%) and about one third reported a curative treatment intent (*n* = 27, 30.7%). There was no significant difference between pancreatic and lung cancer samples on reported treatment intent ($\chi^2(1) = 1.54$, $p = .215$). Of the participants who reported "Other" treatment intent (*n* = 4, 4.5%) reasons identified included "quality of life," "to live every day to the best of my ability," "to return to work," and "to maintain functioning as long as possible."

About half the participants in the overall sample demonstrated concordance between perceived medical condition and treatment intent (*n* = 46, 52.3%). Of those who demonstrated discordance between these two questions (*n* = 36, 40.9%), the vast majority reported that their medical status was not terminally ill in combination with a treatment intent other than curative (*n* = 32, 88.9%). Concordance between perceived prognosis and treatment intent did not differ by cancer type ($\chi^2(1) = 1.13$, $p = .287$). Figures 1 and 2 show participants' responses to prognosis and treatment goal questions on the PTPQ.

Table 2. Key Independent Variable and Outcome Variable Descriptive Statistics

Variable	Overall Sample (*N* = 88)		Pancreatic Cancer Sample (*n* = 36)		Lung Cancer Sample (*n* = 52)		*p*
	N or *M*	% or *SD*	*n* or *M*	% or *SD*	*n* or *M*	% or *SD*	
Information Preference, *N* (%)							.366
Not a lot of details	6	6.8	3	8.3	3	5.8	
Some details	14	15.9	8	22.2	6	11.5	
As many details as possible	64	72.7	24	66.7	40	76.9	

Missing	4	4.5	1	2.8	3	5.8	
Prognosis Conversations, *N* (%)							.946
0	7	8.0	4	11.1	3	5.8	
1	5	5.7	2	5.6	3	5.8	
2-3	24	27.3	10	27.8	14	26.9	
4-5	18	20.5	7	19.4	11	21.2	
> 5	29	33.0	12	33.3	17	32.7	
Missing	5	5.7	1	2.8	4	7.7	
Perceived Medical Status, *N* (%)							.358[a]
Relatively healthy	48	54.5	24	66.7	24	46.2	
Seriously ill and not terminally ill	6	6.8	1	2.8	5	9.6	
Relatively healthy and terminally ill	24	27.3	9	25.0	15	28.8	
Seriously ill and terminally ill	4	4.5	1	2.8	3	5.8	
Missing	6	6.8	1	2.8	5	9.6	
Treatment Goal, *N* (%)							.220
Lessen suffering	2	2.3	1	2.8	1	1.9	
Keep hoping	8	9.1	1	2.8	7	13.5	
Make sure done everything	9	10.2	5	13.9	4	7.7	
Extend life	29	33.0	12	33.3	17	32.7	
Cure cancer	27	30.7	14	38.9	13	25.0	
Help research	4	4.5	0	0.0	4	7.7	
Other	4	4.5	2	5.6	2	3.8	
Missing	5	5.7	1	2.8	4	7.7	
Prognosis-Treatment Goal Concordance, *N* (%)							.287
Concordance	46	52.3	22	61.1%	24	46.2	
Discordance	36	40.9	13	36.1	23	44.2	
Missing	6	6.8	1	2.8	5	9.6	
Coping Processes, mean (SD)							
Emotional Expression	2.82	.85	2.76	.73	2.87	.94	.552
Emotional Processing	2.80	.81	2.83	.81	2.77	.82	.741
Active + Planning	2.94	.79	2.96	.77	2.94	.80	.912
Acceptance	3.36	.64	3.49	.48	3.27	.73	.140
Positive reappraisal	2.94	0.84	3.00	0.83	2.79[b]	.87	.426
Behavioral disengagement	1.35	.44	1.38	.42	1.34	.45	.687
Mental disengagement	2.21	.71	2.20	.67	2.22	.74	.893
Denial	1.33	.48	1.32	.44	1.34	.51	.889
Avoidance Composite	1.63	.41	1.63	.34	1.63	.45	.962

CES-D, *M* (*SD*)	N/A	N/A	10.71	9.73	N/A	N/A	N/A
CES-D cardinal symptoms, *M* (SD)	N/A	N/A	4.29	4.86	N/A	N/A	N/A
Depression composite	1.59	2.02	1.59	1.80	1.60	2.17	.988
PHQ-4-Depression, *M* (SD)	N/A	N/A	N/A	N/A	.96	1.30	N/A
PHQ-4-Anxiety, mean (SD)	.93	1.33	1.0	1.57	.88	1.14	.676
Pain Interference, mean (SD)	11.98	7.12	10.91	6.66	12.75	7.41	.248
Pain Interference T-score, mean (SD)	51.87	10.45	50.67	9.98	52.75	10.80	.373
CESD-D ≥16, *N* (%)							
<16	N/A	N/A	26	76.5	N/A	N/A	N/A
≥16	N/A	N/A	8	23.5	N/A	N/A	N/A
PHQ-4-Depression ≥3, *N* (%)							
<3	N/A	N/A	N/A	N/A	42	87.5	N/A
≥3	N/A	N/A	N/A	N/A	6	12.5	N/A
Clinically elevated depressive symptoms, N (%)							.191
Yes	14	17.1	8	23.5	6	12.5	
No	68	82.9	26	76.5	42	87.5	
PHQ-4-Anxiety ≥3, N (%)							.048
<3	75	90.4	29	82.9	46	95.8	
≥3	8	9.6	6	17.1	2	4.2	
Pain Interference cutoffs, N, (%)							.415
Within normal limits	51	61.5	25	71.4	26	54.2	
Mild	10	12.1	3	8.6	7	14.6	
Moderate/severe	22	26.5	7	20.0	15	31.3	

Table note. *n* varies by variable due to missing data. a. *p* value from chi-square test with dichotomous "terminally ill vs. not terminally ill" variable. b. *n* = 14 in lung cancer sample c. CES-D clinical depression 2 missing, PHQ-4 clinical depression 4 missing, phq-4 anxiety pancreatic 1 missing, lung 4 missing, pain interference cutoffs pancreatic 1 missing, lung 5 missing.

Figure 1. Primary treatment goals entire sample

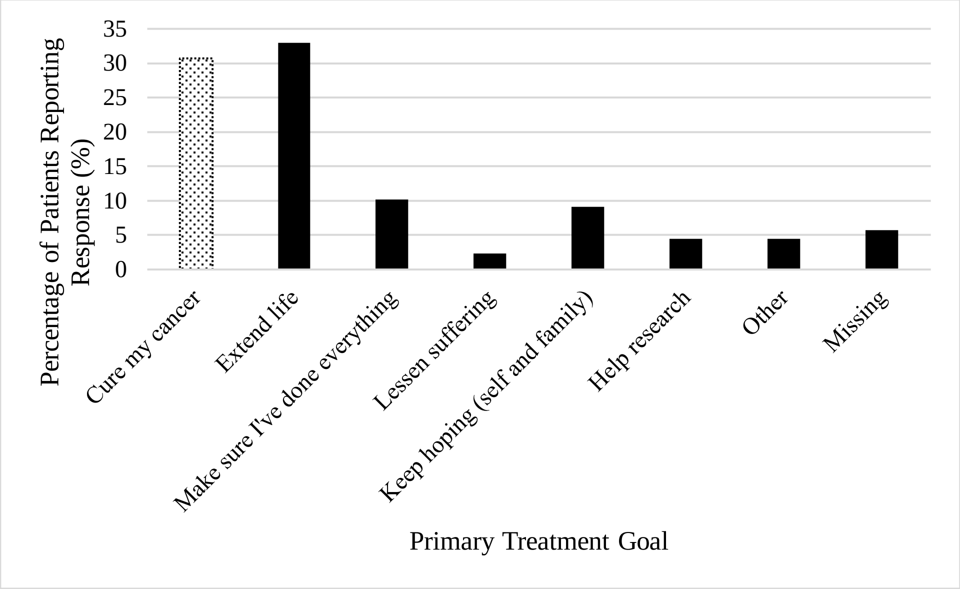


Figure note. Solid bars represent "non-curative" treatment goal. Dotted bar represents "curative" treatment goal

Figure 2. Perceived medical status entire sample

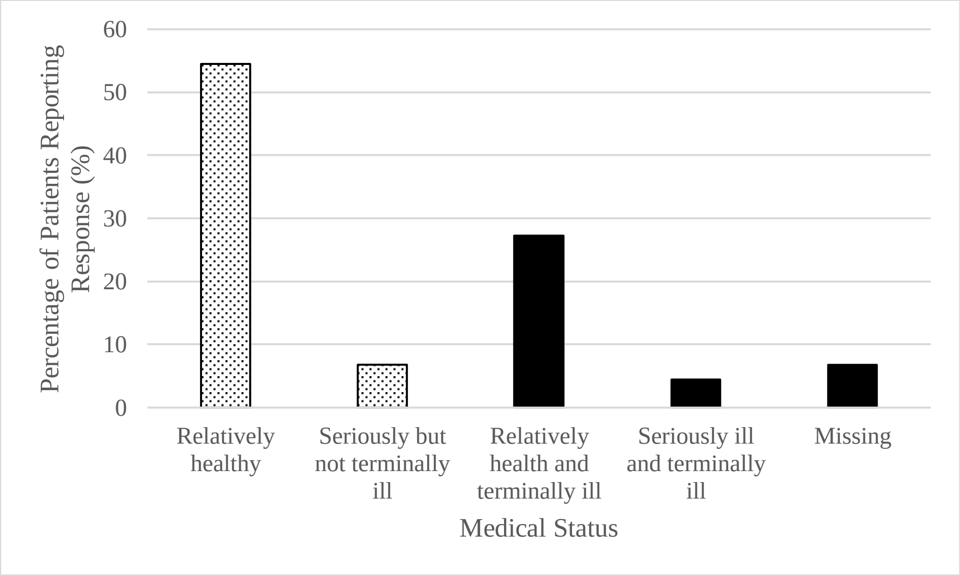


Figure note: Solid bars represent terminally ill perceived prognosis. Dotted bars represent non-terminally ill perceived prognosis.

Coping processes

Participants in the overall sample reported moderate levels (i.e., > *a little bit*) of emotional expression (M = 2.8, SD = 0.85) and emotional processing (M = 2.8, SD = 0.81). Participants reported moderate levels of active coping (M = 2.94, SD = 0.79). Participants reported high levels (i.e., > *a moderate amount*) of acceptance coping (M = 3.36, SD = 0.64). Participants reported low levels (i.e., < *a little bit)* of avoidance coping (M = 1.63, SD = 0.41). Participants reported moderate levels of reappraisal coping (M = 2.94, SD = 0.84). Levels of reported cancer-related coping processes did not differ by cancer type (ps > .05).

Depressive Symptoms

Given that the pancreatic and lung cancer samples were derived from separate studies, depressive symptoms were measured using different scales. Mean depressive symptoms in the pancreatic cancer sample (CES-D) and lung cancer sample (PHQ-4-depression) were below suggested clinical cutoffs (pancreatic: M = 10.71, SD = 9.73, range = 0-38; lung: M = 0.96, SD = 1.30, range = 0-4). Approximately one quarter of the pancreatic cancer sample endorsed depressive symptoms at or above the clinical cutoff (i.e., CES-D ≥16 n = 8, 23.5%). A lower percentage of participants with lung cancer reported clinically elevated depressive symptoms (PHQ-4-depression ≥ 3, n = 6, 12.5%), though the difference was not statistically significant (χ^2 (1) = 1.71, p < .191). The “cardinal symptom CES-D score” mean was 4.29 (SD = 4.86, range = 0-15). The depression composite scale mean (both groups combined) was 1.59 (SD = 2.02, range = 0-6.67) for the combined sample, 1.59 (SD = 1.80, range = 0-5.56) for the pancreatic cancer sample, and 1.60 (SD = 2.17, range = 0-6.67) for the lung cancer sample. There was no difference between the pancreatic cancer and lung cancer sample on mean composite depressive symptom score (M_{diff} = 0.007, $t(80)$ = -.015, p = .988, 95% CI [-.91, .90], Cohen’s d = .003).

Anxiety

Across the entire sample, average anxiety symptoms were low (*M* = 0.93, *SD* = 1.33, range = 0-6). In the pancreatic cancer sample, mean anxiety symptoms was 1.0 (*SD* = 1.57, range = 0-6) and in the lung cancer sample, mean anxiety symptoms was .88 (*SD* = 1.14, range = 0-6). There was no significant difference between the pancreatic cancer and lung cancer sample on mean anxiety symptoms (M_{diff} = 0.125, *t*(81) = 0.42, *p* = .676, 95% CI (-0.47, 0.72), Cohen's *d* = .093). In the overall sample, *n* = 8 (9.1%) of the sample reported clinically elevated symptoms of anxiety on the PHQ-2 (i.e., ≥ 3). In the pancreatic cancer sample, *n* = 6 (16.7%) of the sample reported clinically elevated symptoms and in the lung cancer sample, *n* = 2 (3.8%) of the sample reported clinically elevated symptoms. Participants with pancreatic cancer had a higher rate of clinically elevated anxiety than did participants with lung cancer (χ^2 (1) = 3.91, *p* = .048).

Pain interference

Life disruption due to pain was, on average, reported within the normal range (Cella et al., 2010) in the overall sample (T = 51.87, *SD* = 10.45). Pain interference T score did not differ by cancer type (*t* (81) = -.896, *p* = .373, 95% CI [-6.71, 2.55] Cohen's *d* = -.199). Across the overall sample, over half of participants scored "within normal limits" (*n* = 51, 58%). Roughly one third of participants scored within the "mild" or "moderate" range (*n* = 30, 34.1%), and a very small minority of participants scored in the "severe" range for life disruption from pain (*n* = 2, 2.3%). Pain interference score grouped by "within normal limits" and "above normal limits" did not differ by cancer type (χ^2 (1) = 2.55, *p* = .111).

Aim 2. Associations between medical status indicators and other major variables

Associations among perceived prognosis and treatment goal, coping processes, and outcomes were analyzed. Statistics from tests of univariate associations can be found in Table 3.

Coping Processes

Participants who perceived cancer prognosis as non-terminal reported higher levels of emotional processing (*t*(76) = 2.29, *p* = .025, 95% CI [0.06, 0.81], Cohen's *d* = .546), active coping (*t*(78) = 2.10, *p* = .039, 95% CI [0.02, 0.74], Cohen's *d* = .492), and reappraisal coping (*t*(46) = 2.04, *p* = .047, 95% CI [0.01, 1.02], Cohen's *d* = .636) than those who perceived their prognosis as terminal. Emotional expression, acceptance, and avoidance coping did not differ by perceived prognosis (*p*s > .05). Levels of reported coping processes did not differ by reported treatment goal (*p*s > .05).

Depressive Symptoms

Participants who perceived their illness as terminal reported significantly greater depressive symptoms than those who reported non-terminal illness (*t*(79) = -2.81, *p* = .006, 95% CI [-2.19, 0.38], Cohen's *d* = -.663). Depressive symptoms did not differ by reported treatment goal (*t*(80) = 1.14, *p* = .259, 95% CI [-0.40, 1.48], Cohen's *d* = .267).

Anxiety

Anxiety did not differ by perceived prognosis (*t*(80) = -1.84 , *p* = .070, 95% CI [-1.17, 0.05] Cohen's *d* = -.428) or treatment goal (*t*(81) = 0.17, *p* = .868, 95% CI [-0.57, 0.68], Cohen's *d* = .039). Despite the non-significant association between perceived prognosis and anxiety, there was a medium effect size (i.e., *d* = -.428), with participants who perceived their prognosis as terminal reporting more anxiety.

Pain Interference

Pain interference did not differ by perceived prognosis (*t*(80) = -1.43 , *p* = .158., 95% CI [-8.26, 1.37] Cohen's *d* = -.332) or treatment goal (*t*(81) = -.363, *p* = .718, 95% CI [-5.79, 4.01] Cohen's *d* = -.085). Despite the non-significant association between perceived prognosis and life disruption from pain, there was a between a small and medium effect size (i.e., *d* = -.332), with participants who perceived their prognosis as terminal reporting more life disruption from pain.

Table 3. Associations between cancer type, prognosis perceptions, coping strategies, and outcomes

Variable	Terminal Cancer Perception (non-terminal - terminal)				
	t	*df*	*p*	95% CI	Cohen's *d*
Coping Strategy					
Emotional Processing	2.29	76	.025	.06 to .81	.546
Emotional Expression	1.72	78	.089	-.05 to .74	.408
Active	2.10	78	.039	.02 to .74	.492
Acceptance	-1.07	78	.289	-.46 to .14	-.250
Reappraisal	2.04	46	.047	.007 to 1.02	.636
Avoidance Composite	-.964	77	.338	-.29 to .10	-.229
Depression Composite	-2.81	79	.006	-2.19 to -.38	-.663
Anxiety	-1.84	80	.070	-1.17 to .05	-.428
Pain Interference T Score	-1.43	80	.158	-8.26, 1.37	-.332
	Perceived Curative Intent (curative intent – non-curative intent)				
Coping Strategy	*t*	*df*	*p*	95% CI	Cohen's *d*
Emotional Processing	.560	77	.577	-.29 to .51	.137
Emotional Expression	.438	79	.663	-.32 to .50	.104
Active	.807	79	.422	-.22 to .53	.194
Acceptance	.269	79	.789	-.27 to .35	.065
Reappraisal	.913	46	.366	-.28 to .75	.279
Avoidance Composite	.523	78	.603	-.15 to .25	.126
Depression Composite	1.14	80	.259	-.40 to 1.48	.267
Anxiety	.166	81	.868	-.57 to .68	.039
Pain Interference T score	-.363	81	.718	-5.79, 4.01	-.085

Aim 3. Interactions Between Perceived Prognosis and Coping Processes Predicting Outcomes

Preliminary Analyses

Analyses were conducted to examine associations among sociodemographic, medical, primary predictor variables, and outcome variables to test for inclusion in regression analyses.

Sociodemographic factors were age, gender, race/ethnicity, education, parental status, marital status, and income. Women reported greater anxiety (M_{diff} = -0.61, *t*(81) = -2.1, *p* = .039, 95% CI [-1.18, -0.03]) and greater emotional expression coping ($M_{diff} = -0.43$, $t(79) = -2.31$, $p = .023$, 95% CI [-0.80, -0.06]) than did men. Education level was associated with acceptance coping ($F(2,75) = 1.54$, $p = .025$), such that on average, participants with college or higher level of education reported greater acceptance coping than participants with high school or less education ($M_{diff} = 0.54$, $p = .016$, 95% CI (.10, .97)). Marital status was significantly associated with active and planning coping ($F(3, 77) = 2.75$, $p = .049$), such that widowed participants reported greater active and planning coping that married participants ($M_{diff} = 0.77$, $p = .006$, 95% CI [0.23, 1.32]), and household income was associated with avoidance coping ($F(4, 73) = 2.70$, $p = .037$), such that participants with incomes of $75,000 to $99,000 and >$100,000 reported lower levels of avoidance coping than participants who reported income of $25,000 - $49,000 ($M_{diff\ 75k} = 0.32$, $p = .049$, 95% *CI* (0.002, 0.64); $M_{diff\ 100k} = 0.39$, $p = .005$, 95% *CI* (0.12, 0.65). There were no significant associations between race/ethnicity or parental status with prognosis perception, coping strategies, or outcome variables. Because gender was associated with one of the outcome variables (i.e., anxiety), and gender is a known associate of depressive symptoms and anxiety (Kessler et al., 2005b; Seedat et al., 2009), gender was included as a covariate in all regression models.

Medical factors were cancer type and months since diagnosis. There were no significant associations between cancer type or months since diagnosis and prognosis perceptions, coping processes, or outcome variables (*p*s > .05). Given the theoretical plausibility of the effect of prognosis perceptions on outcomes depending on cancer type, we conducted preliminary tests of the interaction of perceived prognosis and treatment intent with cancer type in predicting outcomes. No significant interaction effects were identified (*p*s > .05). Given these preliminary findings and the relatively small sample size, cancer type was dropped from all regression models to maximize parsimony and preserve statistical power. Conditionality of the effect of perceived prognosis and coping strategy on outcomes by gender was examined and yielded no significant interactions (*p*s > .05). Therefore, only the main effect of gender on outcomes was analyzed, and no other covariate was included.

Coping x prognosis perception interaction models

Moderation analyses were conducted to examine interactions between perceived prognosis and coping processes in predicting depressive symptoms, anxiety, and pain interference. Gender was included as a covariate in all models due to its significant association with anxiety. Unstandardized regression coefficients, standard errors, 95% confidence intervals, and interaction R^2 and model R^2 from significant interactions models are presented in Table 4. Statistics from all models are available in Appendix A.

Depressive symptoms. Of the five analyses conducted to assess approach-oriented coping scales (i.e., emotional processing, emotional expression, active coping, acceptance, and positive reappraisal) one significant interaction accounting for 5.2% of the unique variance was detected, such that active coping interacted with perceived prognosis (b = -1.27, SE = 0.59, p = .034, 95% CI [-2.44, -0.10]). Analysis of simple slopes revealed that the positive association between perceiving the disease as terminal and depressive symptoms was significant at low (i.e., 16th percentile; b = 2.47, SE = 0.67, t = 3.69, p < .001, 95% CI [1.14, 3.80]) and moderate (i.e., 50th percentile; b = 1.31, SE = .46, t = 2.85, p = .006, 95% CI [.39, 2.22]) levels of active and planning coping but not at high (i.e., 84th percentile; b = 0.28, SE = 0.69, t = 0.41, p = .680, 95% CI [-1.10, 1.66]) levels of active and planning coping. Figure 1 displays the interaction and corresponding simple slopes. No other approach-oriented coping process had a statistically significant effect, controlling for gender and perceived prognosis, on depressive symptoms (*p*s > .05).

The analysis conducted to assess the avoidance-oriented coping composite found no significant interaction between avoidance-oriented coping and perceived prognosis (*p* > .05). The main effect of avoidance coping on depressive symptoms was statistically significant (*b* = 1.10, *SE* = 0.52, *p* = .038, 95% CI [0.063, 2.15]), over and above the effect of gender and perceived prognosis. A one unit increase in avoidance coping was associated with a 1.10 unit increase on the depression composite scale.

The effect of prognosis perception was statistically significant in all models predicting depressive symptoms (*bs* = 1.26-1.63, *p*s < .01), such that perceiving the cancer as terminal was associated with greater depressive symptoms. The effect of gender, over and above perceived prognosis and coping processes, was not significant in any model predicting depressive symptoms (*p*s > .05).

Anxiety. Of the five analyses conducted to assess approach-oriented coping scales, one significant interaction accounting for 4.8% of the unique variance was detected, such that emotional processing coping interacted with perceived prognosis (*b* = -0.78, *SE* = 0.38, *p* = .043, 95% [-1.52, -0.03]). Analysis of simple slopes revealed that the positive association between a terminal prognosis perception and anxiety was significant at low (*b* = 1.23, *SE* = 0.40, *t* = 3.05, *p* = .003, 95% CI [0.42, 2.03]) but not at moderate (*b* = 0.61, *SE* = 0.32, *t* = 1.92, *p* = .059, 95% CI [-0.02, 1.24]) or high (*b* = -0.13, *SE* = 0.51, *t* = -0.25, *p* = .800, 95% CI [-1.15, 0.89]) levels of emotional processing. Figure 2 displays the interaction and corresponding simple slopes. No other approach-oriented coping process had a significant effect on anxiety, controlling for gender and perceived prognosis (*p*s > .05).

The analysis conducted to assess the avoidance-oriented coping composite demonstrated no significant interaction between avoidance-coping and perceived prognosis (*p* > .05). There was also no main effect of avoidance coping on anxiety (*p* > .05), controlling for gender and perceived prognosis.

The effect of gender was statistically significant in all models predicting anxiety, such that female-identifying participants reported greater anxiety (*b*s = .65-.74, *p*s < .05), over and above prognosis perception and the coping strategy included in each model. The effect of prognosis perception was statistically significant in each model, such that terminal prognosis was associated with greater anxiety (*bs* = .64-.68, *p*s < .05), over and above the effect of gender and coping process included in each model. Effects of all other coping strategies were not significant (*p*s > .05).

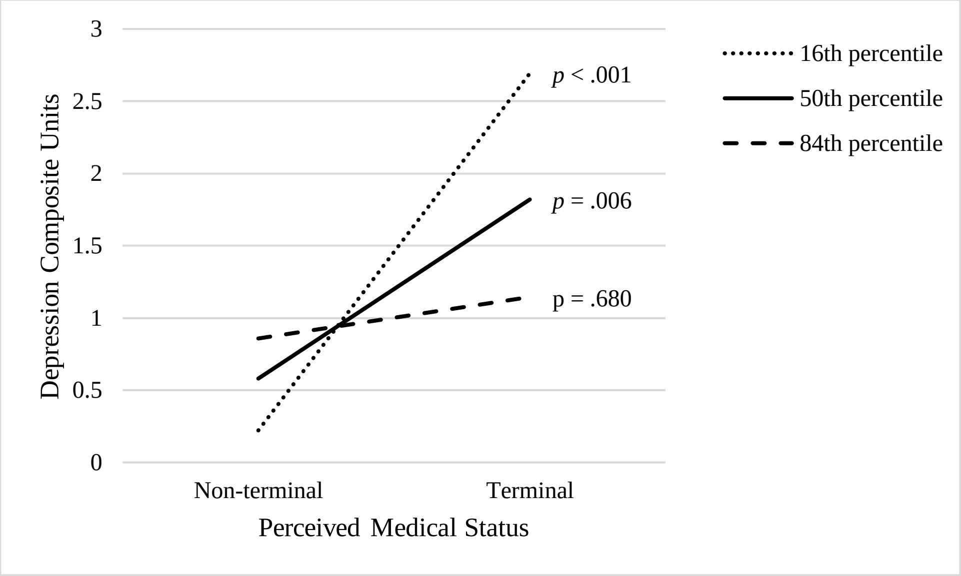
Pain interference. Of the 5 analyses conducted to assess approach-oriented coping scales, there were no significant interactions with perceived prognosis in predicting pain interference (*p*s > .05). There was also no significant interaction between avoidance coping and perceived prognosis in predicting pain interference (*p* > .05). The main effects of gender, perceived prognosis, and any coping strategy were not statistically significant (*ps* > .05).

Table 4. Significant interactions of medical status indicators and coping processes predicting depressive symptoms, anxiety, and pain interference.

	Active Coping on Depressive Symptoms				
	b	*SE*	*t*	*p*	95% CI
Constant	0.56	0.38	1.47	.150	-0.20, 1.32
Gender	0.77	0.44	1.76	.082	-0.10, 1.64
Prognosis Perception	**1.31**	**0.46**	**2.85**	**.006**	**0.39, 2.22**

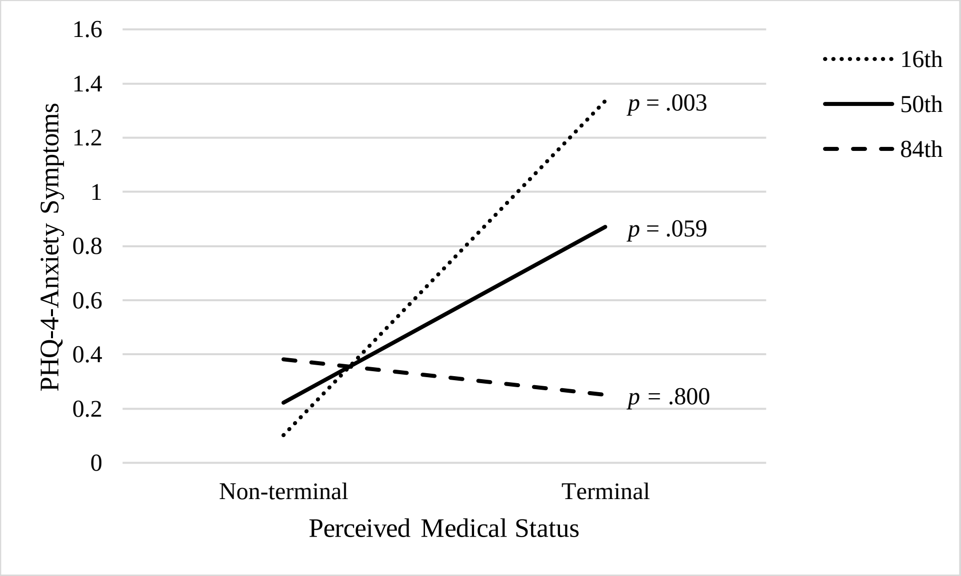
Active Coping	0.37	0.34	1.09	.280	-0.31, 1.05
Prognosis x Active	**-1.27**	**0.59**	**-2.17**	**.034**	**-2.44, -0.10**
	F	*p*	R^2 change	*df*	
Interaction Term	4.69	.034	.052	1, 74	
	F	*p*	Total R^2	*df*	MSE
Model	3.99	.006	.177	4, 74	3.48
	Emotional Processing on Anxiety Symptoms				
	b	*SE*	*t*	*p*	95% CI
Constant	0.23	0.26	0.87	.387	-0.29, 0.74
Gender	**0.74**	**0.30**	**2.45**	**.017**	**0.14, 1.34**
Prognosis Perception	0.61	0.32	1.92	.059	-0.02, 1.24
Emotional Processing Coping	0.16	0.24	0.65	.520	-0.32, 0.63
Prognosis x Processing	**-0.78**	**0.38**	**-2.06**	**.043**	**-1.52, -0.03**
	F	*p*	R^2 change	Df	
Interaction Term	4.25	.043	.048	1, 73	
	F	*p*	Total R^2	df	MSE
Model	3.98	.006	.179	4, 73	1.58

Figure 1. Interaction between active coping and prognosis perception on depressive symptom composite.



Note: Depression composite score range = 0 – 10. Active + Planning mean-centered scores: 16th percentile = -0.91, 50th percentile = 0.056, 84th percentile = 0.81.

Figure 2. Interaction between emotional processing coping and prognosis perception on depressive symptom composite.



Note: PHQ-4-Anxiety score range = 0 – 6; PHQ-Anxiety ≥3 is clinically elevated. Emotional processing coping mean-centered scores: 16th percentile = -0.80, 50th percentile = -0.05, 84th percentile = 0.95.

Coping x treatment goal interaction models

There were no significant interactions between treatment goal and coping processes in predicting depression, anxiety, and pain interference. There were no main effects of treatment goal in predicting depressive symptoms, anxiety, and pain interference.

Discussion

In this study of adults diagnosed with any-stage pancreatic or lung cancer, we examined subjective medical status indicators (i.e., perceived prognosis as terminal or non-terminal and participant-identified treatment goal as curative or not curative), cancer-related coping strategies, and key mental and physical health outcomes (i.e., depressive symptoms, anxiety, and pain interference). We aimed to compare mental and physical health outcomes in this sample diagnosed with generally poor-prognosis cancer to other samples of adults with cancer, including those with more favorable prognosis. Additionally, we aimed to describe the association of the subjective medical status indicators with outcomes, and to analyze the moderating capacity of coping processes on this hypothesized association.

Depressive Symptoms, Anxiety, and Pain Interference

Overall, participants in the current study reported relatively low mean levels of depressive symptoms, anxiety, and pain interference. Compared with samples of adults with more favorable prognosis cancers, we found comparable rates of clinically elevated depressive symptoms in the overall sample (15.9% vs. 15-18% [prostate, Watts et al., 2014] vs. 20% [breast, Krebber et al., 2014]) and comparable rates of clinically elevated anxiety in the pancreatic cancer sample (16.7% vs. 15.09-18.49% [prostate, Watts et al., 2014] vs. 17.9% [breast, Mitchell et al., 2013]). We found significantly lower clinically elevated anxiety in the lung cancer sample (3.8%). Compared with a sample of gynecological cancer patients and a mixed sample of cancer patients, pain interference was comparable in the overall sample (*M* = 51.87 vs. 49.5 (gynecological, Wagner et al., 2015) vs. 47.7 [prostate, Quach et al., 2016] vs. 51.9 [mixed cancers, Askew et al., 2016] vs. 50 [general population, Cella et al., 2010).

Compared with other samples of lung and pancreatic cancer survivors, the current samples reported lower levels of clinically elevated depressive symptoms (lung: 16-29%, Hopwood & Stephens, 2000; pancreatic: 15-78%, Bauer et al., 2018), lower levels of clinically elevated anxiety (pancreatic: 15%, Janda et al., 2017; lung: 26.9%, Temel et al., 2010). The current sample reported more frequent clinically elevated depressive symptoms than the general population (5-6%, Kessler & Bromet, 2013).

The finding that this sample of poor-prognosis cancer reported comparable levels of depressive symptoms, anxiety, and pain interference as adults with more favorable prognosis cancers is contrary to our hypothesis based on the existing literature. However, these outcomes vary based, in part, on the time point of measurement in relation to major disease-related events (e.g., initial diagnosis, treatment initiation, recurrence, treatment completion, survivorship) and time elapsed since diagnosis (Arch et al., 2020; Anderson et al., 2022; Stanton et al., 2018). On average, the overall sample was nearly 3 years post-initial diagnosis (*M* = 34.40 months, *SD* = 32.64, range = 1-196). The pancreatic sample was assessed considerably further out from diagnosis than other similar studies examining mental and physical health-related outcomes (*M*s = 1 - 5 months, Bauer et al., 2018), whereas the lung cancer sample was more similar to existing samples in terms of time since diagnosis (*M*s = 13.4 - 52.8 months Choi & Ryu, 2018; Eichler et al., 2018). Given the average time elapsed since diagnosis in this sample of people with poor-prognosis cancers, the sample may be more comparable to favorable-prognosis cancers as is reflected in these comparisons. Additionally, selection bias likely occurred, such that adults who agreed to take part were physically and psychologically well enough to participate in a relatively time-intensive psychosocial study. This selection bias is common across psychosocial oncology research (van Lankveld et al., 2018). The sample was also majority white, well-educated, and financially secure, indicating that, on average, participants were not experiencing many other life stressors associated with higher rates of psychological distress.

Medical Status Perceptions

We also aimed to characterize perceived medical status and treatment goal in a sample of individuals diagnosed with generally poor-prognosis cancer and to identify associations between these indicators and coping processes, depressive symptoms, anxiety, and pain interference. We characterized concordance between perceived prognosis and treatment goal despite the primary research questions being agnostic as to “objective” incurability of advanced/metastatic disease or “prognostic accuracy.” Findings were consistent with research in advanced cancer samples (Thompson et al., 2020), such that we observed considerable discordance between perceived prognosis and treatment goal. Specifically, about two-thirds of participants reported their medical status as non-terminal, while only one-third of participants reported a curative treatment goal. Of those who evidenced discordance, the vast majority reported a non-terminal perceived prognosis and a non-curative treatment goal. This discordance may be associated with various values participants held regarding goals for treatment. For example, patients may continue to report, “to extend life,” or “help cancer research” (i.e., non-curative goals) even if they report that they perceive their cancer as non-terminal. Beliefs and about treatment goals may explain, in part, the lack of significant associations between treatment goal and outcomes as compared with perceived prognosis and outcomes. This finding may also be due to differences in how individuals perceived the response options. For example, the option, “to be able to keep hoping,” may be interpreted to include hope for a cure without outright stating cure as a treatment goal.

Consistent with recommendations from prior studies utilizing the PTPQ (Thompson et al., 2020), future research should use a more refined definition and assessment of the perceived prognosis and the treatment goal constructs. Alternative ways to assess treatment goal may be to restrict response options (“curative vs. non-curative”) or be more specific with regard to medically relevant treatment “endpoints” (e.g., “to get rid of the cancer completely”; “to prolong life while knowing cure is not possible”). One study has proposed a comprehensive assessment of prognostic awareness (Prognostic Awareness Impact Scale [PAIS]) that assesses three domains deemed relevant to prognosis perceptions, including cognitive understanding of prognosis, emotional coping involving processing the uncertainty of terminal prognosis, and capacity to use prognostic awareness to inform life decisions (Brenner et al., 2022). Given the conceptual issues with assessment of prognosis perceptions using the PTPQ, we suggest that future research seeking to explore prognosis perceptions and associations with psychological and physical health-related outcomes should attempt to validate this new scale which is likely a step forward with regard to the validity in assessment of prognosis perceptions.

An alternative explanation for these findings is the heterogeneity of the sample with regard to medical status. Participants in the study were involved in cancer-related treatment to different degrees based on their time since diagnosis, which made drawing inferences about the influence of subjective medical status indicators challenging. Information about treatment was assessed via self-report, and “active or most recent treatment,” was assessed. Therefore, not all patients were in active treatment at the time of the study, which likely influenced the ability to make meaningful inferenced findings regarding the association between perceived treatment goal and outcomes at the time of assessment.

With regard to associations between perceived prognosis and outcome variables, we observed an association between perceiving a terminal prognosis and greater depressive symptoms and anxiety. This finding supports our hypothesis and is consistent with research in advanced cancer samples that report an association between perceiving a terminal prognosis and worse quality of life and mood (El-Jawahri et al., 2014; El-Jawahri et al., 2015; Nipp et al., 2017). Perceived prognosis and pain interference were not associated significantly.

Coping Processes and Medical Status Perceptions

We also aimed to characterize coping processes and examine associations with medical status perceptions. On average, the sample reported moderate to high levels of approach-oriented coping strategies (i.e., emotional processing and expression, active coping, acceptance, reappraisal) and low levels of avoidance coping. With regard to associations between medical status perceptions and coping processes, we observed a univariate association between perceived prognosis and emotional processing coping, active coping, and reappraisal coping such that participants who reported a non-terminal prognosis reported higher levels of all three coping strategies. No other significant associations were observed between perceived prognosis and coping or between treatment goal and coping processes. Based on the Common-Sense Model of Illness Representations (Leventhal, Meyer, & Nerenz, 1980), we would posit that a more potent perceived health threat (i.e., perceived terminal prognosis) would elicit higher levels of both approach-oriented and avoidance-oriented coping, in an effort to manage the stressor. Factors that were not measured in this study that would be theoretically important include negative physical effects of cancer treatment or of the cancer itself, which are central indicators of the severity of disease in the context of illness perception and coping processes. Future studies should examine the interplay between subjective medical status indicators, coping processes, and physical symptoms/side effects.

We interrogated moderation effects between perceived prognosis and coping processes on depressive symptoms, anxiety, and interference from pain. Perceived prognosis interacted significantly with coping strategies in their association with depressive symptoms and anxiety, but not interference from pain. Specifically, lower level of active coping was associated with higher depressive symptoms in individuals who reported a terminal prognosis compared with individuals who reported a non-terminal prognosis. At higher levels of active coping, this difference was not present. Findings indicate that lower levels of engagement in active coping may serve as a risk factor for higher depressive symptoms in individuals who identify their diagnosis as terminal. This finding is in line with our hypothesis that the impact of identifying with a terminal prognosis on depressive symptoms would depend on use of approach-oriented coping strategies such as active coping.

The interaction involving emotional processing coping was also in line with hypothesis in that participants with low levels of emotional processing coping and terminal perceived prognosis demonstrated the highest levels of anxiety. It seems that higher levels of emotional processing coping buffer the association between perceived terminal (vs. non-terminal) status and anxiety. Associations between emotional processing and emotional expression with depressive symptoms (Reese et al., 2017) and with general distress (Stanton et al., 2000a) are documented. The present findings are novel with regard to the significant association between emotional processing with anxiety in poor-prognosis cancer and are in line with exposure models of anxiety reduction through emotional processing (Foa & Kozak, 1986). Findings also provide further support for the positive association between emotional approach coping and positive outcomes (Austenfeld & Stanton, 2004; Stanton et al., 2000). Facilitating emotional processing of a diagnosis perceived as terminal and its implications could be a productive focus of intervention, in order to reduce anxiety and support adjustment to the diagnosis.

We did not find support for the moderating capacity of emotional expression coping on the association between perceived prognosis and any outcome. This result is unexpected given documented findings related to the association of emotional processing, emotional expression, and distress. Stanton et al., (2000) documented an association between greater use of emotional expression and lower distress and greater use of emotional processing coping and increased distress when controlling for emotional expression. This suggests that the variance unique to emotional processing may represent a ruminative component of the construct, and the beneficial facets of emotional approach coping are conferred through the expression of emotions. However, more recent research in prostate cancer survivors has documented the association between emotional approach coping and lower depressive symptoms and disease-specific physical outcomes (Hoyt et al., 2013). Emotional processing has also been associated with beneficial outcomes in older adults (Hoyt et al., 2020). While we cannot draw substantial empirical conclusions from this null finding in this relatively small sample, findings provide support for the idea that emotionally processing a cancer diagnosis that is perceived as terminal confers benefits through reduced anxiety.

We also observed consistent main effects of perceived prognosis on depressive symptoms and anxiety, controlling for gender and coping. This finding stands in contrast to research suggesting that, when considered together, coping is a stronger predictor of psychological distress than illness perceptions (Dempster, Howell, & McCorry, 2015). It is likely that prognosis perception represents an illness perception with unique influence on psychological distress and thus operates in the context of coping differently than do typically assessed illness perceptions (e.g., cause, consequences, chronicity).

We did not observe significant interaction effects between avoidance coping and medical status indicators in predicting any outcome. However, avoidance coping was related significantly to depressive symptoms and anxiety, controlling for gender. A focus on reducing avoidance-oriented coping may be important regardless of perceived health status and could be a target of intervention for all patients.

Limitations of the Research

Several limitations of this study might constrain its generalizability to other populations with poor-prognosis cancers. First, the two samples were recruited in different ways, with the pancreatic sample being recruited through both a philanthropic organization and academic medical center treatment setting whereas the lung cancer sample was primarily recruited within an academic medical center treatment setting. The pancreatic cancer recruitment method likely resulted in a bias towards individuals who were doing better physically. A large number of eligible study participants declined to participate, mostly attributing their declining study participation to “not doing well physically.” Recruitment is a key consideration in conducting research with this vulnerable population.

The cross-sectional design of this study also does not address questions of causality and directionality with regard to perceptions of prognosis, coping processes, and mental health outcomes (Coyne & Racioppo, 2000). For example, it is plausible that outcomes such as depressive symptoms and anxiety significantly contribute to coping processes (e.g., greater use of avoidance coping as a symptom of anxiety or depression). This issue is particularly salient with regard to coping given the association between an increased need to cope, in general, in people who experience worse physical and psychological symptoms (Skinner et al., 2003). It has also been suggested that elements of illness perceptions may reflect coping processes, and therefore may be confounded with coping (Dempster, Howell, & McCorry, 2015). We also did not account for pre-morbid psychiatric morbidity which an important considering in the context of adjustment to cancer diagnosis across an extended period of time.

Implications of the Findings

The current findings have several theoretical and clinical implications. Findings from the current moderation analyses provide support for situating coping as a moderator in the associations between illness perceptions and outcomes. A review of the literature in illness perceptions and coping with health stressors suggested lack of empirical clarity in the operationalization of coping in this context (Dempster, Howell, & McCorry, 2015), and research has typically operationalized coping as a mediator. We found support for the hypothesis that the influence of the illness perception in question (e.g., one's perceived prognosis) would depend on coping (i.e., a moderator effect). The influence of perceiving one's cancer as terminal on psychological outcomes appears to depend on, rather exert influence through, coping.

The current findings of the association between perceiving prognosis as terminal and depressive symptoms and anxiety highlight the importance of support for individuals who identify their prognosis as terminal. Findings support pursuing clinical intervention to increase the degree to which patients engage in approach-oriented coping, particularly active coping and emotional processing coping. High engagement in active coping may enable individuals to identify values, make informed treatment decisions, and identify and align their behavior with end-of-life goals (Greer et al., 2020). Treatments tailored to supporting patients and loved ones following a terminal cancer diagnosis, including early integrated palliative care (EIPC), have been shown to improve quality of life, depressive symptoms, and survival in patients diagnosed with terminal lung cancer (Greer et al., 2020; Hoerger et al., 2018; Jacobsen et al., 2014; Temel et al., 2011; Temel, Petrillo, & Greer, 2022). Mechanistic studies have shown that an increase in approach-oriented coping (including active coping) is one way this effect is achieved (Greer et al., 2018). The current findings add support to pursuing intervention development focused on improving facets of approach-oriented coping, specifically active coping and emotional processing coping.

Future research should longitudinally examine associations among prognosis and treatment perceptions, coping processes, and psychological and physical health-related outcomes to more rigorously establish directionality in these relationships. It is plausible that outcomes such as depressive symptoms and anxiety significantly contribute to coping processes (e.g., greater use of avoidance coping as a symptom of anxiety or depression), and longitudinal analyses would help to clarify the positionality of these variables. Coping with cancer often involves close loved ones. Future studies should examine the influence of prognosis perceptions and coping on both patients’ and caregivers’ outcomes. Two such studies of caregiver prognostic awareness have been conducted to date (Forst et al., 2020; Gray et al., 2021), with findings suggesting similar patterns of discordance between prognosis perceptions and treatment goals in caregivers as in patients, as well as discordance between patients’ and caregivers’ prognosis perceptions. Given the present findings, it is likely the interplay of patient-caregiver prognosis perceptions and coping influence psychological health in patients with poor-prognosis cancer and their caregivers.

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Interdependence of patients' and caregivers' coping and adjustment to poor-prognosis cancers

Study 2 Abstract

Objective: Diagnosis of cancer can be a profoundly stressful experience for individuals and their loved ones. Social-cognitive models of coping with stressful experiences posit that coping attempts and partners' responses to coping attempts unfold together to predict psychological distress in dyads. The proposed study focuses on adults with lung or pancreatic cancer and their caregivers, populations for whom dyadic processes and factors influencing psychological distress are understudied. The primary aim is to investigate the mutual relationships of patients' and caregivers' coping on their depressive symptoms, anxiety, and experience of life disruption from pain.

Method: Over approximately 3 years from 2017 to 2020, adults who had received a diagnosis of lung cancer (n = 52) or pancreatic cancer (n = 36) and patient-nominated primary caregivers (lung, n = 20; pancreatic n = 28) were enrolled in two separate studies focused on the experience of each respective cancer. Participants in both studies completed measures of illness-related coping processes, depressive symptoms, anxiety, and life disruption from pain. Differences by patient/caregiver role and gender on each variable were examined in the overall sample. In complete patient-caregiver dyads (i.e., both patient and caregiver participated, n = 43), Actor-Partner Interdependence Modeling was used to examine relationships between each dyad's self-reported illness-related coping and depressive symptoms, anxiety, and life disruption from pain.

Results: The overall sample was nearly 3 years post-initial diagnosis (M = 33.93, SD = 33.47). Nearly two thirds of caregivers were women (n = 30, 62.5%) while about half the patients were women (n = 48, 54.5%). Comparing patients and caregivers, caregivers reported significantly more anxiety symptoms ($t(128) = 3.99$, $p < .001$, $d = .73$). Patients and caregivers did not differ

significantly in depressive symptoms, life disruption from pain, or self-reported coping strategies (ps > .05). Comparing men and women, there were no differences in depressive symptoms, anxiety, or life disruption from pain (ps > .05). Women reported more coping through emotional expression ($t(126) = -4.07$, $p < .001$, $d = -.73$) and emotional processing ($t(124) = -2.47$, $p = .015$, $d = -.45$), and they used greater reappraisal coping with a moderate effect size, although not statistically significant ($t(75) = -1.94$, $p = .056$, $d = -0.45$). Within dyads, patients' and caregivers' depressive symptoms, anxiety, and life disruption from pain were not correlated significantly. Only patients' reappraisal coping was inversely correlated with caregivers' avoidance coping ($r = .43$, $p = .030$). Actor-Partner Interdependence Modeling showed that greater avoidance in patients was associated with greater depressive symptoms in their caregivers. Patients' and caregivers' own avoidance coping was associated with their own greater depressive symptoms and life disruption from pain, and caregivers' avoidance coping was associated with their own greater anxiety. No interdependence was found between patients' and caregivers' approach-oriented coping processes and outcomes. Patient actor effects were observed between greater acceptance and active coping with lower depressive symptoms, greater emotional processing coping with lower anxiety, and greater acceptance coping with lower life disruption from pain. Caregiver actor effects were observed between greater emotional expression coping and lower depressive symptoms and greater emotional expression coping and lower life disruption from pain.

Discussion: In the context of poor-prognosis cancer, caregivers experienced greater anxiety than patients, with comparable levels of depressive symptoms and life disruption from pain. Findings indicate that patients' avoidance coping was associated with caregivers' depressive symptoms, but no patterns of interdependence were observed between approach-oriented coping and outcomes among dyads facing diagnosis of pancreatic or lung cancer. For both patients and caregivers, individuals' approach and avoidance-oriented coping processes impact their own depressive symptoms, anxiety, and life disruption from pain. Results suggest the promise of interventions to increase active coping, emotional processing, and acceptance in patients and coping through emotional expression in caregivers. Intervening to reduce avoidance-oriented coping may yield benefits at the dyadic level for both patients' and caregivers' depressive symptoms.

Introduction

Diagnosis of cancer commonly results in adverse psychological and physical consequences both for patients and their loved ones. Early theories of stress and coping focused on individual processes and outcomes (Lazarus & Folkman 1984). Accordingly, the impact of diagnosis and treatment on patients' own psychological and physical health-related outcomes has been studied extensively and is well documented, particularly for the most common cancers (Linden, Vodermaier, MacKenzie, & Greig, 2012; Stanton, 2006). Recently, theory and research specific to the psychosocial experience of caregiving in the context of cancer has proliferated (Stenberg, Ruland, & Miaskowski, 2010; Ugalde et al., 2019). The impact of cancer on caregivers has been recognized to such an extent that caregivers have been referred to as "the other cancer survivor," (Golant & Haskins, 2008). The term "caregiver" can refer to a paid or unpaid individual who is involved in assisting others with activities of daily living and medical tasks and providing emotional support. Approximately 2.8 million adults serve as caregivers for people diagnosed with cancer (NAC, 2016), the vast majority of whom are family members, and, more specifically, spouses or intimate partners (78.3%; Kim, Baker, & Spillers, 2007). For the remainder of the paper, the term "patient" will be used to describe the individual who has been diagnosed with cancer or another relevant disease. The term "caregiver," "partner," or "spouse" will be used to refer to the individual providing care to the other member of the dyad, depending on the specific participant sample referenced.

Providing care for a person with cancer presents many challenges, including tracking complex medical regimens, navigating new medical systems, managing households, and meeting the affected loved one's instrumental and emotional needs (Nijboer et al., 1998). The effect of these stressors on caregivers' well-being is compounded by the emotional strain of the life-threatening illness of a loved one and the re-negotiation of roles within the relationship (Schumacher et al., 2008). Patients often report unmet psychological needs after diagnosis with cancer (Andersen et al., 2014), and caregivers are frequently required to provide emotional support that may lead to a sense of lack of preparedness for caregiving and added psychological distress (Girgis et al., 2013; Hudson et al., 2004). The neglect of self-care also can contribute to mental, physical, and social morbidities for the caregiver (Li & Loke, 2013). Given recent advances in treatment, patients with poor-prognosis cancers are surviving longer on active treatment in the outpatient setting, presenting caregivers with an extended period of time to provide care for the patient (Jacobsen, Nipp, & Ganz, 2017).

Studies of psychological morbidity in caregivers have shown that rates of clinically elevated depressive symptoms and anxiety, as diagnosed by clinical interview, range from 10% of caregivers of patients with early-stage disease to 33% of caregivers of patients who are terminally ill (Pitceathly & Maguire, 2003). Slow trajectories of psychological recovery for distressed partners of cancer survivors demonstrate the prolonged impact of distress related to caregiving (Lambert, Jones, Girgis, & Lecathelinais, 2012). Moreover, the experience of stress from caregiving influences physical health and can contribute to chronic health conditions in caregivers (Northouse, Katapodi, Schafenacker, & Weiss, 2012). In particular, research demonstrates that caring for a patient with advanced cancer in the outpatient context is particularly challenging for caregivers, and is associated with poorer quality of life, and higher depressive symptoms and anxiety compared to caregivers for patients with earlier stage cancer (Grunfeld et al., 2004; Nipp et al., 2016; Palos et al., 2011; Wadhwa et al., 2013). These findings demonstrate the importance of identifying risk and protective factors for psychological and physical health in caregivers and developing supportive interventions to mitigate the impact of caregiving-related stress.

Empirical research examining the impact of cancer diagnosis and caregiving burden on psychological and physical health-related outcomes for caregivers has burgeoned over the past three decades (Stenberg, Ruland, & Miaskowski, 2010; Geng et al., 2018). Additionally, a relatively recent shift in the conceptualization and analysis of stress and coping processes in patient and caregivers has occurred (Badr & Acitelli, 2017; Fletcher et al., 2012). Emphasis now is placed on analyzing the effect of patient and caregiver psychosocial factors on their own outcomes (i.e., actor effects) as well as the effects they have on their partner's outcomes (i.e., partner effects) to improve the ecological validity of research guided by traditional stress and coping theories, which focus primarily on the individual (e.g., Lazarus & Folkman, 1984). Additionally, as with the majority of psycho-oncology research, studies involving caregivers have primarily focused on breast or prostate cancer patients (and their spouse caregivers). A paucity of research involves caregivers of adults living with non-gendered cancers and poor-prognosis cancers (Hagedoorn et al., 2008; Kim & Given, 2008). Moreover, the majority of the research does not examine the effect of both patients' and caregivers' coping processes on both of their psychological and physical health-related outcomes. The proposed research seeks to address these gaps in the literature by examining psychosocial risk and protective factors for adjustment to cancer in patient-caregiver dyads coping with poor-prognosis cancers.

Dyadic Models of Distress and Coping

Distress

Emotions serve to motivate individual responses to threat but can also serve an interpersonal function to alert others and marshal support (Tooby & Cosmides, 2008). Thus, the expression of emotion can be conceptualized as a form of relational experience (Frijda, 1986). Multiple models of the dyadic processes of stress and coping are relevant to the shared cancer experience of patients and caregivers. In the context of cancer, patients and close others who are highly involved may share internal emotional experiences through a process termed emotion contagion (Hatfield et al., 1994). Emotional contagion operates largely through unconscious interpersonal processes within a dyad that contribute to shared emotional experiences (Parkinson & Simons, 2012). Similarly, emotion co-regulation and co-dysregulation models posit that interpersonal processes that unfold within dyads contribute to the mitigation of negative emotional experiences (co-regulation) or the heightening of negative emotional experiences (co-dysregulation; Reed, Barnard, & Butler, 2015).

Evidence in support of emotion contagion and emotion regulation in patient-caregiver dyads coping with cancer comes from the distress interdependence literature. Several studies have demonstrated that breast cancer patients’ anxiety or depressive symptoms are related to spousal caregivers’ anxiety and depressive symptoms (Given et al., 1993; Segrin et al., 2007; Segrin & Badger, 2014). Regarding the experience of advanced cancers, one study demonstrated that both patients’ and caregivers’ anxiety influenced patients’ depressive symptoms and caregivers’ depressive symptoms in patients newly diagnosed with incurable lung and gastrointestinal cancer (Jacobs et al., 2017). Another study demonstrated frequently co-occurring diagnoses of anxiety disorders in caregivers and patients living with various advanced cancers (Bambauer et al., 2006). These studies highlight the bidirectional and interdependent nature of psychological distress in cancer patient-caregiver dyads.

Coping Processes in Dyadic Context

Theory and research in psycho-oncology emphasize the importance of conceptualizing the cancer experience as affecting the patient and caregiver as a unit (Kayser, Watson, & Andrade, 2007). As theory in stress and coping with health threats expanded to accommodate patient-caregiver dyads, the multifaceted construct of dyadic coping was articulated. The definition of dyadic coping varies by context, but generally refers to the way partners deal with individual and dyadic stressors together (Bodenmann 1995, 1997). Centrally, dyadic coping represents a relational and interdependent process between partners in a dyad. A large body of research is founded in a conceptualization of dyadic coping as distinct from individual coping and representing a systemic approach to coping as a unit (Falconier, Jackson, Hilpert, & Bodenmann, 2015; Falconier & Kuhn, 2019). This conceptualization has been employed across studies of intimate relationships and with cancer patient-caregiver dyads. A second conceptualization of dyadic coping in which the individual coping of both partners is related to each other's coping and adjustment also has received study. The majority of this research examines coping congruence between patients and caregivers and has been conducted in gendered cancers (i.e., breast cancer; Ben-Zur et al., 2001; Kraemer et al., 2011). These two conceptualizations of individual coping congruence with dyads and dyadic coping as a distinct construct from individual coping have been the primary focus on research with regard to coping processes within dyads (Bodenmann, Meuwly, & Kayser, 2011). Despite the relative novelty of research on systemic dyadic coping with health-related stressors in cancer patient-caregiver dyads, we acknowledge the importance of individual coping in the dyadic context and the value of examining the potentially unique relationships of coping and mental and physical health outcomes in the dyadic context. We consider the individual coping strategies that each member of the dyad brings to the interpersonal environment as potentially crucial contributors to their own and their counterpart's coping as well as psychological and physical health-related outcomes.

Social cognitive theory (SCT; Bandura, 1986) provides a useful framework for examining individual coping processes within patient-caregiver dyads. SCT focuses on the bidirectional influence of individual characteristics (e.g., cognitions, behaviors) and environmental factors (e.g., family, relationships). Under this view, patients and caregivers represent individual parts of a collective social environment that influences individuals' cognitions and responses to stress. Within this environment, patients and caregivers can observe, learn from, and be affected by one another's cognitive and behavioral attempts to manage stress. SCT has been examined relative to patients' individual experiences with cancer. A review of the psychosocial intervention literature in cancer demonstrated that the inclusion of SCT components in interventions for individuals with cancer resulted in improved quality of life, global affect, depressive symptoms, and objective physical health outcomes (Graves, 2003). Research using SCT to analyze cancer patient-caregiver dyads is surprisingly limited given those investigations' strong theoretical foundation. One study used SCT as a framework to examine the interdependence of mental health, physical health, and self-efficacy in advanced cancer patients and their caregivers; higher self-efficacy for managing cancer-related stress was associated with better personal mental health and partner physical health (Kershaw et al., 2015). Given the relatively limited literature drawing from SCT to dyadic coping in cancer, further exploration is warranted.

The social-cognitive processing (SCP) model (Lepore, 2001) also is relevant in that it describes how characteristics of the social environment can affect both patients' and caregivers' adjustment to cancer by altering how people talk, think, and feel about cancer, themselves, and their relationships. To the extent that individuals affected by cancer, both patients and caregivers, want to discuss aspects of cancer with their partners, benefits of disclosure will depend in part on the response of the other. Partner responsiveness is likely influenced by their own personal coping processes in response to stressors. Thus, adjustment is affected both by each individual's own coping processes and by the coping of the other member of the dyad.

Within the SCP model, the construct of social constraint provides a possible explanation for the processes of approach and avoidance within dyads. Social constraint refers to withdrawal or efforts to curb interaction, which can influence the other person's coping behaviors, such as expressing and processing emotions, and seeking social support (Lepore & Revenson, 2007). Given that adults often are motivated to express feelings related to their cancer experience, a partner's avoidance-oriented coping may negatively influence, and approach-oriented coping positively influence, a patient's psychological and physical health-related outcomes, and vice versa (Davison, Pennebaker, & Dickerson, 2000).

Evidence from research on other dyadic health-related stressors has demonstrated bidirectional effects of patient-caregiver individual coping that is in line with social cognitive theories. For example, Berghuis and Stanton (2002) found that in couples coping with infertility who were undergoing alternate insemination, women's own infertility-related emotional expression was protective from depressive symptoms after they received a negative pregnancy test. Moreover, women who were low in expressive coping but whose husbands were high in expressive coping were protected from an increase in depressive symptoms. Similarly, in breast cancer, both patients' and partners' approach-oriented coping predicted patients' positive adjustment longitudinally, whereas patients' and partners' avoidance-oriented coping predicted patients' negative adjustment (Kraemer et al., 2011).

Other studies have yielded some support for individual psychological resources influencing partner outcomes. Individual coping has been examined in cancer survivors, demonstrating that patient resilience characteristics were associated with less spouse psychological distress, but spouse resilience was not associated significantly with patient distress (Lim, Shon, Paek, & Daly, 2014). Additionally, spouse avoidance mediated the association between spouse unsupportive behavior and patient distress (Manne et al., 2005). In a sample of colorectal patients, relationship intimacy moderated the influence of emotional expression on depressive symptoms, such that lower intimacy attenuated the inverse association between expression and depressive symptoms (Reese et al., 2017). In a psychosocial intervention trial of individuals with breast cancer, greater use of emotional approach coping enhanced the effect of a dyadic coping intervention on indicators of distress and well-being (Manne, Ostroff, & Winkell, 2007). One study in patients with advanced lung or gastrointestinal cancer examining the relationship of patients' coping with caregivers' outcomes found that greater use of emotional support coping was associated with higher levels of depressive symptoms but lower anxiety, and greater use of acceptance by the patient was associated with lower depressive symptoms in caregivers (Nipp et al., 2016).

Taken together, these findings demonstrate the importance of dyadic processes in coping on psychological and physical health-related outcomes. Because the vast majority of studies are conducted in couples experiencing gendered cancers (i.e., breast and prostate cancer), gender is confounded with the target of the cancer diagnosis. Limited research is available in less-gendered cancers such as colorectal (Kayser et al. 2018), head and neck (Manne, Badr, & Kashy, 2012), lung (Badr & Taylor, 2008; Carmack Taylor et al., 2008), and gastrointestinal cancer (Jacobs et al., 2017). In a meta-analysis of dyadic coping studies in cancer, gender accounted for more of the variance in distress than did patient-caregiver status, with women reporting greater distress regardless of patient status (Hagedoorn et al., 2008). A review of studies in colorectal cancer, which is diagnosed in men and women at relatively equal rates (i.e., 53% male, 47% female; ACS, 2020), revealed a similar finding, such that female patients and caregivers reported higher levels of distress than men in those roles (Kayser et al., 2018). The latter review exemplifies the importance of conducting dyadic studies in non-gendered cancer samples in order to tease apart the influence of gender and role (patient or caregiver) on psychological and physical health outcomes.

Thus far, findings are consistent with theories on the influence of gender in coping with health threats, such that gender may systematically influence stress appraisals and coping behaviors. For example, women have been found in cancer samples and in healthy adult samples to report higher distress than men, with similar effects sizes across both settings (Hagedoorn et al., 2008; Davis, Matthews, & Twamley, 1999). With regard to coping processes, research on non-cancer samples demonstrates that women report higher overall levels of coping, and specifically positive self-talk, emotional support seeking, and rumination, with the largest gender-related difference existing in acknowledgment of emotions and expression of emotions to others (Tamres, Janicki, & Helgeson, 2002). In the context of cancer, one study found that men who cope through emotional processing and women who cope through emotional expression have more favorable mental health outcomes (Cho, Park, & Blank, 2013). These findings indicate that gender-related variables are important in terms of distress and coping, although it is also important to note that finding a gender-related difference is uninformative with regard to what produced the difference. As such, a particular interest is how gender is associated with the specific coping and distress patterns in patient-caregiver dyads experiencing lung and pancreatic cancer.

The body of research on dyadic coping largely focuses on spouse-patient dyads (Traa, De Vries, Bodenmann, & Den Oudsten, 2015). However, a substantial number of caregivers are not spouses (21.7%, Kim, Baker, & Spillers, 2007), and the experiences of dyads that incorporate spouse caregivers versus non-spouse caregivers may differ meaningfully. As such, research that includes non-spouse caregivers is needed. Additionally, a large proportion of the literature examining cancer patient-caregiver dyadic coping does so under a coping congruence model (Kraemer et al., 2011; Revenson, 1994). Coping congruence models posit that the degree to which patients and caregivers employ similar or complementary coping strategies dictates outcomes. For example, in couples coping with child's cancer diagnosis, similar levels of emotion-focused coping and differing levels of problem-focused coping were predictive of better marital and health adjustment (Barbarin, Hughes, & Chesler, 1985). However, synthesis of findings across multiple studies using the congruence model of dyadic coping reveals inconsistent or no associations of patient-caregiver congruence/incongruence in using specific coping strategies on outcomes (Badr, 2004; Guinta & Compas, 1993; Revenson, 2003). As such, research related to individual coping processes within dyads warrants further exploration outside of the conceptual constraints of congruence. The proposed study seeks to address these gaps in the literature by examining the interdependence of patients' and caregivers' coping and distress associated with lung and pancreatic cancer. Both of which represent non-gendered, poor-prognosis cancers. Interdependence exists when the emotion, cognition, or behavior of one member of the dyad influences that of the other member. In order to design and implement effective interventions to support well-being in patient-caregiver dyads, it is important to understand how individuals' coping processes influence coping and outcomes in the other member of the dyad. Findings from the proposed research will extend knowledge related to coping processes and mental and physical health-related outcomes in poor-prognosis cancer patient-caregiver dyads and inform the development of interventions that promote adaptive coping processes in both patients and caregivers.

Study Aims

This study examined the hypothesized influence of patient and caregiver coping processes on patient and caregiver depressive symptoms, anxiety, and life disruption from pain. In line with a social cognitive conceptualization of stress and coping, associations between patients' and caregivers' own coping and these outcomes ("actor effects") as well as associations between patient coping and caregiver outcomes and caregiver coping and patient outcomes ("partner effects") were analyzed. In order to design effective interventions to support both patients and caregivers in the context of poor-prognosis cancer, it is crucial to understand the mutual influence of patients' and caregivers' experiences of the disease on their psychological and physical well-being. These experiences include depressive symptoms and anxiety as well as relevant coping processes. Knowledge of psychosocial risk and protective factors in patient-caregiver dyads will also provide insight into identifying patients and caregivers at risk for poor psychological and physical health outcomes. This study will contribute to the relatively small knowledge base at the intersection of poor-prognosis cancers, non-gendered cancers, and patient-caregiver coping processes and psychological and physical health-related outcomes.

With regard to dependent variables in the proposed research, depressive symptoms and anxiety are common psychological experiences of both patients and caregivers coping with a diagnosis of poor-prognosis cancer (Bauer et al., 2018; Nipp et al., 2016). These psychological symptoms have a significant impact on quality of life in people with advanced cancer (Smith, Gomm, & Dickens, 2003) and caregivers (Grov, Dahl, Goum, & Fasså, 2005). In terms of physical consequences of cancer and its treatment, pain is a particularly prevalent symptom in both lung (Potter & Higginson, 2004) and pancreatic cancer (Bauer et al., 2018). The experience of pain is also associated with cognitive and affective processes, including catastrophizing, and evidence suggests that coping processes influence the experience of pain in patients with lung cancer (Prasertsri, Holden, Keefe, & Wilkie, 2011). Additionally, dyadic psychosocial processes are associated with experience of pain in couples (Porter, Keefe, Lipkus, & Hurwitz, 2005). As such, life disruption from pain (Cella et al., 2010) was selected as an outcome.

Aim 1

To investigate the use of coping processes and levels of depressive symptoms, anxiety, and life disruption from pain in samples of patients with lung or pancreatic cancer and their caregivers. I compared these variables as a function of patient-caregiver role and gender.

Exploratory Aim. To compare patients' outcomes as a function of the nature of the relationship to the caregiver and when no caregiver is nominated (i.e., spouse vs. non-spouse vs. no caregiver).

Aim 2

To determine whether coping processes and depressive symptoms, anxiety, and life disruption from pain are interdependent in patients with lung or pancreatic cancer and their caregivers, such that the extent of use of coping processes in one member is associated with outcomes in the other member.

Hypothesis 2. Higher approach-oriented coping and lower avoidance-oriented coping will be associated with lower depressive symptoms, less anxiety, and less life disruption from pain within partners and between partners.

Method

Participants

Patient participants were adults diagnosed with lung or pancreatic cancer and caregiver participants were patient-elected loved ones who had been highly involved in the cancer experience with the patient. Patients were eligible if they had received a diagnosis of lung cancer or pancreatic cancer (any stage), were able to read and write in English, and had ambulatory status sufficient to attend outpatient medical visits. Patients were ineligible if they were unable to complete assessments in English, not sufficiently mobile to attend outpatient clinical appointments, or had observable cognitive impairment that prevented informed consent. Caregivers were eligible if they were comfortable reading and writing in English and did not have observable cognitive impairment that prevented completion of informed consent.

Procedure

Adults diagnosed with pancreatic cancer were recruited primarily through the Agi Hirshberg Pancreatic Clinic at UCLA, as well as outreach through the Hirshberg Foundation for Pancreatic Cancer Research, including emailed announcements and promotions at the Foundation’s public events (e.g., the Los Angeles Cancer Challenge 5k). Adults diagnosed with lung cancer were recruited through contact with participants in another study conducted by our group (Williamson et al., 2020) and through approach and screening of consecutive patients at a UCLA-affiliated oncology clinic by trained study staff, within scheduling constraints. Institutional Review Board approval was obtained for both studies.

Patients were asked to identify a primary caregiver with the following prompt: “A part of the study is to learn more about caregiver experiences as well. Do you have a loved one who is involved with your care or supports you during your experience with [lung or pancreatic] cancer that you think might be interested in participating in the study?” Patients elected a single person who was deemed their “primary caregiver.” Caregiver participants were enrolled only after confirming patients’ participation in the study, that is, caregivers did not participate in the study without a patient participant. Caregiver participation was not required for patient participation in the study, and some patients chose to participate without a caregiver.

Measures

Medical and demographic information

Relevant medical data (i.e., cancer type and stage, diagnosis duration, medical comorbidities) and demographic information (i.e., age, sex, race/ethnicity, education, socioeconomic status, marital/partner status) were assessed through patient self-report. Caregivers completed identical demographic information and reported medical comorbidities.

Cancer-related Coping Processes

Coping processes were assessed with 32 items from the COPE scale (Carver, Scheier, & Weintraub, 1989) with items anchored to participants’ experience of pancreatic or lung cancer. Each item was rated on a four-point scale: 1 (“I don’t do this at all”), 2 (“I do this a little bit”), 3 (“I do this a medium amount”), and 4 (“I do this a lot”). Subscales were calculated by averaging responses, with scores ranging from one to four.

Approach-oriented coping was assessed with 12 items from the COPE (Carver, Scheier, & Weintraub, 1989) as well as the 8-item Emotional Approach Coping scales (Stanton, Kirk, et al., 2000). Participants responded to items in reference to their experience with lung or pancreatic cancer. Responses are on a 1- 4-point Likert scale (1 = I don’t do this at all; 4 = I do this a lot), with higher scores indicating a greater tendency to use the specific coping strategy. The approach-oriented subscales from the COPE include positive reinterpretation and growth (4 items, e.g., “I try to grow as a person as a result of the experience,” referred to as “positive reappraisal coping” from here forward; patient α = .81, caregiver α = .80), active coping (4 items, e.g., “I concentrate my efforts on doing something about it,” patient α = .79, caregiver α = .77), and acceptance (4 items, e.g., “I accept the reality of the fact that it happened,” patient α = .69, caregiver α = .42). Due to distinct study designs, coping through positive reappraisal was assessed in the pancreatic cancer sample only. The Emotional Approach Coping subscales include emotional processing (4 items, e.g., “I take time to figure out what I’m really feeling,” patient α = .78, caregiver α = .76) and emotional expression (4 items, e.g., “I allow myself to express my emotions,” patient α = .87, caregiver α = .89). The approach-oriented subscales were analyzed separately to investigate differences between the specific strategies in their associations with patient and caregiver outcomes.

Avoidance-oriented coping strategies were assessed with 12 items from three COPE subscales (Carver, Scheier, & Weintraub, 1989): denial (4 items, e.g., “I refuse to believe that it has happened” patient α = .63, caregiver α = .88), mental disengagement (4 items, e.g., “I go to movies or watch TV to think about it less” patient α = .59, caregiver α =.60), and behavioral disengagement (4 items, e.g., “I just give up trying to reach my goal” patient α = .49, caregiver α = .66). The 12-item avoidance-oriented coping composite was used for analysis (patient α = .71, caregiver α = .69)

Depressive symptoms

Depressive symptoms were measured using a different scale in the pancreatic cancer subsample versus the lung cancer subsample due to differing emphasis on depressive symptoms in original aims from the two separate studies. The 20-item Center for Epidemiologic Studies-Depression scale (Radloff, 1977) measured depressive symptoms in the pancreatic subsample. The CES-D has well-established internal consistency and reliability ranging from .84 to .90 (Radloff, 1977). It has demonstrated good reliability and validity in studies with cancer patients (Hann, Winter, & Jacobsen, 1999; Stanton et al., 2005). In the current study, Cronbach's α was .90 in patients and .93 in caregivers. A total score of 16 or greater suggests clinically significant levels of depression (e.g., Andresen, Malmgren, Carter, & Patrick, 1994). In the lung cancer subsample, depressive symptoms were assessed using two items of the Patient Health Questionnaire – 4 (PHQ-4), a validated, 4-item scale containing two, 2-item subscales assessing cardinal depressive symptoms and anxiety symptoms (Kroenke, Spitzer, Williams, & Löwe, 2009; Löwe et al., 2010). Scores on the depressive symptoms subscale range from 0-6 with scores of 3 or greater suggesting clinically significant depression. In the current study, Cronbach's α was .71 in patients and .80 in caregivers. To allow for analysis of depressive symptoms across the sample, both total scores were rescaled to scores ranging from 0-10 using the following formula:

$$Rescaled\ score = \left(\frac{score - minimum}{maximum}\right) * 10$$

Eleven CES-D items that did not measure cardinal depressive symptoms (i.e., depressed mood, anhedonia) were removed prior to scaling to maximize conceptual comparability of the two scales. The 20-item CES-D and the 9-item CES-D "cardinal symptom" measure were highly correlated in patients ($r = .90$, $p < .001$) and caregivers ($r = .93$, $p < .001$).

Anxiety

Anxiety symptoms were assessed in both samples using the PHQ-4. The two-item anxiety subscale scores range from 0-6 with scores of 3 or greater suggesting clinically significant anxiety (Kroenke, Spitzer, Williams, & Löwe, 2009). In the current sample, Cronbach's α was .80 in patients and .90 in caregivers.

Pain interference

Life disruption from pain was measured with the PROMIS-Pain Interference scale (PROMIS-PI; Amtmann et al., 2010). The PROMIS measures are from the NIH-funded Patient-Reported Outcomes Measurement Information System (PROMIS), a family of instruments designed to measure different aspects of physical, mental, and social health (Cella et al., 2010). Pain interference is assessed based on the prior 7 days and item scores are on a 5-point Likert scale with responses ranging from "Not at all" to "Very much." The total score ranges from 6-30, with higher scores representing greater disruption due to pain in the prior 7 days. T scores were computed based established scoring guidelines (Cella et al., 2010) and utilized in analyses. Established cutoffs for "within normal limits" ($T < 55$) elevations including, "mild," ($T = 55\text{-}59$), "moderate," ($T = 60\text{-}69$) and, "severe," ($T \geq 70$) pain interference were computed. The PROMIS-PI has been validated in healthy people (Revicki et al., 2009) as well as people in ambulatory cancer care (Wagner et al., 2015). In the current sample, Cronbach's α was .97 in patients and .95 in caregivers.

Analytic plan

Descriptive statistics were computed for all continuous and categorical predictors and outcomes for both patients and caregivers. Pearson's correlations assessed the relationships between predictors and outcomes to characterize zero-order relationships within patients and caregivers. Dyads that were "complete" (i.e., both patient and caregiver participated in the study) were utilized in analyses. Use of coping strategies, depressive symptoms, anxiety, and life disruption from pain were compared as a function of patient-caregiver role using paired samples *t*-tests (continuous) or McNemar's chi-square tests (categorical). Comparisons by gender were made using independent *t*-tests and chi-square test due to heterogeneity of gender in dyads. Differences in predictors and outcomes by caregiver role (i.e., spouse vs. non-spouse vs. caregiver did not participate vs. no caregiver) were analyzed with one-way ANOVAs. Post-hoc tests for a significant omnibus test were conducted with a familywise error rate of .05 specified to account for the inflated error rate resulting from multiple testing. Statistical significance was determined based on a two-sided alpha of .05. As is standard for preliminary studies, effect sizes were analyzed regardless of *p* value (Schäfer & Schwarz, 2019). Missing data were listwise deleted for all analyses.

Actor-Partner Interdependence Model

Actor-partner interdependence modeling (APIM) was carried out using *APIM_SEM* (Stas, Kenny, Mayer, & Loeys, 2018) a freely available, online application written in shiny (Chang et al., 2017), a web application framework for R, that utilizes structural equation modeling with maximum likelihood estimation using Lavaan (Rosseel, 2012). APIMs tested the relationships between patient and caregiver coping processes and depressive symptoms, anxiety, and pain interference. APIMs were conducted on complete dyads (i.e., both members of the dyad participated). For the purposes of analysis, dyad members were considered distinguishable given their unique roles in this setting (e.g., patient as care recipient and caregiver as care provider). Therefore, APIM results were interpreted under the assumption of distinguishability and preliminary tests of distinguishability were not conducted. The analyses and corresponding parameters are depicted in Figure 1. The "actor effect" is the relation of participant coping with their own outcomes (Figure elements a_1 and a_2). The “partner effect” is the relation of participant coping with their partner’s outcome (Figure elements p_{12} and p_{21}). APIM allows for the estimation of the unique contribution of the patient’s own coping to their caregiver’s distress (partner effects) over and above the effect of the caregiver’s own coping on their own distress (actor effects). Interdependence is accounted for by allowing correlations between the patients’ and caregivers’ predictor variables (Figure element c_{x1z1} through c_{x2z2}) and between the outcome error terms (Figure element c_{y12}). Dyadic interdependence is indicated by statistically significant partner effects (i.e., an effect from one dyad member to the other). Gender was also included as a covariate based on existing literature demonstrating the importance of gender in studies of cancer patients and caregivers (Hagedoorn et al., 2008). Gender was entered as a within-dyad effect (i.e., different scores for the two members of the dyad), thus only “actor effects” of gender are reported (figure element g_1 and g_2).

Figure 1. Actor-Partner Interdependence Model

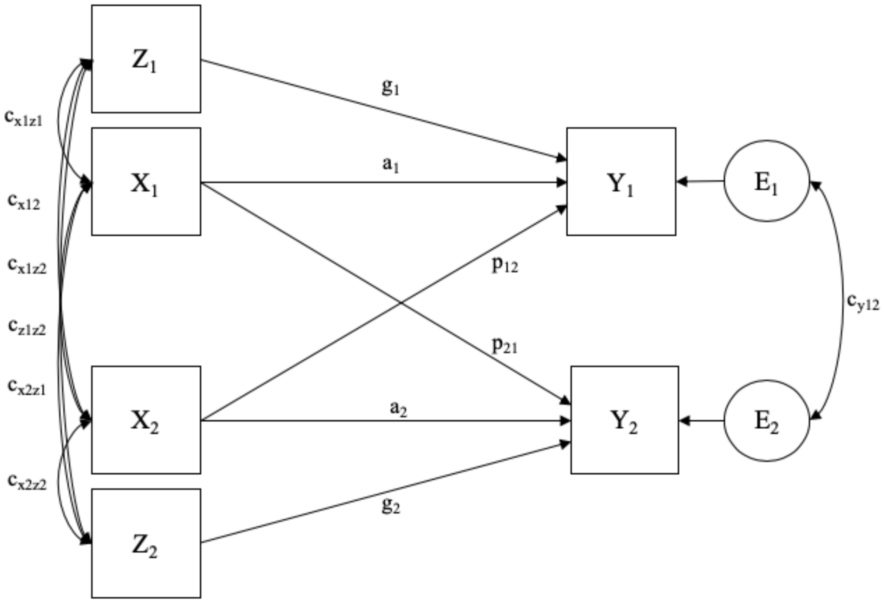

Figure note. X_1 and X_2 represent predictor variables (i.e., coping processes). Y_1 and Y_2 represent outcome variables (i.e., depressive symptoms, anxiety, pain interference). Lines a_1 and a_2 represent actor effects of predictor variables on outcomes. Lines p_{12} and p_{21} represent partner effects of predictor variables on partner outcomes. Elements E_1 and E_2 represent the patient and caregiver outcome error variance and c_2 the correlation between E_1 and E_2. Line c_1 represents the correlation in errors between patient and caregiver predictors. Elements Z_1 and Z_2 represent patient and caregiver gender, respectively.

Results

Patient and Caregiver Characteristics

Participants were patients diagnosed with pancreatic cancer (n = 36, 40.9%) or lung cancer (n = 52, 59.1%) and patient-elected primary informal caregivers (pancreatic n = 28, 58.3%; lung n = 20, 41.7%). There was no significant difference in proportion of patients by cancer type (Z = 1.71, p = .088) or of caregivers by cancer type (Z = -1.16, p = .258). A substantial minority of patients reported that they did not have a primary caregiver (n = 24, 27.3%) or participated in the study without their identified primary caregiver (n = 20, 22.7%). Reasons for patients' non-participation were related to feeling too physically unwell to be a part of the study. Reasons for caregivers' non-participation varied but were mostly related to lack of availability or lack of interest in participation.

Table 1 displays descriptive statistics on demographic and cancer-related variables. On average, patients were older than caregivers by approximately 4 years (M_{diff} = -4.53, SE = 1.96, $t(131)$ = -2.31, p = .023, 95% CI [-8.42, -0.65]). Both patients and caregivers were predominantly white, non-Hispanic, and well-educated. Patients were more likely to be female (n = 30, 62.5%), though this difference in proportion of patients and caregivers by gender was not statistically significant ($\chi 2(1) = .80$, $p = .370$). The majority of caregivers were married to the patient ($n = 37$, 77.1%). In the full patient sample (i.e., inclusive of patients that participated without caregivers) the average time since initial diagnosis was 34.4 months (*SD* = 32.64, range = 1 – 196). For caregivers, the average time since diagnosis was 32.98 (SD = 35.45, range = 2 – 196). The difference was not statistically significant ($t(128) = -.23$, $p = .821$).

Table 1. Patient and caregiver characteristics

Characteristic	Patients (*n* = 88)		Caregivers (*n* = 48)	
	n or mean	% or *SD*	*n* or mean	% or *SD*
Age, years, mean (*SD*)	66.74	10.33	62.21	1.71
Cancer Type, *n* (%)				
Pancreatic	36	40.9	28	58.3
Lung	52	59.1	20	41.7
Gender, *n* (%)				
Male	40	45.5	18	37.5
Female	48	54.5	30	62.5
Race/ethnicity, *n* (%)				
Black	4	4.5	2	4.2
AAPI	12	13.6	4	8.3
Non-Hispanic white	65	73.9	35	72.9
Hispanic	5	5.7	4	8.3
Other	2	2.3	3	6.3
Education *n* (%)				
High school or less	10	11.4	6	12.5
Some college	16	18.2	5	10.4
College or more	56	63.6	33	68.8
Missing	6	6.8	4	8.3
Employment status, *n* (%)				
Full-time	19	21.6	19	39.6
Part-time	2	2.3	7	14.6
Retired/not employed	42	47.7	21	43.8
Disability/Medical leave	18	20.5	0	0.0
Missing	7	8.0	1	2.1
HH Income, *n* (%)				
< \$25,000	7	8.0	0	0.0
\$25,000 - \$49,999	11	12.5	6	12.5
\$50,000 – \$74,999	8	9.1	3	6.3
\$75,000 – 99,999	16	18.2	9	18.8
≥ \$100,000	44	50.0	30	62.5

Missing	2	2.3	0	0.0
Relationship Status, *n* (%)				
Married	62	70.5	43	89.6
Single	4	4.5	2	4.2
Divorced	13	14.8	1	2.1
Widowed	9	10.2	2	4.2
Children, *n* (%)				
Yes	73	83	40	83.3
No	15	17	7	14.6
Caregiver relationship, *n* (%)[a]				
Spouse	37	42	40	83.3
Child	3	3.4	4	8.3
Friend	3	3.4	3	6.3
Other relative	1	1.1	1	2.1
No caregiver elected	24	27.3	n/a	n/a
Caregiver did not participate	20	22.7	n/a	n/a

Table note. AAPI = Asian and Pacific Islander. HH income = household income.

a. 4 caregivers participated as part of dyads with patient data completely missing. These dyads were excluded from APIMs.

Aim 1. Depressive Symptoms, Anxiety, Pain Interference and Coping Processes

Descriptive statistics on the major independent variables and outcomes were conducted, as were comparisons between patients and caregivers and between men and women. Descriptive statistics and significance levels for tests of difference between patients and caregivers are presented in Table 2 and by gender in Table 3.

Differences on Major Variables as a Function of Participant Role and Gender

Differences on depressive symptoms, anxiety, and pain interference were examined by gender and by patient/caregiver role using t tests in the overall sample. Caregivers reported significantly more anxiety than did patients, with a moderate effect size (M_{diff} = -1.02, SE = 0.35; t (40) = -2.94, p = .005, 95% CI [-1.73, -0.32], Cohen's d = -.46). Mean and clinically elevated depressive symptoms and pain interference did not differ significantly by participant role (ps >

.05). There were no statistically significant differences by gender on depressive symptoms, anxiety, or pain interference (*p*s > .05).

Caregivers reported greater use of active coping (M_{diff} = -.33, *SE* = 0.15, *t* (35) = -2.17, *p* = .037, 95% CI [-0.65, -0.02], Cohen's *d* = -.36). There were no other significant differences in coping variables based on role (*p*s > .05). Women and men differed significantly in emotional expression coping (M_{diff} = -0.70, *SE* = 0.18, *t*(79) = -3.83, *p* < .001, 95% CI [-1.06, -0.34], Cohen's *d* = -.86) and emotional processing coping (M_{diff} = -0.41, *SE* = 0.17, *t*(79) = -2.46, *p* = .016, 95% CI [-0.74, -0.08], Cohen's *d* = -.55). Women reported higher levels of both variables, with medium effect sizes. The difference between men and women on reappraisal coping was not statistically significant, but there was a moderate effect size, in the direction of women reporting greater positive reappraisal coping (M_{diff} = -0.33, SE = .22, *t*(51) = -1.52, *p* = .135, 95% CI [-0.77, 0.11], Cohen's *d* = -0.42). Active coping, acceptance coping, and avoidance coping did not differ significantly as a function of participant gender.

Table 2. Coping Processes and Outcome Variables by Patient-Caregiver Role

Variable	Patients		Caregivers			
	N or mean	% or *SD*	*N* or mean	% or *SD*	*t*	*df*
Coping Processes, mean (*SD*)						
Emotional Expression	2.72	0..90	2.58	0.80	.77	38
Emotional Processing	2.66	0.77	2.80	0.75	-.88	38
Active	2.79	0.77	3.13	0.61	-2.17*	35
Acceptance	3.39	0.59	3.40	0.48	-.15	38
Positive Reappraisal^a	3.02	0.85	2.99	0.77	.13	25
Behavioral Disengagement	1.26	0.30	1.28	0.48	-.14	37
Mental Disengagement	2.05	0.65	2.20	0.61	-1.25	38
Denial	1.22	0.39	1.28	0.58	-.58	39
Avoidance Composite	1.51	0.32	1.56	0.37	-.66	36

CES-D Depression[b], mean (*SD*)	10.12	9.23	12.48	11.63	-.79	24
PHQ-2-Depression[c], mean (*SD*)	0.87	1.25	1.0	1.36	-.41	14
Depression composite, mean (*SD*)	1.55	1.91	2.10	2.15	-1.31	39
PHQ-4 Anxiety, mean (*SD*)	0.83	1.14	1.85	1.96	-2.94**	40
Pain Interference T-score, mean (*SD*)	51.78	10.68	49.65	9.62	1.04	40
					χ^2	*df*
Clinically elevated CES-D, *N* (%)					.33	1
<16	19	76	15	60		
≥16	6	24	10	40		
Clinically elevated PHQ-2-depression, *N* (%)					6.96**[d]	1
<3	14	93.3	13	100		
≥3	1	6.7	0	0		
Clinically elevated depressive symptoms, *N* (%)					2.98	1
Yes	33	82.5	28	70		
No	7	17.5	12	30		
Clinically elevated anxiety (PHQ-4), *N* (%)					.039	1
<3	37	90.2	29	70.7		
≥3	4	9.8	12	29.3		
Pain Interference cutoffs, N, (%)					1.81	3
Within normal limits	28	68.3	29	70.7		
Mild	2	4.9	4	9.8		
Moderate/severe	11	26.8	8	19.5		

Table note. a. *N* varies by analysis due to missing data. Total dyad *N* = 43 b. CES-D administered in pancreatic sample only c. PHQ-2 Depression administered to lung sample only. d. Expected cell size < 5, thus chi-square test uninterpretable *n* = 5 patients missing clinical anxiety, *n* = 1 caregiver missing clinical anxiety; *n* = 6 patients missing clinical depression, *n* = 1 caregiver missing clinical depression; *n* = 5 patients missing pain interference, *n* = 1 caregiver missing pain interference. *p < .05. **p < .01. ***p < .001.

Table 3. Coping Processes and Outcome Variables by Gender

Variable	Men (*n* = 38)		Women (*n* = 48)			
	N or mean	% or *SD*	*N* or mean	% or *SD*	*t*	*df*
Coping Processes, mean (*SD*)						
Emotional Expression	2.29	0.83	2.98	0.80	-3.83***	79
Emotional Processing	2.52	0.67	2.93	0.78	-2.46*	79
Active	2.87	0.78	2.97	0.72	-.57	78
Acceptance	3.48	0.49	3.35	0.56	1.10	79
Positive Reappraisal	2.83	0.77	3.16	0.79	-1.52	51
Behavioral Disengagement	1.26	0.30	1.28	0.46	-.21	78
Mental Disengagement	2.06	0.71	2.19	0.60	-.83	79
Denial	1.29	0.56	1.21	0.43	.67	80
Avoidance Composite	1.49	0.33	1.56	0.35	-.85	77
CES-D Depression^{b}, mean (*SD*)	11.24	9.74	11.7	11.11	-.15	49
PHQ-2-Depression^{c}, mean (*SD*)	0.86	1.46	1.06	1.14	-.43	29
Depression composite	1.80	2.11	1.95	2.04	-.34	80
PHQ-4 Anxiety, mean (*SD*)	1.08	1.65	1.62	1.74	-1.42	81
Pain Interference T-score, mean (*SD*)	48.95	8.93	52.18	10.81	-1.45	81
					χ^2	*df*
Clinically elevated CES-D, N (%)					.36	1
<16	15	71.4	19	63.3		
≥16	6	28.6	11	36.7		
Clinically elevated PHQ-2-depression, n (%)					.62	1
<3	12	85.7	16	94.1		
≥3	2	14.3	1	5.9		

Clinically elevated depressive symptoms, *N* (%)					.08	1
Yes	8	22.9	12	25.5		
No	27	77.1	35	74.5		
Clinically elevated anxiety (PHQ-4), *N* (%)					.57	1
<3	30	83.3	36	76.6		
≥3	6	16.7	11	23.4		
Pain Interference cutoffs, N, (%)					1.45	2
Within normal limits	27	75	30	63.8		
Mild	3	8.3	4	8.5		
Moderate/severe	6	16.7	13	27.7		

Table note. a. n varies based on missing data. b. for positive reappraisal coping, patient $n = 48$, caregiver $n = 29$ because not administered to majority of lung cancer sample. $n = 5$ men missing clinical anxiety, $n = 2$ women missing clinical anxiety; $n = 4$ men missing clinical depression, $n = 2$ women missing clinical depression; $n = 4$ men missing pain interference, $n = 2$ women missing pain interference. *$p < .05$. **$p < .01$. ***$p < .001$.

Exploratory Aim: Differences in Patients' Major Variables by Caregiver Status

Differences in patients' depressive symptoms, anxiety, pain interference, and coping strategies by caregiver status were examined using one-way ANOVA. Table 4 shows means, standard deviations, and results for ANOVAs (i.e., *F* statistics, *df*, and *p*-values). Analyses examined differences between patients with spouse caregivers ($n = 37$, 42%), non-spouse caregivers ($n = 7$, 8%), identified caregivers who did not participate ($n = 20$, 22.7%), and no caregiver ($n = 24$, 27.3%). Omnibus tests of significance for patients' depressive symptoms, anxiety, and pain interference by caregiver group revealed no significant differences (*p*s > .05).

Regarding approach-oriented coping processes, a significant overall effect of caregiver status on active coping ($F(3, 77) = 2.78$, $p = .047$) and accompanying post-hoc tests (Tukey's LSD) revealed that patients with spouse caregivers reported significantly less active coping than patients without a caregiver (M_{diff} = -0.52, *SE* = 0.21, *p* = .013, 95% CI [-0.93, -0.11]). Overall tests of significance for emotional expression, emotional processing, acceptance, and positive reappraisal were not significant (*p*s > .05).

There was also a significant overall effect of caregiver status on avoidance coping (*F*(3, 76) = 3.67, *p* = .016). Post-hoc tests revealed that patients with spouse caregivers engaged in less avoidance coping than patients without a caregiver (M_{diff} = -0.33, *SE* = 0.11, *p* = .003, 95% CI [-0.54, -0.12]) and patients whose caregiver did not participate (M_{diff} = -0.24, *SE* =0.11, *p* = .039, 95% CI [-0.47, -0.01]).

Table 4. Patient Coping Processes and Outcome Variables by Caregiver Status

Variable	Spouse *n* = 37		Non-spouse *n* = 7		Caregiver did not participate, *n* = 20		No caregiver, *n* = 24				
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F*	*df*	*p*
Depression	1.71	2.03	1.30	1.86	1.84	2.19	1.30	1.99	0.32	3, 78	.809
Anxiety	1.0	1.41	0.67	1.21	1.06	1.16	0.78	1.41	0.25	3, 79	.860
Pain Interference	51.51	11.24	57.5	10.45	52.81	9.79	50.24	9.75	0.83	3, 79	.484
Expression	2.64	0.89	3.20	0.80	3.04	0.69	2.83	0.90	1.35	3, 77	.266
Processing	2.58	0.76	3.21	0.58	3.02	0.77	2.85	0.91	1.82	3, 75	.150
Acceptance	3.37	0.59	3.42	0.61	3.38	0.42	3.33	0.86	0.04	3, 77	.989
Active	**2.68**	**0.76**	**3.45**	**0.87**	**2.97**	**0.79**	**3.21**	**0.78**	**2.78**	**3, 77**	**.047**
Positive Reappraisal^a	2.92	0.84	3.45	0.87	2.82	0.84	2.84	0.90	0.72	3, 44	.543
Avoidance	**1.47**	**0.28**	**1.71**	**0.42**	**1.70**	**0.38**	**1.79**	**0.51**	**3.67**	**3, 76**	**.016**

Table note. a. *n* = 47 because the scale was not administered to most of the lung cancer sample.

Bivariate Correlations

As displayed in Table 5, bivariate correlations between patients' and caregivers' independent variables and outcomes were examined in dyads that were included in the APIM (*n* = 43 dyads) to examine patterns of association. Patients' depressive symptoms were correlated significantly and positively with their own anxiety symptoms and avoidance coping, and negatively with their own active and acceptance coping. Patients' anxiety was significantly and negatively correlated with their own acceptance coping. Patients' pain interference was correlated significantly and negatively with their own acceptance coping and significantly and positively with their own avoidance coping. There were no significant correlations between patients' outcomes and caregivers' outcomes or coping variables.

Caregivers' depressive symptoms were correlated significantly and positively with their own anxiety, pain interference, and avoidance-oriented coping and negatively with their own emotional expression coping. Caregivers' depressive symptoms were also correlated significantly and positively with patients' avoidance coping. Caregivers' anxiety was correlated positively with their own pain interference and avoidance coping. Caregivers' pain interference was also associated negatively with their own emotional expression coping and positively with their own avoidance coping.

With regard to interrelationships among coping variables, expected patterns of positive correlation emerged between patients' own approach-oriented coping processes (i.e., emotional processing, emotional expression, active, acceptance, positive reappraisal). The associations between patients' own approach-oriented coping processes and avoidance coping were not significant. Patients' own approach-oriented coping processes and partners' approach-oriented coping processes were not correlated significantly. There was an inverse correlation between patients' positive reappraisal coping and caregivers' avoidance coping, which was the only significant cross-partner correlation observed within coping processes or within outcomes.

Table 5. Outcomes and coping variables bivariate correlations

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1 P depression	1.00																	
2 C depression	.15	1.00																
3 P anxiety	.55***	-.05	1.00															
4 C anxiety	.24	.72***	.033	1.00														
5 P pain	.26	.23	.20	.13	1.00													
6 C pain	-.23	.55***	-.18	.45**	.16	1.00												
7 P processing	-.18	.04	-.30	-.17	-.03	-.02	1.00											
8 C processing	.03	-.19	-.09	-.10	-.08	-.24	.12	1.00										
9 P expression	.10	.11	.10	-.11	-.02	-.21	.61***	.18	1.00									
10 C expression	.07	-.48**	-.12	-.21	-.08	-.36*	-.05	.58***	.01	1.00								
11 P active	-.35*	-.08	-.15	-.23	-.11	-.04	.65***	.33	.33*	.01	1.00							
12 C active	-.12	-.14	.20	-.16	-.07	-.18	-.14	.48**	-.12	.13	.12	1.00						
13 P acceptance	-.34*	-.11	-.32*	-.04	-.58***	.01	.22	.14	.19	.23	.07	-.02	1.00					
14 C acceptance	.01	-.07	-.01	-.07	.01	-.13	-.15	.40**	.01	.47**	-.10	.26	-.17	1.00				
15 P reappraisal	-.29	.07	-.13	.10	-.09	.14	.63***	.13	.33	.06	.67***	-.15	.18	-.07	1.00			
16 C reappraisal	.22	-.28	.26	-.11	.20	-.10	-.16	.38	-.29	.58	.18	.46*	-.36	.37	.07	1.00		
17 P avoidance	.50**	.40*	.18	.24	.43**	.20	.01	-.18	-.03	-.02	-.19	-.29	-.26	.06	.03	.05	1.00	
18 C avoidance	.05	.52***	.25	.59***	.11	.53***	.099	-.06	.09	-.10	.22	-.07	-.03	-.03	.43*	.33	.27	1.00

Table note. P = Patient, C = Caregiver. Column numbers denote variable from corresponding row. *$p <$ .05. **$p < .01$. ***$p < .001$.

Actor-Partner Interdependence Modeling

Dyadic interdependence between patients' and caregivers' coping processes and depressive symptoms, anxiety, and pain interference was tested, adjusting for patient and caregiver gender (i.e., within-dyad effects). For each outcome, coping processes (i.e., emotional processing, emotional expression, active, acceptance, positive reappraisal, avoidance coping) were tested separately in 6 APIMs. Results from each model are reported below and statistics from APIMs, including unstandardized and standardized beta coefficients, partial correlation coefficients, *p* values, 95% CIs, and model R^2 for patients and caregivers are available in Tables 6-8. For actor or partner effects that were statistically significant and > |.1|, the *k*-ratio of dyadic patterns is also reported. Interpretation of *k*-ratios was in line with Lederman and Kenny (2010), as well as Fitzpatrick, Gareau, Lafontaine, and Gaudreau (2016). APIM models with statistically significant actor or partner effects are depicted in Figures 2-4. Covariance matrices for each model are available in Appendix 2.

Depressive Symptoms

Statistics from APIMs testing coping on depressive symptoms are presented in Table 6. APIM path diagrams of models with statistically significant paths are presented in Figure 2.

Emotional Processing Coping. The model accounted for 8.4% and 4.2% of the variance in patients' and caregivers' depressive symptoms, respectively. The difference in intercepts was not statistically significant, indicating no main effect of role (Patient $\hat{y}$ = 1.05, Caregiver $\hat{y}$ = 2.20, $\hat{y}_{\text{diff}}$ = -1.15, p = .091, 95% CI [-2.47, 0.18]). As shown in Table 6, the actor effects for both patients (b = -0.65, p = .108) and caregivers (b = -0.55, p = .221) were not statistically significantly different from zero, controlling for own gender and partner effect. Neither partner effect (i.e., caregivers' coping on patients' depressive symptoms and patients' coping on caregivers' symptoms) was statistically significantly different from zero, controlling for partner gender and actor effect. Given that none of the actor and partner effects were statistically significant, patients' and caregivers' *k*-ratios were not interpreted, and no dyadic pattern was identifiable.

Emotional Expression Coping. The model accounted for 3.5% and 30.7% of the variance in patients' and caregivers' depressive symptoms, respectively. The difference in intercepts was not statistically significant, indicating no main effect of role, over and above the effect of gender and emotional expression (Patient $\hat{y} = 1.22$, Caregiver $\hat{y} = 1.27$, $\hat{y}_{\text{diff}} = -0.05$, $p = .943$, 95% CI [-1.35, 1.26]). The actor effect for patients was not statistically significantly different from zero ($b = 0.01$, $p = .982$), controlling for own gender and partner effect. The actor effect for caregivers was statistically significant ($b = -1.61$, $p < .001$), controlling for own gender and partner effect, such that greater emotional expression was associated with lower depressive symptoms. Neither partner effect was statistically significantly different from zero, controlling for partner gender and actor effects.

The absolute value of the standardized actor effects for caregivers, but not patients, was > 0.1 and statistically significant. Therefore, the ratio of the partner-to-actor effects (i.e., *k*) can be interpreted for caregivers. The caregiver *k*-ratio was -0.23 and Monte Carlo simulation produced a 95% CI from -0.64 to 0.18, thus the actor-only model ($k = 0$) is plausible, meaning that caregivers' depressive symptoms were influenced to a greater degree by their own emotional expression coping than by patients' emotional expression coping.

Acceptance Coping. The model accounted for 12.2% and 1.7% of the variance in patients' and caregivers' depressive symptoms, respectively. The difference in intercepts was not statistically significant, indicating no main effect of role, controlling for effects of acceptance coping and own gender (Patient $\hat{y}$ = 1.49, Caregiver $\hat{y}$ = 2.11, $\hat{y}_{\text{diff}}$ = -0.62, p = .381, 95% [-2.02, 0.77]). The actor effect of acceptance coping for patients was statistically significant, controlling for gender and partner effect (b = -1.13, p = .034), with greater acceptance associated with lower depressive symptoms. The actor effect for caregivers was not statistically significantly different from zero (b = -0.40, p = .582). Neither partner effect was statistically significantly different from zero.

The absolute value of the standardized actor effects for patients, but not caregivers, was > .1 and statistically significant. Therefore, the ratio of partner to actor effect (i.e., k) is interpretable for patients. Patients' k-ratio was 0.16 and a Monte Carlo simulation produced a 95% CI from -0.87 to 1.19. Therefore, the couple (k = 1) and the actor-only (k = 0) models are plausible. Partners' effect on patients' depressive symptoms was not statistically significant, however. Therefore, we adopt the actor-only model, meaning that patients' acceptance coping influenced their own depressive symptoms to a greater degree than caregivers' acceptance coping influenced patients' depressive symptoms.

Active coping. The model accounted for 18.1% and 1.9% of the variance in patients' and caregivers' depressive symptoms, respectively. The difference in intercepts was not statistically significant, indicating no main effect of role (Patient $\hat{y}$ = 1.13, Caregiver $\hat{y}$ = 2.32, $\hat{y}_{\text{diff}}$ = -1.19, p = .086, 95% CI [-2.54, 0.17]). The actor effect for patients was statistically significant, controlling for gender (b = -0.98, p = .008), with greater active coping associated with lower depressive symptoms. The actor effect for caregivers was not statistically significantly different from zero (b = -0.39, p = .455). Neither partner effect was statistically significantly different from zero (ps > .05).

The absolute value of the standardized actor effects for patients, but not caregivers was > .1 and statistically significant. Therefore, the ratio of partner-to-actor effects (i.e., k) can be interpreted for patients. Patient k-ratio was 0.12 and a Monte Carlo simulation produced a 95% CI from -0.8 to 1.03. Therefore, the couple (k = 1) and the actor-only (k = 0) models are plausible. Given that the partner effect from caregiver to patient was not statistically significant, we adopt the actor-only model, meaning that patients' active coping was associated with their own depressive symptoms to a greater degree than caregivers' active coping was related to patients' depressive symptoms.

Positive Reappraisal Coping. The model accounted for 16.6% and 12.4% of the variance in patients' and caregivers' depressive symptoms, respectively. The difference in intercepts was not statistically significant, indicating no main effect of role, controlling for positive reappraisal coping and gender (Patient $\hat{y}$ = 1.07, Caregiver $\hat{y}$ = 2.01, $\hat{y}_{\text{diff}}$ = -0.94, p = .209, 95% *CI* [-2.41, 0.53]). The actor and partner effects for patients and caregivers were not statistically significantly different from zero in the model (ps > .05). Thus, no dyadic pattern was identifiable.

Avoidance-oriented Coping. The model accounted for 23% and 36.2% of the variance in patients' and caregivers' depressive symptoms, respectively. The difference in intercepts was not statistically significant, indicating no main effect of role (Patient $\hat{y}$ = 1.57, Caregiver $\hat{y}$ = 2.18, $\hat{y}_{\text{diff}}$ = -0.61, p = .293, 95% CI [-1.74, 0.53]). The actor effects for patients (b = 2.94, p = .001) and caregivers (b = 2.78, p < .001) were statistically significantly different from zero, controlling for gender and partner effect. Greater avoidance coping was associated with greater depressive symptoms. The partner effect from caregivers to patients was not statistically significantly different from zero (*b* = -0.15, *p* = .841). The partner effect from patients to caregivers (i.e., patient coping on caregiver depressive symptoms) was statistically significant, controlling for gender (*b* = 1.88, *p* = .038). Greater patient avoidance coping associated with greater caregiver depressive symptoms.

The absolute value of the standardized actor effects for both patients and caregivers was > .1 and statistically significant. Thus, the ratio of partner-to-actor effects (i.e., k) can be interpreted. Patients' k-ratio was -0.05 and a Monte Carlo simulation produced a 95% CI from -0.56 to 0.46, thus the actor-only (k = 0) model is plausible, meaning that patients' depressive symptoms are influenced by their own avoidance coping more than by caregivers' avoidance coping. For caregivers, the k-ratio was 0.68 and a Monte Carlo simulation produced a 95% CI from -0.13 to 1.49, thus the couple (k = 1) and actor-only (*k* = 0) models are plausible. Given that both the actor and partner effects on caregivers' depressive symptoms were statistically significant and positive, the couple model was adopted, indicating that caregivers' depressive symptoms are equally influenced by their own avoidance coping and patients' avoidance coping.

Gender Effects. The effect of gender was not statistically significant in any of the models predicting depressive symptoms, controlling for coping (*p*s > .05).

Anxiety

Statistics from APIMs testing coping on anxiety are presented in Table 7. APIM path diagrams of models with statistically significant paths are presented in Figure 3.

Emotional Expression Coping. The model accounted for 11% and 6.2% of the variance in patients' and caregivers' anxiety, respectively. The difference in intercepts was not statistically significant, indicating was no main effect of role (Patient $\hat{y}$ = 0.47, Caregiver $\hat{y}$ =

1.58, $\hat{y}_{\text{diff}} = -1.11$, $p = .054$, 95% *CI* [-2.24, 0.02]). As shown in Table 7, neither actor effect was statistically significantly different from zero, controlling for own gender and partner effect (ps < .05). Neither partner effect (i.e., caregivers' coping on patients' depressive symptoms and patients' coping on caregivers' symptoms) was statistically significantly different from zero, controlling for partner gender and actor effect (ps > .05). Thus, no dyadic patterns were identifiable.

Emotional Processing Coping. The model accounted for 24.5% and 3.4% of the variance in patients' and caregivers' anxiety symptoms, respectively. The difference in intercepts was statistically significant, with caregivers reporting greater symptoms of anxiety, controlling for gender, at average levels of emotional processing coping (Patient $\hat{y} = 0.32$, Caregiver $\hat{y} = 1.86$, $\hat{y}_{\text{diff}} = -1.54$, $p = .004$, 95% CI [-2.58, -0.49]). The actor effect for patients was statistically significant ($b = -0.58$, $p = .007$), with higher levels of emotional processing coping associated with less anxiety. The actor effect for caregivers was not statistically significantly different from zero ($b = -0.22$, $p = .603$). Neither partner effect was statistically significantly different from zero (ps > .05).

The absolute value of the standardized actor effects for patients, but not caregivers, was > .1 and statistically significantly different from zero. Thus, the ratio of partner to actor effect (i.e., k) can be interpreted for patients. Patient k was -0.03 and a Monte Carlo simulation produced a 95% CI from -0.75 to 0.69, thus the actor-only ($k = 0$) model is plausible, meaning that patients' own emotional processing coping is associated with their anxiety more than is caregivers' emotional processing coping.

Acceptance Coping. The model accounted for 16.2% and 1.2% of the variance in patients' and caregivers' anxiety, respectively. The difference in intercepts was statistically significant, indicating a main effect of role (Patient $\hat{y}$ = 0.56, Caregiver $\hat{y}$ = 1.79, $\hat{y}_{\text{diff}}$ = -1.23, *p* = .037, 95% *CI* [-2.39, -0.08]), with caregivers reporting higher levels of anxiety at average levels of acceptance coping in the sample, controlling for gender. Neither actor effect was statistically significantly different from zero, controlling for own gender and partner effect (*p*s > .05). Neither partner effect was statistically significantly different from zero, controlling for partner gender and actor effects (*p*s > .05). Thus, no dyadic patterns were identifiable.

Active Coping. The model accounted for 20.2% and 6.0% of the variance in patients' and caregivers' anxiety, respectively. The difference in intercepts was not statistically significant, indicating no main effect of role (Patient $\hat{y}$ = 0.31, Caregiver $\hat{y}$ = 1.73; $\hat{y}_{\text{diff}}$ = -1.51, *p* = .619, 95% *CI* [-0.44, 0.74]). Neither actor effect was statistically significantly different from zero, controlling for own gender and partner effect (*p*s > .05). Neither partner effect was statistically significantly different from zero, controlling for partner gender and actor effect (*p*s > .05). Thus, no dyadic patterns were identifiable.

Positive Reappraisal Coping. The model accounted for 26.1% and 17% of the variance in patients' and caregivers' anxiety, respectively. The difference in intercepts was not statistically significant, indicating no main effect of role (Patient $\hat{y}$ = 1.55, Caregiver $\hat{y}$ = 1.06, $\hat{y}_{\text{diff}}$ = 0.48, *p* = .432, 95% *CI* [-0.72, 1.69]). Neither actor effect was statistically significantly different from zero, controlling for own gender and partner effect (*p*s > .05). Neither partner effect was statistically significantly different from zero, controlling for partner gender and actor effect (*p*s > .05). Thus, no dyadic patterns were identifiable.

Avoidance-oriented Coping. The model accounted for 16.9% and 36.4% of the variance in patients' and caregivers' anxiety, respectively. The difference in intercepts was statistically significant, indicating a main effect of role (Patient $\hat{y}$ = 0.48, Caregiver $\hat{y}$ = 1.86, $\hat{y}_{\text{diff}}$ = -1.38, *p*

= .003, 95% CI [-2.27, -.48]); caregivers reported greater anxiety than patients at average levels of avoidance coping, controlling for own gender. The actor effect for patients was not statistically significant, controlling for own gender and partner effect ($b = 0.14$, $p = .805$). The actor effect for caregivers was statistically significant ($b = 3.07$, $p < .001$), with greater avoidance coping associated with greater anxiety, controlling for own gender and partner effect. Neither partner effect was statistically significantly different from zero, controlling for own gender and actor effect (*p*s > .05).

The absolute value of the standardized actor effects for caregivers, but not patients, was > .1 and statistically significantly different from zero, thus the ratio of partner to actor effect (i.e., *k*) can be interpreted for caregivers. Caregiver *k* was 0.19 and a Monte Carlo simulation produced a 95% CI from -0.38 to 0.75. Thus, the actor-only model ($k = 0$) is plausible, meaning caregivers' own avoidance coping is associated with their own anxiety more than is patients' avoidance coping with caregivers' anxiety.

Gender effects. The effect of patient gender on own anxiety was statistically significant in models including emotional expression, emotional processing, active, and positive reappraisal coping (*b*s = 0.73-1.14, *p*s < .05). In patients, female gender was associated with greater anxiety on models controlling for emotional expression, emotional processing and active coping. In the model with positive reappraisal coping, male gender was associated with greater anxiety. The effect of caregiver gender on own anxiety was statistically significant in the model with reappraisal coping ($b = 0.49$, $p = .030$). In caregivers, female gender was associated with greater anxiety, controlling for positive reappraisal coping.

Pain Interference

Statistics from APIMs testing coping on depressive symptoms are presented in Table 8. APIM path diagrams of models with statistically significant paths are presented in Figure 4.

Emotional Expression Coping. The model accounted for 11.2% and 22.3% of the variance in patient and caregiver pain interference, respectively. The difference in intercepts was not statistically significant, indicating no main effect of role (Patient $\hat{y}$ = 48.16, Caregiver $\hat{y}$ = 46.20, $\hat{y}_{\text{diff}}$ = 1.96, p = .540, 95% CI [-4.29, 8.2]), controlling for gender and emotional expression coping. As shown in Table 8, the actor effect for patients was not statistically significantly different from zero (b = -1.40, p = .451). The actor effect for caregivers was statistically significantly different from zero (b = -5.64, p = .002), with greater emotional expression coping associated with less pain interference. Neither partner effect was statistically significant different from zero, controlling for partner gender and actor effect (ps > .05).

The absolute value of the standardized actor effects for caregivers, but not patients, was > .1 and statistically significant. Thus, the ratio of partner to actor effect (i.e., k) can be interpreted for caregivers. Caregiver k was 0.33 and a Monte Carlo simulation produced a 95% CI from -.23 to 0.9. Thus, the actor-only (k = 0) model is plausible, meaning caregivers' own emotional processing coping is associated with their own pain interference more than is patients' emotional expression coping.

Emotional Processing Coping. The model accounted for 12% and 6.5% of the variance in patients' and caregivers' pain interference, respectively. The difference in intercepts was not statistically significant, indicating no main effect of role (Patient $\hat{y}$ = 48.02, Caregiver $\hat{y}$ = 48.70, $\hat{y}_{\text{diff}}$ = -0.68, p = .834, 95% CI [-7.02, 5.67]). Neither actor effect was statistically significantly different from zero, controlling for own gender and partner effect (ps > .05). Neither partner effect was statistically significantly different from zero, controlling for gender and actor effect. Thus, no dyadic patterns were identifiable.

Acceptance. The model accounted for 35% and 2% of the variance in patient and caregiver anxiety, respectively. The difference in intercepts was not statistically significant, indicating no main effect of role (Patient $\hat{y}$ = 50.20, Caregiver $\hat{y}$ = 48.88, $\hat{y}_{\text{diff}}$ = 1.32, p = .692, 95% CI [-5.18, 7.81]). The actor effect for patients was statistically significantly different from zero (b = -9.68, p < .001), controlling for own gender, with greater acceptance coping associated with less pain interference. The actor effect for caregivers was not statistically significantly different from zero, controlling for own gender (b = -2.83, p = .372). Neither partner effect was statistically significantly different from zero, controlling for own gender and actor effect (ps > .05). Thus, no dyadic patterns were identifiable.

Active Coping. The model accounted for 12.2% and 3% of the variance in patient and caregiver pain interference, respectively. The difference in intercepts was not statistically significant, indicating no main effect of role (Patient $\hat{y}$ = 48.08, Caregiver $\hat{y}$ = 49.36, $\hat{y}_{\text{diff}}$ = -1.28, p = .701, 95% CI [-7.84, 5.27]). Neither actor effect was statistically significantly different from zero, controlling for own gender and partner effect (ps > .05). Neither partner effect was statistically significantly different from zero, controlling for own gender and actor effect (ps > .05). Thus, no dyadic patterns were identifiable.

Positive Reappraisal Coping. The model accounted for 14.4% and 4.5% of the variance in patient and caregiver pain interference, respectively. The difference in intercepts was not statistically significant, indicating no main effect of role (Patient $\hat{y}$ = 47.98, Caregiver $\hat{y}$ =49.10 , $\hat{y}_{\text{diff}}$ = -1.12, p = .765 , 95% CI [-8.46, 6.22]). Neither actor effect was statistically significantly different from zero, controlling for own gender and partner effect (ps > .05). Neither partner effect was statistically significantly different from zero, controlling for own gender and actor effect (*p*s > .05). Thus, no dyadic patterns were identifiable.

Avoidance. The difference in intercepts was not statistically significant, indicating no main effect of role (Patient $\hat{y}$ = 49.84, Caregiver $\hat{y}$ = 48.73, $\hat{y}_{\text{diff}}$ = 1.11, p = .703, 95% CI [-4.61, 6.83]). The model accounted for 24% and 29.1% of the variance in patients' and caregivers' pain interference, respectively. The actor effect for patients (b = 12.86, p = .013) and caregivers (b = 13.34, p < .001) were statistically significantly different from zero, such that greater avoidance coping was associated with greater pain interference, controlling for own gender and partner effect. Neither partner effect was statistically significantly different from zero, controlling for own gender.

The absolute value of the standardized actor effects for both patients and caregivers was statistically significant and > .1. Thus, the ratio of partner to actor effect (i.e., k) can be interpreted. Patient k was 0.05 and a Monte Carlo simulation produced a 95% CI from -0.61 to 0.71. Thus, the actor-only model is plausible (k = 0). For caregivers, k was 0.21 and a Monte Carlo simulation produced a 95% CI from -0.47 to .9. Thus, the actor-only model is plausible. For both patients and caregivers, their own avoidance coping was associated with pain interference more than was their partners' avoidance coping.

Gender Effects. The effect of patient gender on own pain interference was statistically significant in patient models including emotional expression, emotional processing, and active coping (*b*s = 7.18 – 7.56, *p*s < .05). In patients, female gender was associated with significantly greater pain interference, controlling for coping. There were no significant effects of caregiver gender (*p*s > .05).

Figure 2. Depressive symptom APIMs

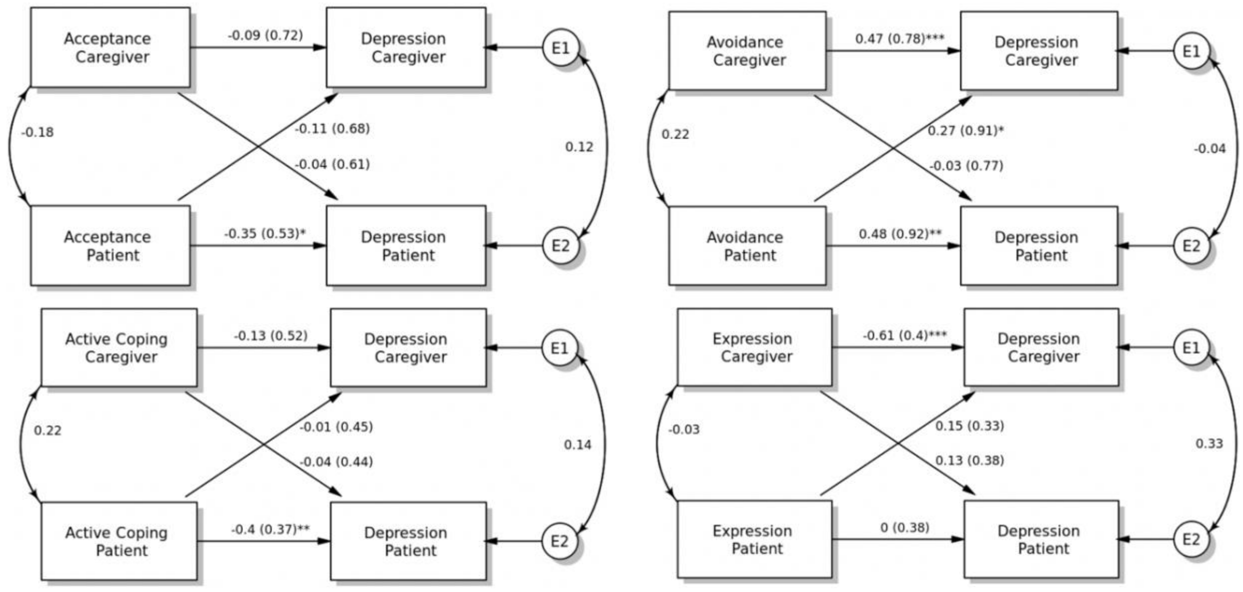

Figure note. **p* < .05. ***p* < .01. ****p* < .001. E_1 and E_2 patient and caregiver depressive symptom residuals. All paths are standardized. Actor effects of gender not displayed.

Figure 3. Anxiety APIMS

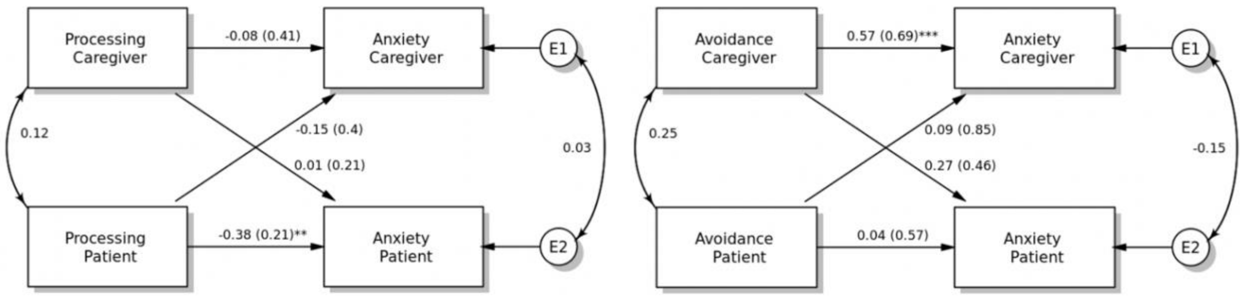

Figure note. **p* < .05. ***p* < .01. ****p* < .001. E_1 and E_2 patient and caregiver anxiety residuals. All paths are standardized. Actor effects of gender not displayed.

Figure 4. Pain interference APIMs

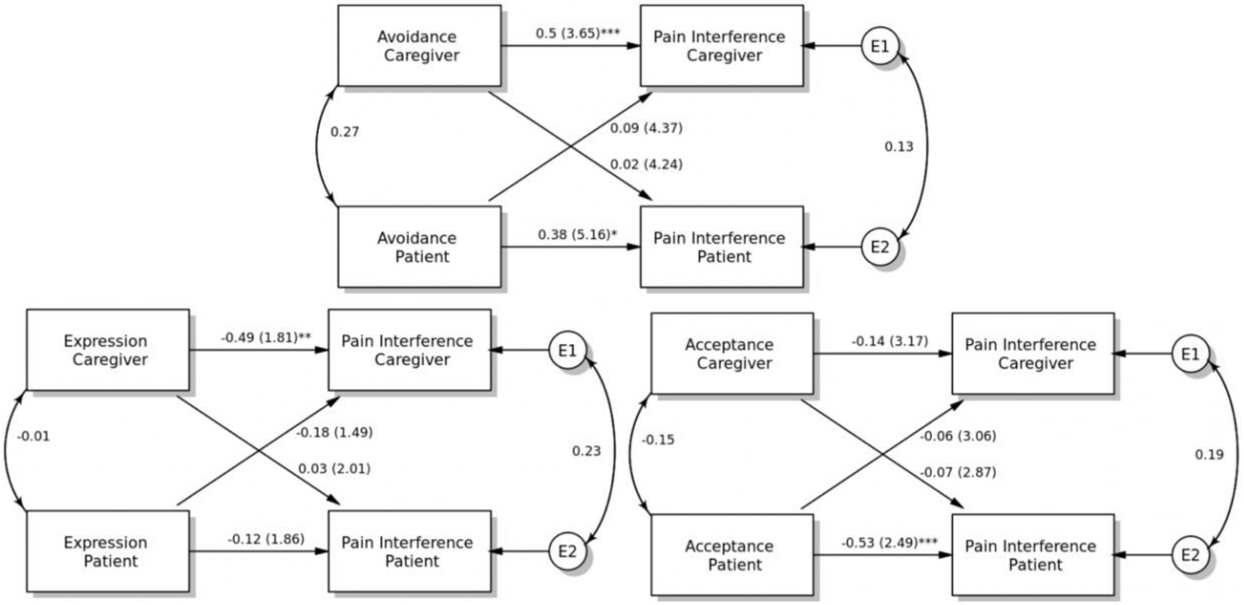

Figure note. **p* < .05. ***p* < .01. ****p* < .001. E_1 and E_2 patient and caregiver pain interference residuals. All paths are standardized. Actor effects of gender not displayed.

Table 6. Actor-Partner Interdependence Model Testing Effects of Own Coping Processes on Own and Partner Depressive Symptoms Adjusting for Gender

	Patient Depressive Symptoms					**Caregiver Depressive Symptoms**				
Emotional Processing	*B*	*95% CI*	*p*	*β*	*r*	*B*	*95% CI*	*p*	*β*	*r*
Intercept	**1.05**	**0.20, 1.90**	**.015**	-	-	**2.20**	**1.17, 3.22**	**< .001**	-	-
Actor	-0.65	-1.45, 0.14	.108	-0.25	-0.18	-0.55	-1.44, 0.33	.221	-0.21	-0.20
Partner	0.24	-0.53, 1.01	.543	0.09	0.05	0.23	-0.62, 1.08	.597	0.09	0.07

Gender (actor)	0.81	-0.37, 1.99	.176	0.22	-	-0.05	-1.39, 1.29	.941	-0.01	-
	k	*95% CI*				*k*	*95% CI*			
Dyadic pattern	-0.37	-1.56, 0.82	-	-	-	-0.41	-2.01, 1.19	-	-	-
	R^2					R^2				
Model	.084					.042				
Emotional Expression	*B*	*95% CI*	*P*	*β*	*r*	*B*	*95% CI*	*P*	*β*	*r*
Intercept	**1.22**	**0.36, 2.08**	**.005**	-	-	**1.27**	**0.29, 2.25**	**.011**	-	-
Actor	0.01	-0.74, 0.76	.982	0.004	0.09	**-1.61**	**-2.40, -.82**	**< .001**	**-0.68**	**-0.48**
Partner	0.30	-0.45, 1.05	.429	0.13	0.07	0.37	-0.28, 1.02	.262	0.16	0.13
Gender (actor)	0.69	-0.59, 1.97	.292	.18	-	1.28	-0.04, 2.59	.057	0.28	-
	k	*95% CI*				*k*	*95% CI*			
Dyadic pattern	35.7	-3133.83, 3205.23	-	-	-	-0.23	-0.64, 0.18	-	-	-
	R^2					R^2				
Model	.035					.307				
Acceptance	*B*	*95% CI*	*P*	*β*	*r*	*B*	*95% CI*	*P*	*β*	*r*
Intercept	**1.49**	**0.69, 2.28**	**< .001**	-	-	**2.11**	**.97, 3.26**	**< .001**	-	-
Actor	**-1.13**	**-2.17, -0.09**	**.034**	**-0.30**	**-0.34**	-0.40	-1.81, 1.02	.583	-0.11	-0.09

Partner	-0.18	-1.36, 1.01	.771	-0.05	-0.05	-0.40	-1.73, 0.93	.554	-0.11	-0.12
Gender (actor)	0.07	-1.08, 1.23	.901	0.02	-	-0.03	-1.58, 1.52	.969	-0.01	-
	k	*95% CI*				*k*	*95% CI*			
Dyadic Pattern	0.16	-0.87, 1.19	-	-	-	1.01	-3.30, 5.32	-	-	-
	R^2					R^2				
Model	.122					.017				
Active	*B*	*95% CI*	*P*	*β*	*r*	*B*	*95% CI*	*P*	*β*	*r*
Intercept	1.13	0.31, 1.95	.007	-	-	2.32	1.24, 3.4	< .001	-	-
Actor	**-0.98**	**-1.70, -0.26**	**.008**	**-0.32**	**-0.34**	-0.39	-1.42, 0.64	.455	-0.13	-0.13
Partner	-0.12	-0.98, 0.75	.796	-0.04	-0.09	-0.03	-0.92, 0.86	.949	-0.01	-0.07
Gender (actor)	0.60	-0.48, 1.68	.275	-0.16	-	-0.25	-1.60, 1.09	.713	-0.06	-
	k	*95% CI*				*k*	*95% CI*			
Dyadic Pattern	0.12	-0.80, 1.03	-	-	-	0.07	-2.24, 2.39	-	-	-
	R^2					R^2				
Model	.181					.019				
Positive Reappraisal	*B*	*95% CI*	*P*	*β*	*r*	*B*	*95% CI*	*P*	*β*	*r*
Intercept	**1.07**	**0.15, 1.99**	**.022**	-	-	**2.01**	**.86, 3.17**	**< .001**	-	-

Actor	-0.67	-1.44, 0.09	.084	-0.12	-0.28	-0.96	-2.05, .13	.084	-0.40	-0.25
Partner	0.69	-0.24, 1.62	.143	0.29	0.21	0.16	-0.72, 1.04	.720	0.07	0.08
Gender (actor)	0.66	-.64, 1.96	.320	0.19	-	0.76	-0.75, 2.27	.324	0.19	-
	k	*95% CI*				*k*	*95% CI*			-
Dyadic Pattern	-1.03	-2.80, 0.74	-	-	-	-0.17	-1.11, .77	-	-	-
	R^2					R^2				
Model	.166					.124				
Avoidance	*B*	*95% CI*	*P*	*β*	*r*	*B*	*95% CI*	*P*	*β*	*r*
Intercept	**1.57**	**.82, 2.33**	**< .001**	-	-	**2.18**	**1.32, 3.04**	**< .001**	-	-
Actor	**2.94**	**1.14, 4.73**	**.001**	**0.52**	**0.50**	**2.78**	**1.24, 4.13**	**< .001**	**0.49**	**0.44**
Partner	-0.15	-1.65, 1.35	.841	-0.03	-0.10	**1.88**	**0.1, 3.66**	**.038**	**0.33**	**0.33**
Gender (actor)	0.12	-0.94, 1.17	.830	0.03	-	-0.24	-1.36, 0.88	.678	-0.05	-
	k	*95% CI*				*k*	*95% CI*			
Dyadic Pattern	-.05	-.56, .45	-	-	-	.68	-.13, 1.49	-	-	-
	R^2					R^2				
Model	.23					.362				

Table 7. Actor-Partner Interdependence Model Testing Effects of Own Coping Processes on Own and Partner Anxiety Adjusting for Gender

	Patient Anxiety					**Caregiver Anxiety**				
Emotional Processing	*B*	*95% CI*	*p*	*β*	*r*	*B*	*95% CI*	*p*	*β*	*r*
Intercept	0.32	-0.12, 0.77	.153	-	-	**1.86**	**0.91, 2.81**	**< .001**	-	-
Actor	**-0.58**	**-0.99, -0.16**	**.007**	**-0.14**	**-0.29**	-0.22	-1.03, 0.60	.603	-0.10	-0.08
Partner	0.02	-0.40, 0.43	.938	0.01	-0.06	-0.40	-1.19,0.40	.326	-0.19	-0.16
Gender (actor)	**0.93**	**.30, 1.56**	**.004**	**0.41**	**-**	-0.04	-1.28, 1.20	.949	-0.01	-
	k	*95% CI*				*k*	*95% CI*			
Dyadic Pattern	-.03	-.75, .69	-	-	-	1.85	-6.44, 10.14	-	-	-
	R^2					*R^2*				
Model	.245	-	-	-	-	.034	-	-	-	-
Emotional Expression	*B*	*95% CI*	*P*	*β*	*r*	*B*	*95% CI*	*P*	*β*	*r*
Intercept	**0.47**	**.001, .943**	**.049**	-	-	**1.58**	**0.55, 2.62**	**.003**	-	-
Actor	0.01	-0.37, 0.40	.951	0.06	0.11	-0.61	-1.41, 0.19	.137	-0.32	-0.21
Partner	-0.03	-0.45, 0.40	.902	-0.01	-0.12	-0.22	-0.87, 0.44	.518	-0.11	-0.12
Gender (actor)	**0.73**	**0.01, 1.45**	**.046**	**0.32**	**-**	0.39	-0.98, 1.77	.580	0.10	-
	k	*95% CI*				*k*	*95% CI*			

Dyadic Pattern	-2.18	-77.18, 72.82	-	-	-	0.35	-0.83, 1.54	-	-	-
	R^2					R^2				
Model	.11	-	-	-	-	.062	-	-	-	-
Acceptance	*B*	*95% CI*	*P*	*β*	*r*	*B*	*95% CI*	*P*	*β*	*r*
Intercept	**0.56**	**0.10, 1.02**	**.017**	-	-	**1.79**	**.73, 2.86**	**< .001**	-	-
Actor	-0.49	-1.07, 0.10	.104	-0.11	-0.33	-0.37	-1.65, 0.91	.569	-0.13	-0.08
Partner	-0.09	0.77, 0.59	.790	-0.03	-0.07	-0.30	-1.53, 0.94	.638	-0.10	-0.05
Gender (actor)	0.55	-0.14, 1.23	.116	0.24	-	0.10	-1.36, 1.56	.891	0.03	-
	k	*95% CI*				*k*	*95% CI*			
Dyadic Pattern	0.19	-1.18, 1.56	-	-	-	0.79	-2.96, 4.55	-	-	-
	R^2					R^2				
Model	.162	-	-	-	-	.012	-	-	-	-
Active	*B*	*95% CI*	*P*	*β*	*r*	*B*	*95% CI*	*P*	*β*	*r*
Intercept	0.31	-0.14, 0.77	.179	-	-	**1.83**	**.86, 2.80**	**< .001**	-	-
Actor	-0.32	-0.74, 0.10	.139	-0.08	-0.18	-0.33	-1.22, 0.06	.470	-0.14	-0.14
Partner	0.41	-0.07, 0.89	.090	0.17	0.22	-0.51	-1.31, 0.29	.213	-0.21	-0.22
Gender (actor)	**0.82**	**0.19, 1.45**	**.011**	**0.36**	**-**	0.01	-1.20, 1.22	.987	.002	-

	k	*95% CI*				*k*	*95% CI*			-
Dyadic Pattern	-1.31	-3.40, 0.79	-	-	-	1.55	-3.55, 6.66	-	-	-
	R^2					R^2				
Model	.202	-	-	-	-	.06	-	-	-	-
Positive Reappraisal	*B*	*95% CI*	*P*	*β*	*r*	*B*	*95% CI*	*P*	*β*	*r*
Intercept	**1.55**	**0.86, 2.23**	**< .001**	-	-	**1.06**	**0.12, 2.01**	**.028**	-	-
Actor	-0.27	-0.80, 0.25	.306	-0.09	-0.18	-0.44	-1.51, 0.64	.424	-0.22	-.011
Partner	.59	-.06, 1.24	.073	.29	0.32	0.57	-0.32, 1.46	.210	0.28	0.11
Gender (actor)	**-1.14**	**-2.04, -.25**	**.012**	**-.43**	**-**	**0.49**	**0.05, 0.93**	**.030**	**0.42**	-
	k	*95% CI*				*k*	*95% CI*			
Dyadic Pattern	-2.17	-6.96, 2.63	-	-	-	-1.31	-5.02, 2.41	-	-	-
	R^2					R^2				
Model	.261	-	-	-	-	.17	-	-	-	-
Avoidance	*B*	*95% CI*	*P*	*β*	*r*	*B*	*95% CI*	*P*	*β*	*r*
Intercept	**0.48**	**0.02, 0.93**	**.041**	-	-	**1.86**	**1.07, 2.64**	**< .001**	-	-
Actor	0.14	-0.97, 1.25	.805	0.03	0.12	**3.07**	**1.71, 4.43**	**< .001**	**0.66**	**0.55**
Partner	0.84	-0.05, 1.74	.065	0.18	0.21	0.57	-1.09, 2.23	.501	0.12	0.11

Gender (actor)	**0.69**	**0.03, 1.34**	**.041**	**0.31**	**-**	-0.11	-1.13, .90	.829	-0.03	-
	k	*95% CI*				*k*	*95% CI*			
Dyadic Pattern	6.04	-44.12, 56.20	-	-	-	0.19	-0.38, 0.75	-	-	-
	R^2					*R^2*				
Model	.169	-	-	-	-	.364	-	-	-	-

Table 8. Actor-Partner Interdependence Model Testing Effects of Own Coping Processes on Own and Partner Pain Interference Adjusting for Gender

	Patient Pain Interference					**Caregiver Pain Interference**				
Emotional Processing	*B*	*95% CI*	*P*	*β*	*r*	*B*	*95% CI*	*P*	*β*	*r*
Intercept	**48.02**	**43.54, 52.51**	**< .001**			**48.70**	**44.20, 53.20**	**< .001**	-	-
Actor	-1.55	-5.79, 2.70	.475	-0.002	-0.02	-3.30	-7.2, .60	.098	-0.24	-0.23
Partner	-0.30	-4.52, 3.91	.888	-0.02	-0.08	0.21	-3.6, 4.02	.913	0.02	0.01
Gender (actor)	**7.43**	**1.11, 13.76**	**.021**	**0.35**		1.99	-3.82, 7.80	.502	0.10	
	k	*95% CI*				*k*	*95% CI*			
Dyadic Pattern	0.20	-2.66, 3.05	-	-	-	-0.06	-1.21, 1.09	-	-	-
	R^2					*R^2*				
Model	.12	-	-	-	-	.065	-	-	-	-
Emotional Expression	*B*	*95% CI*	*P*	*β*	*r*	*B*	*95% CI*	*P*	*β*	*r*

Intercept	**48.16**	**43.80, 52.51**	**< .001**	-	-	**46.20**	**41.72, 50.68**	**< .001**	-	-
Actor	-1.40	-5.04, 2.24	.451	-0.002	-0.02	**-5.64**	**-9.19, -2.10**	**.002**	**-0.47**	**-0.36**
Partner	0.41	-3.53, 4.35	.839	0.03	-0.07	-1.89	-4.81, 1.04	.206	-0.16	-0.22
Gender (actor)	**7.56**	**.99, 14.14**	**.024**	**0.36**	-	5.20	-.64, 11.04	.081	.26	-
	k	*95% CI*				*k*	*95% CI*			
Dyadic Pattern	-0.29	-3.14, 2.56	-	-	-	0.33	-0.23, 0.90	-	-	-
	R^2					R^2				
Model	.112	-	-	-	-	.223	-	-	-	-
Acceptance	*B*	*95% CI*	*P*	*β*	*r*	*B*	*95% CI*	*P*	*β*	*r*
Intercept	**50.20**	**46.39, 54.0**	**< .001**	-	-	**48.88**	**43.72, 54.04**	**< .001**	-	-
Actor	**-9.68**	**-14.56, -4.80**	**< .001**	**-0.03**	**-.059**	-2.83	-9.06, 3.39	.372	-0.15	-0.13
Partner	-1.58	-7.20, 4.05	.582	-0.08	-0.12	-1.05	-7.05, 4.94	.731	-0.06	-0.015
Gender (actor)	3.17	-2.41, 8.75	.265	0.15	-	1.29	-5.73, 8.30	.719	0.07	-
	k	*95% CI*				*k*	*95% CI*			
Dyadic Patter	0.16	-0.41, 0.74	-	-	-	0.37	-1.72, 2.46	-	-	-
	R^2					R^2				
Model	.35	-	-	-	-	.02	-	-	-	-

Active	*B*	*95% CI*	*P*	*β*	*r*	*B*	*95% CI*	*P*	*β*	*r*
Intercept	48.08	43.58, 52.58	< .001	-	-	49.36	44.59, 54.13	< .001	-	-
Actor	-1.71	-5.85, 2.43	.419	-0.01	-0.10	-2.27	-6.62, 2.08	.306	-0.16	-0.18
Partner	-0.37	-5.49, 4.75	.888	-0.03	-0.05	-0.15	-4.16, 3.86	.942	-0.01	-0.03
Gender (actor)	**7.18**	**1.08, 13.28**	**.021**	**0.34**	-	1.05	-4.82, 6.92	.727	0.05	-
	k	*95% CI*				*k*	*95% CI*			
Dyadic Pattern	0.22	-2.91, 3.34	-	-	-	0.07	-1.72, 1.85	-	-	-
	R^2					R^2				
Model	.122	-	-	-	-	.03	-	-	-	-
Positive Reappraisal	*B*	*95% CI*	*P*	*β*	*r*	*B*	*95% CI*	*P*	*β*	*r*
Intercept	**47.98**	**43.1, 52.86**	**< .001**	-	-	**49.10**	**43.52, 54.68**	**< .001**	-	-
Actor	-2.22	-6.52, 2.07	.310	-0.01	0.09	-1.51	-6.15, 3.13	.523	-0.13	-0.11
Partner	3.16	-1.41, 7.73	.175	0.27	0.19	1.72	-2.49, 5.94	.423	0.15	0.14
Gender (actor)	6.17	-0.87, 13.20	.086	0.32	-	2.25	-4.83, 9.32	.534	0.12	-
	k	*95% CI*				*k*	*95% CI*			
Dyadic Pattern	-1.42	-4.68, 1.84	-	-	-	-1.14	-5.45, 3.17	-	-	-
	R^2					R^2				

Model	.144	-	-	-	-	.045	-	-	-	-
Avoidance	*B*	*95% CI*	*P*	*β*	*r*	*B*	*95% CI*	*P*	*β*	*r*
Intercept	**49.84**	**45.68, 54.0**	**< .001**	-	-	**48.73**	**44.79, 52.67**	**< .001**	-	-
Actor	**12.86**	**2.76, 22.97**	**.013**	**0.01**	**0.42**	**13.34**	**6.18, 20.49**	**< .001**	**0.45**	**0.51**
Partner	0.59	-7.73, 8.91	.889	0.02	-0.01	2.85	-5.71, 11.42	.514	0.10	0.07
Gender (actor)	4.97	-0.92, 10.85	.098	0.24	-	1.39	-3.68, 6.46	.592	0.07	-
	k	*95% CI*				*k*	*95% CI*			
Dyadic Pattern	0.05	-0.61, 0.71	-	-	-	0.21	-0.47, 0.90	-	-	-
	R^2					*R^2*				
Model	.24	--	-	-	-	.291	-	-	-	-

Discussion

In this study of adults diagnosed with any-stage pancreatic or lung cancer and patient-elected primary caregivers, we examined key mental and physical health-related outcomes including depressive symptoms, anxiety, and life disruption from pain and their association with cancer-related coping strategies. We aimed to characterize coping processes and mental and physical health related outcomes based on patient/caregiver status, participant gender, and caregiver role (i.e., spouse, non-spouse, no caregiver identified, caregiver did not participate in study). Using Actor-Partner Interdependence Modeling we aimed to examine the mutual influence of patient and caregiver individual coping processes on one’s own outcomes (actor effects) and one’s partner’s outcomes (partner effects).

Patients' and Caregivers' Depressive Symptoms, Anxiety, and Pain Interference

Patient reported depressive symptoms were comparable to breast cancer samples (CES-D M = 7.25, 15.6% clinical; Stanton et al., 2015) and a sample of generally healthy older adults (CES-D M = 8.33, 13.73% clinical; Lewinsohn, Seeley, Roberts, & Allen, 1997] and lower than a sample of hospitalized advanced cancer patients (28%, Nipp et al., 2017). Patients reported anxiety at comparable mean levels as the general population (M = .93 vs. 1.4) but a greater proportion clinically elevated anxiety symptoms (9.6% vs. 4.8%; Kroenke, Spitzer, Williams, & Löwe, 2009) though at lower rates than advanced cancer samples (28.8%, Nipp et al., 2017)

Caregivers reported clinically elevated depressive symptoms and anxiety at rates comparable to advanced cancer samples (anxiety: 37%, depressive symptoms: 29%; Haun et al., 2014; Jacobs et al., 2017) and significantly greater than the general population (PHQ-2-anxiety = 1.4 (1.7), 4.8% clinically elevated, PHQ-2-depression = 1.0 (1.4), 6.6% clinically elevated [Kroenke, Spitzer, Williams, & Löwe, 2009; Löwe et al., 2010]).

Pain interference was reported in both patients and caregivers at mean levels comparable to the general population (Cella et al., 2010). Patients reported pain interferences scores that were elevated above "normal limits" at rates comparable to other cancer samples, while caregivers reported elevated rates comparable to the general population (Amtmann et al., 2010). Caregivers reported significantly greater mean levels of anxiety. This finding adds to the limited existing research showing higher levels of anxiety in caregivers of patients diagnosed with poor-prognosis cancer (Jacobs et al., 2017; Nipp et al., 2016). With regard to anxiety, we did not find a significant difference between men and women in the current sample. Although the majority of caregivers identified as women, a substantial minority of caregivers identified as men. As such, we can conclude that the impact of role on anxiety was not confounded with gender and these findings suggest that a significant proportion of the variance in caregiver outcomes might be attributed to aspects of the caregiver role, above and beyond the effect of gender on higher reported psychological distress.

There were no differences in depressive symptoms or pain interference as a function of role. The lack of difference between patients' and caregivers' pain interference is notable and, given the relatively low levels of pain interference reported in the sample, may speak to the relatively positive physical health of the patient sample. On average, the patient sample was nearly 3 years post-initial diagnosis (*M* = 34.4 months, *SD* = 32.64, range = 1 – 196) and participants were able to complete a relatively time-intensive psychosocial oncology research protocols, suggesting that patients' participation was biased towards physical wellness. Although there was no statistically significant difference between patients' and caregivers' clinically elevated depressive symptoms, caregivers were somewhat more likely to evidence clinically elevated depressive symptoms in the current sample. This finding contrasts with findings in a sample of patients with newly diagnosed incurable cancer and their caregivers (Jacobs et al., 2017), which found patients had higher levels of clinically elevated depressive symptoms, and consistent with other research in advanced cancers showing no difference in clinically elevated depressive symptoms between patients and caregivers (Nipp et al., 2016). The current sample is distinct with regard to its longer time elapsed since diagnosis, which may influence both patients' and caregivers' experience of cancer. The lack of difference between men and women on depressive symptoms is somewhat inconsistent with existing research on gender differences in depressive symptoms in the context of cancer (Li & Loke, 2013) and may indicate the experience of cancer for both patients and caregivers overrides the effect of gender on depressive symptoms.

We also explored patients' depressive symptoms, anxiety, and pain interference as a function of the nature of the caregiver relationship. We included comparisons among patients with spouse caregivers, non-spouse caregivers, patients who identified no caregiver, and patients who elected to participate in the study without the person they identified as their primary caregiver. The majority of patient-caregiver dyads that participated in the study together were married (84.1%), and a sizeable number of patients did not identify with having a primary caregiver (27.3%). No differences were observed in depressive symptoms, anxiety, or pain interference as a function of caregiver status. Differences did emerge in approach- and avoidance- oriented coping strategies as a function of caregiver status, however. Patients with a spouse caregiver reported utilizing significantly less active coping than patients without a caregiver and significantly less avoidance coping than patients without a caregiver or whose caregiver did not participate. Patients with spouse caregivers may engage in less overall coping due to the availability of a support system that might take on some of the burden of coping with the stress of living with cancer.

Interdependence in Coping and Outcomes

Interdependence among patient and caregiver coping and outcomes was observed between greater patient avoidance coping and greater caregiver depressive symptoms. This finding is line with hypothesis based on Social Cognitive Theory (Bandura, 1986) and Social Cognitive Processing (Lepore, 2001) which suggests that individuals' cognitions and behaviors (e.g., avoidance coping) influence both their own mental and physical health-related outcomes and the outcomes of their partner in the social context (e.g., the patient-caregiver relationship). There is mixed evidence regarding interdependence of coping in predicting health-related quality of life in cancer patient and caregivers, with some research finding only actor effects (Boyer et al., 2017) and some research finding significant partner effects of greater approach-oriented coping and avoidance-oriented coping on better and worse quality of life, respectively (Baumstarck et al., 2016). The current findings lend support to the interdependence of avoidance coping on specific mental health outcomes, specifically depressive symptoms. However, we generally did not find support for other patterns of interdependence between coping and outcomes. Specifically, we found no evidence of interdependence of approach-oriented coping and outcomes or interdependence of avoidance-oriented coping with anxiety or life disruption from pain. This may be due to the heterogeneity in time since diagnosis in the current sample. The threat of cancer and associated distress is typically most salient closer to diagnosis (Stanton et al., 2015), thus patients and caregivers may have become less dependent upon or influenced by their partner's coping such that the majority of the variance in outcomes is accounted for by their own coping. The ability to analyze differences by time since diagnosis was limited due to the small sample size of the current study. Future research should explore differences by time since diagnosis to elucidate this question.

Multiple actor effects were observed in APIMs predicting depressive symptoms, anxiety, and pain interference from approach and avoidance-oriented coping processes. Individuals' avoidance coping was found to be associated with depressive symptoms and pain interference in both patients and caregivers and with anxiety in caregivers. These models accounted for a substantial proportion of the variance in patient (23%) and caregiver (36.2) depressive symptoms, caregiver anxiety (36.4%), and patient (24%) and caregiver (29.1%) life disruption from pain. This suggests that the association of avoidance-oriented coping and these outcomes is relatively strong in patients and caregivers coping with poor-prognosis cancer. Avoidance-oriented coping has been conceptualized as generally harmful in attempts to cope with chronic stressors including breast cancer (Kvillemo & Branstrom, 2014), prostate cancer (Roesch et al., 2005), and incurable lung and gastrointestinal cancers (Nipp et al., 2017). It is unsurprising that we identified a significant relationship of avoidance-oriented coping with worse mental and physical health outcomes given the length of survival in this sample. Avoidance coping has been conceptualized as potentially beneficial in the context of acute stressors and in the short-term (Suls & Fletcher, 1985). However, over an extended period of time, coping with a major health threat in the form of poor-prognosis cancer, avoidance is associated with greater depressive symptoms and anxiety (Jacobson & Newman, 2014) as well as maintenance of chronic pain (Philips, 1987).

A variety of approach-oriented coping processes were associated with favorable outcomes in APIMs for both patients' and caregivers' effects on their own outcomes. Greater emotional processing coping was associated with lower anxiety in patients, over and above the significant effect of gender in this model. This model accounted for a significant portion of the variance in patient anxiety (24.5%), suggesting a significant contribution of emotional processing to patients' anxiety. Emotional processing has also been associated with beneficial outcomes in older adults (Hoyt et al., 2020), and the present findings are in line with exposure models of anxiety reduction through emotional processing (Foa & Kozak, 1986). Findings lend support to the idea that emotional processing coping can be beneficial in its own right, as compared with an empirical question that has been raised regarding whether the benefit of emotional processing occurs only in the context of emotional expression (Stanton et al., 2000).

Greater use of acceptance coping was associated with lower depressive symptoms and lower pain interference in patients. This finding is consistent with research in breast cancer showing that acceptance coping is potent predictor of lower depressive symptoms across one year following diagnosis (Stanton et al., 2018). This finding is also in line with findings in the chronic pain literature related to the benefits of acceptance coping (McCracken & Eccleston, 2003), and also in samples of advanced cancer patients (Gauthier et al., 2009). Similarly, an association between greater active coping and lower depressive symptoms in patients was observed, an effect that has been observed in samples of advanced cancer patients (Nipp et al., 2017). No significant effects of positive reappraisal coping were observed, though the sample size for this analysis was substantially smaller than others and therefore analyses had low statistical power to detect effects.

Greater coping through cancer-related emotional expression was associated with lower depressive symptoms and life disruption from pain in caregivers. This effect was observed over and above the effect of gender, suggesting that the relatively larger percentage of female caregivers did not account for this effect. The models accounted for 30.7% of the variance in caregiver depressive symptoms and 22.3% of the variance in caregivers' pain interference, indicating a relative strong association between caregivers' emotional expression coping and their own depressive symptoms and life disruption due to pain. This finding is congruent with the general literature related to emotional expression coping being associated with beneficial outcomes (Stanton, 2011). Notably, emotional expression was the only approach-oriented coping strategy was associated with outcomes in caregivers, suggesting that expressing emotions related to the impact of the patient's cancer carries particular importance for caregivers. Indeed, research has found that caregivers express unmet needs related to emotional support (Sklenarova et al., 2015). The findings add to the relatively limited research base in non-gendered, poor-prognosis cancers suggesting the benefit of emotional expression coping in caregivers.

Findings of associations between approach-oriented coping and beneficial outcomes and avoidance-oriented coping and negative outcomes highlight specific treatment targets that are common in transdiagnostic treatment approaches (e.g., Unified Protocol, Barlow et al., 2017; Acceptance and Commitment Therapy, Hayes, 2004; Roemer & Orsillo, 2009) and treatment modalities specific to cancer (i.e., palliative care, Greer et al., 2018). Treatment implications are discussed below.

Strengths and Limitations

A strength of the study is the use of Actor Partner Interdependence Modeling, which allowed for the control of covariance between patient and caregiver predictors and outcomes. However, the study was conducted on cross-sectional data, limiting conclusions about directionality and temporality of the findings. For example, the experience of depressive symptoms might have precipitated avoidance-oriented coping as well as the reverse. Reciprocal causality is likely. Several limitations of this study might constrain its generalizability to other populations with poor-prognosis cancers. First, the two samples were recruited in different ways, with the pancreatic sample being recruited through both a philanthropic organization and academic medical center treatment setting whereas the lung cancer sample was recruited within an academic medical center treatment setting. The pancreatic cancer recruitment method likely resulted in a bias towards individuals who were doing better physically. A large number of eligible individuals declined to participate, mostly attributing their declining study participation to “not doing well physically.” Recruitment is a key consideration in conducting research with this vulnerable population. In addition, the vast majority of the sample was white, well-educated, and of high socioeconomic status, limiting the generalizability of the findings.

Another limitation of the study is the relatively small sample size, particularly in the caregiver sample. The small sample size may have precluded detecting statistically significant partner effects. A unique aspect of the sample was the heterogeneity of time since diagnosis, with time since initial diagnosis ranging from 1 month to nearly 16 years, with an average time since diagnosis of about 3 years (median = 2 years). Given the large variability in time since diagnosis, patients and caregivers were likely experiencing distinct “islands of distress,” which imply discrete periods of increased distress associated with significant milestones in the cancer trajectory (e.g., diagnosis, active treatment, early post-treatment period) interspersed with periods of mastery and relatively low distress (Andersen, 1994). We also did not account for pre-morbid psychiatric morbidity which an important considering in the context of adjustment to cancer diagnosis across an extended period of time.

Future Directions and Clinical Implications

Despite generally low levels of depressive symptoms, anxiety, and life disruption from pain in this sample, a substantial minority of patients experienced clinically elevated depressive symptoms and anxiety. The finding of greater anxiety in caregivers than in patients reinforces the importance of addressing the caregiver experience of poor-prognosis cancer in loved ones. Interventions that focus on cancer education, problem-solving, and personal support have been shown to be effective in reducing caregiver burden (Badr & Krebs, 2013). eHealth delivery of caregiver support interventions has also been shown to be effective in reducing caregiver burden and caregiver negative mood (DuBenske et al., 2014). The consistent findings related to the association of avoidance-oriented coping and poorer outcomes suggest that interventions designed to reduce avoidance may be particularly beneficial for both patients and caregivers.

Interventions are available that focus on decreasing experiential avoidance and increasing acceptance of painful thoughts and feelings, including emotion-focused and “third wave” cognitive behavioral therapies such Acceptance and Commitment Therapy (ACT, Mennin & Fresco, 2014; Roemer & Orsillo, 2009). ACT and similar mindfulness-based interventions target experiential avoidance of thoughts and feelings that generally serve to maintain distress, including symptoms of depression and anxiety. Acceptance-based interventions are also a particularly good fit for chronic, unchangeable health-related stressors such as poor-prognosis cancer. Limited research has demonstrated greater efficacy of ACT in comparison to traditional CBT-based interventions in improving mood and quality of life, an effect shown to be mediated by decreased cognitive avoidance (Rost et al., 2012). A review of the literature suggests that existing research in ACT in the cancer context is limited in size and lacking in methodological rigor (Gonzalez-Fernandez & Fernandez-Rodriguez, 2018). Thus, further research related to interventions that promote decreased avoidance-oriented coping in poor-prognosis cancer is warranted.

Meaning-Centered Therapy (MCT, Applebaum, Kulikowski, & Breitbart, 2015; Breitbart et al., 2108) has also shown promise in the management of existential distress (e.g., experience of hopelessness, loss of meaning, and demoralization) which is closely associated with depressive symptoms and anxiety. MCT facilitates increased awareness of cognitive, emotional, and behavioral facets of suffering that is in line with the present findings involving emotional processing, active coping, and acceptance coping in patients; emotional expression in caregivers; and avoidance coping in both patients and caregivers.

Given the effect of patients’ avoidance on their own depressive symptoms and on caregiver depressive symptoms, interventions that involve both patient and caregiver may improve the overall experience of the dyad. Interventions under development that involve improving patient-caregiver communication regarding cancer-related stressors are likely to be beneficial in reducing avoidance-oriented coping in both individuals and within the dyadic social context (Tiete et al., 2021).

Future research should examine the interdependence of patients' and caregivers' coping processes. Social cognitive theory suggests that social dynamics may influence the ways in which individuals engage in coping, in addition to the ways patient and caregiver dyads engage in coping together (dyadic coping). This study found that individual coping has significant impact on one's own outcomes and can be interdependent in the patient and caregiver context. The association between coping and outcomes was, however, predominantly independent in patients and caregivers in this relatively small sample, with patients' and caregivers' coping mostly influencing their own outcomes. With regard to the interdependence of patients' avoidance and caregivers' depressive symptoms, it is likely that one partner's coping is perceived by the other partner in the relationship and may either cause tension with regard to a mismatch in coping strategies (Kraemer et al., 2011) or may influence the other partner's coping, which may compound the effects of ineffective coping. Qualitative research in metastatic lung cancer suggests that patient and caregivers perceive their coping strategies "ebb and flow together" (Hendriksen et al., 2019), which suggests that further research is warranted to explore the nature of interdependence in patient and caregiver coping with poor-prognosis cancer. Working to decrease the use of coping strategies associated with negative mental and physical health related outcomes in patients may have the beneficial impact of influencing the entire patient-caregiver ecosystem such that both partners are beneficially impacted.

Conclusion

Caregivers reported higher levels of anxiety compared with patients with pancreatic and lung cancer. Depressive symptoms and life disruption from pain were comparable between patients and caregivers. Overall, levels of clinically elevated depressive symptoms and anxiety in this sample suggest the need for psychological support related to the impact of poor-prognosis cancer. Findings revealed interdependence between greater patients' avoidance coping and greater caregivers' depressive symptoms, but interdependence was not demonstrated in any of the approach-oriented coping subscales. The influence of coping on outcomes was predominantly independent in this sample. Active coping, emotional processing, and acceptance coping represent treatment targets for patients while emotional expression represents a particularly promising treatment target for caregivers. Avoidance-oriented coping represents a treatment target for both patients and caregivers in the context of poor-prognosis cancer in order to promote positive mental and physical health related outcomes.

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General Discussion

Aims of the current studies were to elucidate associations between disease-related perceptions, coping processes, and mental and physical health-related outcomes in individuals who have been diagnosed with lung (*n* = 52) or pancreatic (*n* = 36) cancer and their caregivers (*n* = 48). Associations between perceived prognosis and perceived treatment goal and depressive symptoms, anxiety, and life disruption from pain were examined. Cancer-related approach-oriented (e.g., emotional processing and expression, acceptance, active, positive reappraisal) and avoidance-oriented (denial, mental disengagement, behavioral disengagement) coping strategies were examined as potential moderators of the hypothesized association of perceived medical status indicators and outcomes. Coping was also examined in the context of patient-caregiver dyads (*n* = 43 dyads) to interrogate the potential interdependence between patient and caregiver coping and depressive symptoms, anxiety, and life disruption from pain.

Participants were mostly white, well-educated, and financially secure older adults (patients were 66 years old and caregivers were 62 years old, on average). The average time elapsed since initial cancer diagnosis was nearly 3 years, with substantial heterogeneity in both lung and pancreatic patient samples. These sociodemographic and medical aspects of the samples represent important contextual factors in the interpretation of findings. Perceptions of prognosis and treatment goals, utilization of coping processes, and levels of depressive symptoms, anxiety, and life disruption from pain likely vary depending on significant cancer-related events including proximity to diagnosis, initial treatment, and recurrence and additional lines of treatment. As such, the current findings are somewhat limited in that they collapse across these factors. Future research with larger samples sizes might explore the associations of these cancer trajectory-related factors and perceptions of prognosis, coping, and mental and physical health-related outcomes in patients with poor-prognosis cancer and their caregivers.

Overall rates of clinically elevated depressive symptoms in patients were higher than the general population and comparable to those found in more favorable prognosis cancers (i.e., breast and prostate cancer), and low relative to other advanced cancer samples reported in the literature. Clinically elevated anxiety in patients were lower than more favorable prognosis cancers and advanced cancer, though still greater than the general population. Patients with pancreatic cancer reported higher levels of anxiety than lung cancer patients that were in line with breast and prostate cancer samples. Life disruption from pain was also reported by patients at mean levels comparable to the general population. These findings point to the psychological impact of poor-prognosis cancer and the need for supportive care. However, mental and physical health-related outcomes were, overall, reported at lower levels than hypothesized based on prior literature and the substantial threat to life conferred by poor-prognosis cancer. This may have been related to several factors. Sample demographics, particularly relatively high socioeconomic status (Chidobem et al., 2022), were likely protective. The relatively long time since diagnosis may have allowed for substantial adjustment to diagnosis for patients. Selection bias for patients with relatively favorable physical well-being such that they were able to participate in a time-intensive research protocol may partially account for the relatively lower level of depressive symptoms, anxiety, and life disruption from pain compared with other samples of advanced cancer.

Caregivers reported depressive symptoms and anxiety that were substantially greater than the general population and comparable to other samples of caregivers of patients with advanced cancer. Caregivers also reported greater anxiety than patients, with comparable levels of depressive symptoms, findings which are consistent with multiple other studies involving advanced cancer patients and caregivers (Haun et al., 2014; Jacobs et al., 2017). Caregivers of patients with pancreatic cancer reported significantly more depressive symptoms than those of patients with lung cancer, suggesting an increased psychological burden for caregivers of pancreatic cancer compared with lung cancer. Findings add to the relatively limited research base documenting equal or greater impact of cancer on caregivers' psychological well-being when compared to patients and highlight the need for supportive care for patients and caregivers alike. Given the lengthy time since diagnosis, findings also suggest that for some caregivers, the burden of serving as a caregiver persists for a substantial amount of time after diagnosis.

Findings add to the existing literature that supports an association between terminal illness perception and worse depressive symptoms and anxiety (Cripe et al., 2012; El-Jawahri et al., 2014; El-Jawahri et al., 2015; Greer et al., 2014; Nipp et al., 2017; Thompson et al., 2020; Shin et al., 2016). Emotional processing buffered against this effect on anxiety, and active coping buffered the effect on depressive symptoms. It was somewhat surprising to observe the protective effect of emotional processing, and not emotional expression, but evidence does exist for the benefits of emotional processing per se in cancer (Hoyt et al., 2013). It was also somewhat surprising that there was no evidence of a moderating effect of acceptance coping in this context, given the hypothesized mechanism of action in the literature finding an association between terminal prognosis perception and favorable outcomes (Lee et al., 2013). It is notable that the benefits of terminal illness perception/awareness on outcomes, primarily less anxiety, was observed in research primarily conducted in samples of various Asian cultures (e.g., Korea [Lee et al., 2013], Hong Kong [Chan, 2011], Taiwan [Kao et al., 2013]). Cultural factors that influence patients' cognitive, emotional, and behavioral coping strategies as well as communication among patients, caregivers, and oncologic care team members are important factors to consider in this context and warrant further study.

Avoidance-oriented coping was related significantly to depressive symptoms and anxiety for both patients and caregivers, with greater use of avoidance-coping associated with less favorable outcomes. Avoidance coping did not interact with perceptions of prognosis in predicting outcomes, suggesting that avoidance coping is associated with poor outcomes across different dimensions of illness perceptions. In APIM, patients' avoidance-oriented coping was associated with both patients' and caregivers' depressive symptoms, indicating that patients' avoidance coping influences the social-cognitive context of coping within patient-caregiver dyads such that both partners' outcomes are impacted. However, overall results from APIM demonstrated lack of evidence of interdependence in patients' and caregivers' coping and outcomes. No partner effects were observed involving approach-oriented coping processes or avoidance-oriented coping with anxiety or life disruption from pain. Patient and caregiver actor effects were observed, however, which highlights the importance of individual coping on patients' and caregivers' own outcomes.

Caregivers' cancer-related coping through emotional expression was associated with lower depressive symptoms and lower life disruption from pain with no other approach-oriented coping process associated with outcomes over and above gender and partner effects. This finding suggests that facilitating caregivers' emotional expression is a worthy target for intervention to mitigate depressive symptoms and pain interference. Patients' emotional processing coping was also associated with lower anxiety, and it conditioned the impact of terminal prognosis perception on anxiety and was significant over and above gender. This finding lends support to the research base that identifies emotional processing per se as a beneficial coping process, as compared to emotional expression as the sole necessary ingredient with regard to the benefits of emotional-approach coping on mental health outcomes. Patients' acceptance coping was also associated with their own lower depressive symptoms and less pain interference.

Findings of both studies have several theoretical and clinical implications. I found support for the Transactional Model of Stress and Coping (Lazarus & Folkman, 1984) in the context of perceived prognosis and depressive symptoms and anxiety. Active coping and emotional processing coping served to moderate the impact of an illness perception (perceived prognosis) on outcomes, which adds to the research base supporting coping as a moderator vs. a mediator (Dempster, Howell, & McCorry, 2015). Findings of moderation in this context suggest that those who report terminal prognosis and low active coping and low emotional processing coping are at higher risk for depressive symptoms and anxiety. I also found limited support for interdependence of patient and caregiver coping on mental health outcomes, specifically in avoidance coping on depressive symptoms. These findings are in line with Social Cognitive Theory (Bandura, 1986; Lepore, 2001), and specifically with the effects of social constraint on adjustment to cancer (Lepore & Revenson, 2007). However, in this sample, the effect of patients' and caregivers' coping was primarily on their own outcomes and there were no significant correlations between patients' and caregiver's depressive symptoms, anxiety, or pain interference. These findings paint a picture of independence rather than interdependence in coping with cancer that stands in contrast to much of the dyadic coping literature to date (Streck, Wardell, LoBiondo-Wood, & Beauchamp, 2020). Like patients, avoidance coping was associated with caregiver depressive symptoms, anxiety, and pain interference.

Identifying vulnerability and protective factors for both patients and caregivers early in the cancer experience may serve to mitigate negative mental health outcomes. These findings suggest that improving active efforts to manage consequences of poor-prognosis cancer, facilitating processing of the emotional impact, supporting acceptance of the reality of diagnosis with poor-prognosis cancer, and reducing avoidance-oriented coping are relevant targets for intervention in patients. In caregivers, a focus on supporting emotional expression and mitigating avoidance-oriented coping appears to hold promise for effective intervention. Indeed, Early Integrated Palliative Care is a care modality specifically tailored towards supporting these coping processes (Greer et al., 2020) and frequently involves both patients and caregivers together in appointments. Acceptance and Commitment Therapy (Hayes et al., 1996) and Meaning-Centered Therapy (Applebaum, Kulikowski, & Breitbart, 2015) also are promising interventions that targets these cognitive, emotional, and behavioral facets of coping. Further research in the context of poor-prognosis cancer is warranted to explore the replicability of the obtained findings in larger, more diverse samples of patients and caregivers as well as the potential efficacy of these interventions.

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Appendix A. Study 1 Supplemental Tables

Appendix A Table 1. Interrelationships among coping strategies and outcomes

	1	2	3	4	5	6	7	8
1 Depression	1.0							
2 Anxiety	.60**	1.0						
3 Pain	.38**	.18	1.0					
4 Emotional Expression	.051	.031	.147	1.0				
5 Emotional Processing	-.035	-.098	.136	.729**	1.0			
6 Acceptance	.005	-.019	-.169	.21	.262*	1.0		
7 Active	-.075	.027	-.010	.407**	.656**	.27*	1.0	
8 Avoidance	.28*	.043	.161	.25	.130	.086	.32	1.0

Appendix Table 2: Multiple regressions with non-significant interaction effects dropped

	Depressive Symptoms				
	Unstandardized beta coefficient	*SE*	*t*	*p*	95% CI
Emotional Processing					
Constant	0.56	.39	1.44	.154	-0.22, 1.34
Gender	0.76	.45	1.69	.096	-0.14, 1.66
Perceived Prognosis	**1.63**	**.48**	**3.42**	**.001**	**0.68, 2.57**
Processing	0.07	.28	.24	.811	-0.49, 0.62
	F	*p*	R^2	*df*	*MSE*
Model	**4.44**	**.006**	**.119**	**3, 73**	**3.58**
Emotional Expression					
Constant	0.69	0.38	1.82	.073	-0.07, 1.44
Gender	0.57	0.45	1.26	.210	-0.33, 1.48

Prognosis Perception	**1.48**	**0.47**	**3.18**	**.002**	**0.56, 2.41**
Expression	0.24	0.27	.89	.375	-0.30, 0.78
	F	*p*	*R^2*	*df*	*MSE*
Model	**3.90**	**.012**	**.135**	**3,75**	**3.60**
Acceptance					
Constant	0.70	0.39	1.80	.075	-0.07, 1.46
Gender	0.63	0.44	1.42	.59	-0.25, 1.52
Prognosis Perception	**1.43**	**0.46**	**3.11**	**.003**	**0.51, 2.35**
Acceptance	.003	0.34	.010	.992	-0.68, 0.68
	F	*p*	*R^2*	*df*	*MSE*
Model	**3.56**	**.018**	**.125**	**3,75**	**3.65**
Positive Reappraisal					
Constant	0.83	0.48	1.72	.093	-0.14, 1.80
Gender	0.53	0.56	0.94	.352	-0.61, 1.66
Prognosis Perception	**1.99**	**0.61**	**3.27**	**.002**	**0.77, 3.22**
Positive reappraisal	-0.37	0.33	-1.11	.274	-1.04, 0.30
	F	*p*	*R^2*	*df*	*MSE*
Model	4.74	.006	.248	3, 43	3.20
Avoidance					
Constant	**0.77**	**0.37**	**2.06**	**.043**	**0.02, 1.51**
Gender	0.60	0.43	1.39	.170	-0.26, 1.46
Prognosis Perception	**1.26**	**0.45**	**2.77**	**.007**	**0.35, 2.16**
Avoidance Coping	**1.10**	**0.52**	**2.11**	**.038**	**0.06, 2.15**
	F	*p*	*R^2*	*df*	*MSE*
Model	**5.23**	**.002**	**.175**	**3,74**	**3.45**
	Anxiety				
	Unstandardized beta coefficient	*SE*	*t*	*p*	95% CI
Emotional Expression					
Constant	0.32	0.26	1.25	.215	-0.19, 0.84
Gender	**0.65**	**0.31**	**2.13**	**.037**	**0.04, 1.27**
Prognosis Perception	**0.67**	**0.32**	**2.11**	**.038**	**-0.04, 1.29**
Expression	0.04	0.18	0.22	.830	-0.32, 0.40
	F	*p*	*R^2*	*df*	*MSE*
Model	**2.81**	**.045**	**.10**	**3,76**	**1.70**

Acceptance					
Constant	0.33	0.26	1.27	.210	-0.19, 0.86
Gender	**0.66**	**0.30**	**2.18**	**.032**	**0.06, 1.26**
Prognosis Perception	**0.65**	**0.31**	**2.08**	**.041**	**0.03, 1.27**
Acceptance	-0.003	.23	-.014	.989	-0.47, 0.46
	F	*p*	R^2	*df*	*MSE*
Model	2.64	.055	.095	3,76	1.70
Active					
Constant	0.33	0.26	1.26	.213	-0.19, 0.85
Gender	**0.65**	**0.30**	**2.15**	**.035**	**0.05, 1.24**
Prognosis Perception	**0.68**	**0.32**	**2.14**	**.035**	**0.05, 1.31**
Active/Planning Coping	0.09	0.19	.45	.651	-0.30, 0.47
	F	*p*	R^2	*df*	*MSE*
Model	2.72	.050	.097	3,76	1.70
Positive Reappraisal					
Constant	0.20	0.41	.486	.630	-0.62, 1.01
Gender	0.92	0.47	1.95	.057	-0.03, 1.87
Prognosis Perception	**1.31**	**0.51**	**2.60**	**.013**	**0.29, 2.33**
Positive reappraisal	0.05	0.28	0.17	.863	-0.52, 0.61
	F	*p*	R^2	*df*	*MSE*
Model	2.85	.048	.163	4, 43	2.27
Avoidance					
Constant	0.32	0.26	1.23	.224	-0.20, 0.84
Gender	**0.70**	**0.30**	**2.30**	**.024**	**0.09, 1.30**
Prognosis Perception	**0.64**	**0.32**	**2.04**	**.045**	**0.02, 1.27**
Avoidance Coping	-0.05	0.37	-0.13	.899	-0.78, 0.69
	F	*p*	R^2	*df*	*MSE*
Model	2.81	.045	.101	3,75	1.71
	Pain Interference				
	Unstandardized beta coefficient	*SE*	*t*	*p*	95% CI
Emotional Processing					
Constant	10.40	1.47	7.07	<.001	7.47, 13.33
Gender	1.54	1.69	0.91	.367	-1.84, 4.91
Prognosis Perception	2.94	1.78	1.66	.102	-0.60, 6.48

Processing	1.41	1.05	1.34	.183	-.68, 3.50
	F	*p*	R^2	*df*	*MSE*
Model	1.52	.216	.058	3,74	50.92
Emotional Expression					
Constant	10.60	1.41	7.52	< .001	7.79, 13.40
Cancer Type	1.15	1.67	.69	.495	-2.18, 4.48
Prognosis Perception	2.75	1.72	1.60	.113	-0.69, 6.17
Expression	1.26	.99	1.27	.207	-0.71, 3.23
	F	*p*	R^2	*df*	*MSE*
Model	1.45	.235	.054	3,76	50.34
Acceptance					
Constant	10.46	1.43	7.33	<.001	7.62, 13.30
Cancer Type	1.48	1.64	0.91	.368	-1.78, 4.75
Prognosis Perception	2.44	1.69	1.44	.153	-0.93, 5.81
Acceptance	-2.07	1.26	-1.64	.104	-4.58, 0.44
	F	*p*	R^2	*df*	*MSE*
Model	1.74	.166	.064	3,76	50.21
Active					
Constant	10.33	1.45	7.13	< .001	7.45, 13.22
Cancer Type	1.82	1.66	1.10	.276	-1.49, 5.13
Prognosis Perception	2.20	1.75	1.25	.215	-1.30, 5.69
Active/Planning Coping	0.08	1.06	0.07	.944	-2.04, 2.19
	F	*p*	R^2	*df*	*MSE*
Model	.81	.490	.031	3,76	51.99
Positive Reappraisal					
Constant	49.55	2.83	17.52	<.001	43.85, 55.25
Gender	1.69	3.29	0.51	.611	-4.95, 8.33
Prognosis Perception	3.49	3.54	0.99	.329	-3.64, 10.63
Positive reappraisal	0.81	1.96	0.41	.681	-3.13, 4.76
	F	*p*	R^2	*df*	*MSE*
Model	.38	.770	.025	3, 44	110.91
Avoidance					
Constant	10.71	1.42	7.54	<.001	7.88, 13.54
Cancer Type	1.54	1.64	.94	.351	-1.73, 4.82
Prognosis Perception	2.03	1.72	1.19	.239	-1.38, 5.45

Avoidance Coping	2.41	2.0	1.21	.232	-1.57, 6.39
	F	*p*	R^2	*df*	*MSE*
Model	1.39	.254	.053	3,75	50.61

Appendix B. Study 2 Supplemental Tables

Appendix B Table 1: APIM Covariance Matrices

	Depressive Symptoms Models			
	Estimate	***SE***	***Z*-value**	***p***
Processing				
x_1x_2	.06	.09	.69	.493
y_1y_2	.75	.61	1.22	.221
x_1g_1	.09	.06	1.47	.141
x_1g_2	.001	.06	.02	.988
x_2g_2	-.06	.06	-1.04	.298
x_2g_1	.07	.06	1.31	.190
g_1g_2	**-.18**	**.05**	**-3.86**	**< .001**
Expression				
x_1x_2	-.02	.12	-.17	.867
y_1y_2	1.12	.58	1.94	.052
x_1g_1	.13	.07	1.74	.08
x_1g_2	-.04	.07	-.54	.592
x_2g_2	**-.13**	**.07**	**-1.98**	**.048**
x_2g_1	**.18**	**.07**	**2.76**	**.006**
g_1g_2	**-.18**	**.05**	**-3.86**	**< .001**

Acceptance				
x_1x_2	-.05	.04	-1.14	.253
y_1y_2	.46	.60	.77	.441
x_1g_1	-.09	.05	-1.93	.054
x_1g_2	**.14**	**.05**	**2.81**	**.005**
x_2g_2	-.01	.04	-.38	.702
x_2g_1	.02	.04	.45	.653
g_1g_2	**-.18**	**.05**	**-3.86**	**< .001**
Active				
x_1x_2	.12	.10	1.17	.241
y_1y_2	.51	.58	.88	.380
x_1g_1	.05	.06	.74	.457
x_1g_2	.03	.06	.51	.607
x_2g_2	-.01	.06	-.18	.861
x_2g_1	-.01	.05	-.25	.801
g_1g_2	**-.18**	**.05**	**-3.86**	**< .001**
Positive Reappraisal				
x_1x_2	-.01	.11	-.12	.909
y_1y_2	.43	.59	.73	.463
x_1g_1	.10	.09	1.22	.224
x_1g_2	-.02	.08	-.25	.806
x_2g_2	-.08	.07	-1.16	.247
x_2g_1	.06	.07	.94	.348
g_1g_2	**-.15**	**.06**	**-2.64**	**.008**

Avoidance				
x_1x_2	.02	.02	1.36	.173
y_1y_2	-.12	.47	-.26	.797
x_1g_1	.03	.03	1.03	.302
x_1g_2	-.01	.02	-.44	.66
x_2g_2	-.01	.03	-.42	.675
x_2g_1	-.01	.03	-.22	.83
g_1g_2	**-.18**	**.05**	**-3.86**	**< .001**
	Anxiety Models			
	Estimate	***SE***	***Z*-value**	***p***
Processing				
x_1x_2	.07	.09	.74	.458
y_1y_2	.05	.30	.16	.874
x_1g_1	.08	.06	1.35	.177
x_1g_2	.01	.06	.14	.891
x_2g_2	-.06	.06	-1.04	.298
x_2g_1	.07	.06	1.31	.190
g_1g_2	**-.18**	**.05**	**-3.86**	**< .001**
Expression				
x_1x_2	-.01	.12	-.12	.908
y_1y_2	.21	.33	.63	.528
x_1g_1	.13	.07	1.72	.085
x_1g_2	-.04	.07	-.51	.610
x_2g_2	**-.13**	**.07**	**-1.98**	**.048**
x_2g_1	**.18**	**.07**	**2.76**	**.006**

g_1g_2	**-.18**	**.05**	**-3.86**	**< .001**
Acceptance				
x_1x_2	-.05	.04	-1.03	.303
y_1y_2	.11	.32	.34	.731
x_1g_1	**-.10**	**.05**	**-2.03**	**.045**
x_1g_2	**.14**	**.05**	**2.87**	**.004**
x_2g_2	-.01	.04	-.38	.702
x_2g_1	.02	.04	.45	.653
g_1g_2	**-.18**	**.05**	**-3.86**	**< .001**
Active				
x_1x_2	.08	.10	.77	.444
y_1y_2	.15	.31	.50	.619
x_1g_1	.04	.06	.58	.559
x_1g_2	.04	.06	.67	.502
x_2g_2	-.01	.05	-.18	.859
x_2g_1	-.01	.05	-.25	.802
g_1g_2	**-.18**	**.05**	**-3.86**	**< .001**
Positive Reappraisal				
x_1x_2	-.01	.11	-.12	.909
y_1y_2	-.38	.41	-.92	.358
x_1g_1	-.02	.08	-.25	.806
x_1g_2	-.40	.30	-1.37	.170
x_2g_2	.06	.07	.94	.348
x_2g_1	.28	.24	1.16	.247

g_1g_2	-.17	.17	-1.01	.314
Avoidance				
x_1x_2	.03	.02	1.53	.125
y_1y_2	-.23	.26	-.88	.380
x_1g_1	.03	.03	1.29	.196
x_1g_2	-.02	.02	-.71	.480
x_2g_2	-.01	.03	-.44	.663
x_2g_1	-.01	.03	-.20	.841
g_1g_2	**-.18**	**.05**	**-3.86**	**< .001**
	Pain Interference Models			
	Estimate	***SE***	***Z*-value**	***p***
Processing				
x_1x_2	.06	.09	.66	.508
y_1y_2	19.07	14.61	1.31	.192
x_1g_1	.09	.06	1.43	.154
x_1g_2	.004	.06	.06	.951
x_2g_2	-.06	.06	-1.04	.298
x_2g_1	.07	.06	1.31	.190
g_1g_2	**-.18**	**.05**	**-3.86**	**< .001**
Expression				
x_1x_2	-.01	.12	-.06	.951
y_1y_2	19.12	13.36	1.43	.152
x_1g_1	.12	.07	1.68	.092
x_1g_2	-.03	.07	-.47	.635
x_2g_2	**-.13**	**.07**	**-1.98**	**.048**

x_2g_1	**.18**	**.07**	**2.76**	**.006**
g_1g_2	**-.18**	**.05**	**-3.86**	**< .001**
Acceptance				
x_1x_2	-.04	.04	-.95	.340
y_1y_2	15.43	13.11	1.18	.239
x_1g_1	**-.10**	**.05**	**-1.99**	**.047**
x_1g_2	**.14**	**.05**	**2.86**	**.004**
x_2g_2	-.01	.04	-.38	.702
x_2g_1	.02	.04	.45	.653
g_1g_2	**-.18**	**.05**	**-3.86**	**< .001**
Active				
x_1x_2	.07	.10	.72	.471
y_1y_2	18.87	14.90	1.27	.205
x_1g_1	.04	.06	.65	.519
x_1g_2	.04	.06	.62	.538
x_2g_2	-.01	.06	-.21	.836
x_2g_1	-.01	.05	-.21	.831
g_1g_2	**-.18**	**.05**	**-3.86**	**< .001**
Positive Reappraisal				
x_1x_2	.04	.12	.33	.738
y_1y_2	19.15	16.16	1.19	.236
x_1g_1	.12	.08	1.37	.171
x_1g_2	-.03	.08	-.39	.695
x_2g_2	-.04	.07	-.58	.561

x_2g_1	.04	.07	.48	.631
g_1g_2	**-.15**	**.06**	**-2.73**	**.006**
Avoidance				
x_1x_2	.03	.02	1.68	.092
y_1y_2	9.22	11.69	.79	.430
x_1g_1	.03	.03	1.34	.180
x_1g_2	-.02	.02	-.73	.466
x_2g_2	-.02	.03	-.69	.490
x_2g_1	.003	.03	.11	.915
g_1g_2	**-.18**	**.05**	**-3.86**	**< .001**

Table note. x_1 = patient independent variable, x_2 = caregiver independent variable, y_1 = patient dependent variable, y_2 = caregiver dependent variable, g_1 = patient gender, g_2 = caregiver gender; e.g., x_1x_2 = patient-caregiver independent variable covariance.

Appendix C. Study 1 Measures

Demographic and Medical Information

Date of birth_____________ Age________

Years of education (e.g., high school = 12 years) ______ years

How do you describe yourself?

- ☐ Male
- ☐ Female
- ☐ Other identification

Are you:

- ☐ Married/living as married. If yes, number of years married_______
- ☐ Single
- ☐ divorced/separated
- ☐ widowed

Do you have children? ____yes ____no
If yes, how many children do you have? ________
Number of children living in your home_____

Current or former occupation______________________
Current employment status:

- ☐ employed at least 30 hours a week
- ☐ employed fewer than 30 hours a week
- ☐ not employed for pay
- ☐ on disability/ medical leave

Which category best describes your total combined family income before taxes for the past 12 months?

- ☐ Less than $25,000
- ☐ $25,000 through $49,999
- ☐ $50,000 through $74,999
- ☐ $75,000 through $99,999
- ☐ $100,000 and greater

Ethnic group:

- ☐ African American/Black
- ☐ American Indian/Alaskan Native
- ☐ Asian
- ☐ Non-Hispanic White
- ☐ Hispanic/Latino/a
- ☐ Other, please specify__________________

What is your height? ____feet _____inches
What is your current weight in pounds? _________ pounds

Do you currently smoke? Yes No
If yes, how many cigarettes do you smoke/day (1 pack = 20 cigarettes)? ____ cigarettes

Do you drink alcohol? Yes No
If yes, how many drinks (1 drink = 12 oz of beer/5 oz of wine/1.5 oz of distilled spirits) do you have in a typical week? _______

When were you diagnosed with pancreatic cancer (month and year)? ______________
What is the stage of your pancreatic cancer?

- ☐ Stage 1 (localized to the pancreas)
- ☐ Stage 2 or 3 (grown outside the pancreas [e.g., lymph nodes, blood vessels] but not to distant organs
- ☐ Stage 4 (metastatic; spread to distant organs)
- ☐ I don’t know because I forgot.
- ☐ I don’t know because I haven’t been told.
- ☐ I don’t know because I don’t want to know.

Has the cancer spread to any other organs? Yes No Don’t know
If the answer is yes, to what other organs?

- ☐ Liver
- ☐ Lung
- ☐ Peritoneum
- ☐ Spleen
- ☐ Bowel
- ☐ Other, please specify ________________

Have you had chemotherapy? Yes No

If the answer is yes, please answer the questions below. If the answer is no, please skip.
What chemotherapy were you prescribed? Please select all that apply.

- ☐ Gemcitabine (Gemzar)
- ☐ Albumin-bound paclitaxel (Abraxane)
- ☐ 5-fluorouracil (5-FU)
- ☐ Docetaxel (Taxotere)
- ☐ Paclitaxel (Taxol)
- ☐ Irinotecan (Camptosar)
- ☐ Capecitabine (Xeloda)
- ☐ Cisplatin
- ☐ Methotrexate (MTX, amethopterin)
- ☐ Oxaliplatin (Eloxatin)
- ☐ Irinotecan liposome (Onivyde)
- ☐ Erlotinib (Tarceva)
- ☐ Other, please specify ___________________________

When did you start chemotherapy (month and year)? ___________________

How many cycles of chemotherapy have you received (For example, one week of treatment followed by three weeks of rest is one cycle)?

Are you still receiving chemotherapy? Yes No

If no, when did you stop chemotherapy (month and year)?___________________

Have you had radiation therapy? Yes No

If yes, when did you start radiation (month and year)? ____________

Are you still receiving radiation? Yes No N/A

If no, when did you stop radiation (month and year)?___________________

Have you had surgery for pancreatic cancer? Yes No

If the answer is yes, please answer the questions below, if the answer is no, skip.

How many surgeries have you had? (Do not count initial biopsy) _____________

What type of surgery did you have? Please select all that apply.

☐ Whipple procedure (pancreaticoduodenectomy)
☐ Distal pancreatectomy
☐ Total pancreatectomy
☐ Bile duct bypass surgery
☐ Enucleation
☐ Other, please specify ______________________________

Have you been diagnosed with any other cancer? Yes No

If the answer is yes, what were your cancer diagnoses? Please select all that apply.

☐ Breast cancer
☐ Lung Cancer
☐ Prostate Cancer
☐ Colorectal cancer
☐ Melanoma
☐ Nonmelanoma skin cancer
☐ Other, please specify _______________________

Do you have an oncologist outside UCLA? Yes No

If yes, please list name, practice, and location. For example, Dr. John Strauss, Tower Oncology/Cedars Sinai, Los Angeles, CA.

The following is a list of common problems. Please indicate if you currently have the problem in the first column. If you have the problem, please indicate in the second column if you receive medications or some other type of treatment for the problem. In the third column indicate if the problem limits any of your activities. Finally, indicate any medical conditions that are not listed at the end.

Problem	Do you have the problem?		Do you receive treatment for it?		Does it limit your activities?	
Heart disease	No	Yes	No	Yes	No	Yes
High blood pressure	No	Yes	No	Yes	No	Yes
Lung disease	No	Yes	No	Yes	No	Yes
Diabetes	No	Yes	No	Yes	No	Yes
Ulcer or stomach disease	No	Yes	No	Yes	No	Yes
Kidney disease	No	Yes	No	Yes	No	Yes
Liver disease	No	Yes	No	Yes	No	Yes
Anemia or other blood disease	No	Yes	No	Yes	No	Yes
Cancer (**other than pancreatic)**	No	Yes	No	Yes	No	Yes
Depression	No	Yes	No	Yes	No	Yes
Osteoarthritis, degenerative arthritis	No	Yes	No	Yes	No	Yes
Back pain	No	Yes	No	Yes	No	Yes
Rheumatoid arthritis	No	Yes	No	Yes	No	Yes
Anxiety	No	Yes	No	Yes	No	Yes
________________________	No	Yes	No	Yes	No	Yes
________________________	No	Yes	No	Yes	No	Yes

Prognosis and Treatment Perceptions

El-Jawahri, A., Traeger, L., Park, E. R., Greer, J. A., Pirl, W. F., Lennes, I. T., Jackson, V. A., Gallagher, E. R., & Temel, J. S. (2014). Associations among prognostic understanding, quality of life, and mood in patients with advanced cancer. *Cancer*, *120*(2), 278-285.

1. Patients differ in the amount of information that they want to know about their *diagnosis and treatment*—some want to know everything, others want to know very little. What is your preference for details of information about your diagnosis and treatment? *Please check one.*
   - ☐ I prefer not to hear a lot of details.
   - ☐ I want to hear details only in certain situations, such as when tests are abnormal or when treatment decisions need to be made.
   - ☐ I want to hear as many details as possible in all situations relating to my cancer and its treatment.

2. If you had to choose one, what would you say is *your primary goal* of your current cancer treatment? If you are not currently receiving treatment, please think of your most recent treatment. Many of these goals may be important to you, but *please check the **one goal*** that you feel is most important to you right now.
   - ☐ To lessen my suffering as much as possible
   - ☐ To be able to keep hoping
   - ☐ For my family to be able to keep hoping
   - ☐ To make sure I have done everything
   - ☐ To extend my life as long as possible
   - ☐ To cure my cancer
   - ☐ To help cancer research
   - ☐ Other: please specify ____________________

3. How *important* is it for you to know about your prognosis (i.e., the likely outcome of your cancer)? *Please check one.*
   - ☐ Extremely important
   - ☐ Very important
   - ☐ Somewhat important
   - ☐ A little important
   - ☐ Not at all important

4. How would you describe your current medical status?
   - ☐ Relatively healthy
   - ☐ Relatively healthy and terminally ill
   - ☐ Seriously ill and not terminally ill
   - ☐ Seriously ill and terminally ill

Approach- and avoidance-oriented coping

From: Carver, C. S., Scheier, M. F., & Weintraub, J. K. (1989). Assessing coping strategies: a theoretically based approach. *Journal of Personality and Social Psychology*, *56*(2), 267–283. https://doi.org/10.1037/0022-3514.56.2.267.

Stanton, A. L., Kirk, S. B., Cameron, C. L., & Danoff-Burg, S. (2000). Coping through emotional approach: Scale construction and validation. *Journal of Personality and Social Psychology*, *78*(6), 1150–1169. https://doi.org/10.1037/0022-3514.78.6.1150

We want to understand how individuals respond when they confront difficult or stressful events in their lives. There are many ways to deal with problems. These items ask what YOU HAVE BEEN DOING TO COPE WITH YOUR EXPERIENCE OF **PANCREATIC CANCER.** We want to know to what extent (how much or how frequently) you have been doing what each item says over the past ***4 weeks***. Rate each item separately from the others. Make your answers as true FOR YOU as you can.

1 = I don't do this at all.
2 = I do this a little bit.
3 = I do this a medium amount.
4 = I do this a lot.

____ 1. I learn something from the experience.
____ 2. I take time to figure out what I'm really feeling.
____ 3. I concentrate my efforts on doing something about it.
____ 4. I admit to myself that I can't deal with it, and quit trying.
____ 5. I accept the reality of the fact that it happened.
____ 6. I try to come up with a strategy about what to do.
____ 7. I delve into my feelings to get a thorough understanding of them.
____ 8. I take action to try to make the situation better.
____ 9. I act as though it hasn't even happened.
____ 10. I say to myself "this isn't real."
____ 11. I take time to express my emotions.
____ 12. I pretend that it hasn't really happened.
____ 13. I learn to live with it.
____ 14. I think hard about what steps to take.
____ 15. I allow myself to express my emotions.
____ 16. I try to see it in a different light, to make it seem more positive
____ 17. I look for something good in what is happening.
____ 18. I feel free to express my emotions.
____ 19. I refuse to believe that it has happened.
____ 20. I get used to the idea that it happened.
____ 21. I realize that my feelings are valid and important.
____ 22. I daydream about things other than this.
____ 23. I just give up trying to deal with it.

____ 24. I do something to think about it less, such as going to movies or watching TV.
____ 25. I let my feelings come out freely.
____ 26. I give up the attempt to cope.
____ 27. I sleep more than usual to think about it less.
____ 28. I acknowledge my emotions.
____ 29. I try to grow as a person as a result of the experience.
____ 30. I reduce the amount of effort I'm putting into dealing with it.
____ 31. I turn to work or other activities to take my mind off things.
____ 32. I accept that this has happened and that it can't be changed.

Depressive Symptoms – Center for Epidemiological Studies – Depression Scale

From: Radloff, L. S. (1977). The CES-D Scale: A self report depression scale for research in the general population. *Applied Psychological Measurement*, *1*(3), 385–401. https://doi.org/10.1177/014662167700100306

Directions: Below is a list of feelings, attitudes, and behaviors that you may have experienced during the past week. Please use the scale below and circle the response that best describes how often you have had these experiences during the past week.

0 = Rarely or none of the time (less than 1 day)
1 = Some or a little of the time (1-2 days)
2 = Occasionally or a moderate amount of time (3-4 days)
3 = Most or all of the time (5-7 days)

<u>During the Past Week:</u>

1. I was bothered by things that usually don’t bother me.
2. I did not feel like eating; my appetite was poor.
3. I felt that I could not shake off the blues even with help from my family or friends.
4. I felt I was just as good as other people.
5. I had trouble keeping my mind on what I was doing.
6. I felt depressed.
7. I felt that everything I did was an effort.
8. I felt hopeful about the future.
9. I thought my life had been a failure.
10. I felt fearful.
11. My sleep was restless.
12. I was happy.
13. I talked less than usual.
14. I felt lonely.
15. People were unfriendly.
16. I enjoyed life.
17. I had crying spells.
18. I felt sad.
19. I felt that people disliked me.
20. I could not get going.

Depressive Symptoms – Patient Health Questionnaire – 4

Kroenke, K., Spitzer, R. L., Williams, J. B., & Löwe, B. (2009). An ultra-brief screening scale for anxiety and depression: the PHQ–4. *Psychosomatics*, *50*(6), 613-621.

Over the <u>last 2 weeks</u>, how often have you been bothered by the following problems? *(Use "✓" to indicate your answer)*	**Not at all**	**Several days**	**More than half the days**	**Nearly every day**
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed, or hopeless	0	1	2	3

Anxiety

Kroenke, K., Spitzer, R. L., Williams, J. B., & Löwe, B. (2009). An ultra-brief screening scale for anxiety and depression: the PHQ–4. *Psychosomatics*, *50*(6), 613-621.

Over the last **2 weeks**, how often have you been bothered by the following problems?

	Not at all	**Several days**	**More than half the days**	**Nearly everyday**
1. Feeling nervous, anxious, or on edge	1	2	3	4
2. Not being able to stop or control worrying	1	2	3	4

Pain Interference

Cella, D., Riley, W., Stone, A., Rothrock, N., Reeve, B., Yount, S., Amtmann, D., Bode, R., Buysse, D., Choi, S., & Cook, K. (2010). The Patient-Reported Outcomes Measurement Information System (PROMIS) developed and tested its first wave of adult self-reported health outcome item banks: 2005–2008. *Journal of clinical epidemiology*, *63*(11), 1179-1194.

Please respond to each question or statement by selecting one response per row.
In the **past 7 days,** how much did **pain** interfere with…

	Not at all	**A little bit**	**Somewhat**	**Quite a bit**	**Very much**

1. your day-to-day activities	0	1	2	3	4
2. work around the home?	0	1	2	3	4
3. your ability to participate in social activities?	0	1	2	3	4
4. your household chores?	0	1	2	3	4
5. the things you usually do for fun?	0	1	2	3	4
6. your enjoyment of social activities?	0	1	2	3	4

Appendix D. Study 2 Measures

Demographic and Medical Information

Date of birth_____________ Age________

Years of education (e.g., high school = 12 years) ______ years

How do you describe yourself?

- ☐ Male
- ☐ Female
- ☐ Other identification

Are you:

- ☐ Married/living as married. If yes, number of years married_______
- ☐ Single
- ☐ divorced/separated
- ☐ widowed

Do you have children? ____yes ____no
If yes, how many children do you have? ________
Number of children living in your home_____

Current or former occupation______________________
Current employment status:

- ☐ employed at least 30 hours a week
- ☐ employed fewer than 30 hours a week
- ☐ not employed for pay
- ☐ on disability/ medical leave

Which category best describes your total combined family income before taxes for the past 12 months?

- ☐ Less than $25,000
- ☐ $25,000 through $49,999
- ☐ $50,000 through $74,999
- ☐ $75,000 through $99,999
- ☐ $100,000 and greater

Ethnic group:

- ☐ African American/Black
- ☐ American Indian/Alaskan Native
- ☐ Asian
- ☐ Non-Hispanic White
- ☐ Hispanic/Latino/a
- ☐ Other, please specify__________________

What is your height? ____feet _____inches
What is your current weight in pounds? _________ pounds

Do you currently smoke? Yes No
If yes, how many cigarettes do you smoke/day (1 pack = 20 cigarettes)? ____ cigarettes

Do you drink alcohol? Yes No
If yes, how many drinks (1 drink = 12 oz of beer/5 oz of wine/1.5 oz of distilled spirits) do you have in a typical week? _______

When were you diagnosed with pancreatic cancer (month and year)? ______________
What is the stage of your pancreatic cancer?

- ☐ Stage 1 (localized to the pancreas)
- ☐ Stage 2 or 3 (grown outside the pancreas [e.g., lymph nodes, blood vessels] but not to distant organs
- ☐ Stage 4 (metastatic; spread to distant organs)
- ☐ I don’t know because I forgot.
- ☐ I don’t know because I haven’t been told.
- ☐ I don’t know because I don’t want to know.

Has the cancer spread to any other organs? Yes No Don’t know
If the answer is yes, to what other organs?

- ☐ Liver
- ☐ Lung
- ☐ Peritoneum
- ☐ Spleen
- ☐ Bowel
- ☐ Other, please specify ________________

Have you had chemotherapy? Yes No

If the answer is yes, please answer the questions below. If the answer is no, please skip.
What chemotherapy were you prescribed? Please select all that apply.

- ☐ Gemcitabine (Gemzar)
- ☐ Albumin-bound paclitaxel (Abraxane)
- ☐ 5-fluorouracil (5-FU)
- ☐ Docetaxel (Taxotere)
- ☐ Paclitaxel (Taxol)
- ☐ Irinotecan (Camptosar)
- ☐ Capecitabine (Xeloda)
- ☐ Cisplatin
- ☐ Methotrexate (MTX, amethopterin)
- ☐ Oxaliplatin (Eloxatin)
- ☐ Irinotecan liposome (Onivyde)
- ☐ Erlotinib (Tarceva)
- ☐ Other, please specify ___________________________

When did you start chemotherapy (month and year)? ___________________
How many cycles of chemotherapy have you received (For example, one week of treatment followed by three weeks of rest is one cycle)?
Are you still receiving chemotherapy? Yes No
If no, when did you stop chemotherapy (month and year)?___________________

Have you had radiation therapy? Yes No
If yes, when did you start radiation (month and year)? ___________
Are you still receiving radiation? Yes No N/A
If no, when did you stop radiation (month and year)?___________________

Have you had surgery for pancreatic cancer? Yes No
If the answer is yes, please answer the questions below, if the answer is no, skip.
How many surgeries have you had? (Do not count initial biopsy) ____________
What type of surgery did you have? Please select all that apply.

- ☐ Whipple procedure (pancreaticoduodenectomy)
- ☐ Distal pancreatectomy
- ☐ Total pancreatectomy
- ☐ Bile duct bypass surgery
- ☐ Enucleation
- ☐ Other, please specify _____________________________

Have you been diagnosed with any other cancer? Yes No
If the answer is yes, what were your cancer diagnoses? Please select all that apply.

- ☐ Breast cancer
- ☐ Lung Cancer
- ☐ Prostate Cancer
- ☐ Colorectal cancer
- ☐ Melanoma
- ☐ Nonmelanoma skin cancer
- ☐ Other, please specify _______________________

Do you have an oncologist outside UCLA? Yes No

If yes, please list name, practice, and location. For example, Dr. John Strauss, Tower Oncology/Cedars Sinai, Los Angeles, CA.

The following is a list of common problems. Please indicate if you currently have the problem in the first column. If you have the problem, please indicate in the second column if you receive medications or some other type of treatment for the problem. In the third column indicate if the problem limits any of your activities. Finally, indicate any medical conditions that are not listed at the end.

Problem	Do you have the problem?		Do you receive treatment for it?		Does it limit your activities?	
Heart disease	No	Yes	No	Yes	No	Yes
High blood pressure	No	Yes	No	Yes	No	Yes
Lung disease	No	Yes	No	Yes	No	Yes
Diabetes	No	Yes	No	Yes	No	Yes
Ulcer or stomach disease	No	Yes	No	Yes	No	Yes
Kidney disease	No	Yes	No	Yes	No	Yes
Liver disease	No	Yes	No	Yes	No	Yes
Anemia or other blood disease	No	Yes	No	Yes	No	Yes
Cancer (**other than pancreatic)**	No	Yes	No	Yes	No	Yes
Depression	No	Yes	No	Yes	No	Yes
Osteoarthritis, degenerative arthritis	No	Yes	No	Yes	No	Yes
Back pain	No	Yes	No	Yes	No	Yes
Rheumatoid arthritis	No	Yes	No	Yes	No	Yes
Anxiety	No	Yes	No	Yes	No	Yes
________________________	No	Yes	No	Yes	No	Yes
________________________	No	Yes	No	Yes	No	Yes

Approach- and avoidance-oriented coping

From: Carver, C. S., Scheier, M. F., & Weintraub, J. K. (1989). Assessing coping strategies: a theoretically based approach. *Journal of Personality and Social Psychology*, *56*(2), 267–283. https://doi.org/10.1037/0022-3514.56.2.267.

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4 = I do this a lot.

____ 1. I learn something from the experience.
____ 2. I take time to figure out what I'm really feeling.
____ 3. I concentrate my efforts on doing something about it.
____ 4. I admit to myself that I can't deal with it, and quit trying.
____ 5. I accept the reality of the fact that it happened.
____ 6. I try to come up with a strategy about what to do.
____ 7. I delve into my feelings to get a thorough understanding of them.
____ 8. I take action to try to make the situation better.
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____ 11. I take time to express my emotions.
____ 12. I pretend that it hasn't really happened.
____ 13. I learn to live with it.
____ 14. I think hard about what steps to take.
____ 15. I allow myself to express my emotions.
____ 16. I try to see it in a different light, to make it seem more positive.
____ 17. I look for something good in what is happening.
____ 18. I feel free to express my emotions.
____ 19. I refuse to believe that it has happened.
____ 20. I get used to the idea that it happened.
____ 21. I realize that my feelings are valid and important.
____ 22. I daydream about things other than this.
____ 23. I just give up trying to deal with it.
____ 24. I do something to think about it less, such as going to movies or watching TV.
____ 25. I let my feelings come out freely.
____ 26. I give up the attempt to cope.
____ 27. I sleep more than usual to think about it less.
____ 28. I acknowledge my emotions.
____ 29. I try to grow as a person as a result of the experience.
____ 30. I reduce the amount of effort I'm putting into dealing with it.
____ 31. I turn to work or other activities to take my mind off things.
____ 32. I accept that this has happened and that it can't be changed.

Depressive Symptoms – Center for Epidemiological Studies – Depression Scale

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Directions: Below is a list of feelings, attitudes, and behaviors that you may have experienced during the past week. Please use the scale below and circle the response that best describes how often you have had these experiences during the past week.

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5. I had trouble keeping my mind on what I was doing.
6. I felt depressed.
7. I felt that everything I did was an effort.
8. I felt hopeful about the future.
9. I thought my life had been a failure.

10. I felt fearful.
11. My sleep was restless.
12. I was happy.
13. I talked less than usual.
14. I felt lonely.
15. People were unfriendly.
16. I enjoyed life.
17. I had crying spells.
18. I felt sad.
19. I felt that people disliked me.
20. I could not get going.

Depressive Symptoms – Patient Health Questionnaire - 4

Kroenke, K., Spitzer, R. L., Williams, J. B., & Löwe, B. (2009). An ultra-brief screening scale for anxiety and depression: the PHQ–4. *Psychosomatics*, *50*(6), 613-621.

Over the <u>last 2 weeks</u>, how often have you been bothered by the following problems? *(Use "✓" to indicate your answer)*	**Not at all**	**Several days**	**More than half the days**	**Nearly every day**
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed, or hopeless	0	1	2	3

Anxiety

Kroenke, K., Spitzer, R. L., Williams, J. B., & Löwe, B. (2009). An ultra-brief screening scale for anxiety and depression: the PHQ–4. *Psychosomatics*, *50*(6), 613-621.

Over the last **2 weeks**, how often have you been bothered by the following problems?

	Not at all	**Several days**	**More than half the days**	**Nearly everyday**
3. Feeling nervous, anxious, or on edge	1	2	3	4
4. Not being able to stop or control worrying	1	2	3	4

Pain Interference

Cella, D., Riley, W., Stone, A., Rothrock, N., Reeve, B., Yount, S., Amtmann, D., Bode, R., Buysse, D., Choi, S., & Cook, K. (2010). The Patient-Reported Outcomes Measurement Information System (PROMIS) developed and tested its first wave of adult self-reported health outcome item banks: 2005–2008. *Journal of clinical epidemiology*, *63*(11), 1179-1194.

Please respond to each question or statement by selecting one response per row.
In the **past 7 days,** how much did **pain** interfere with…

	Not at all	**A little bit**	**Somewhat**	**Quite a bit**	**Very much**
1. your day-to-day activities	0	1	2	3	4
2. work around the home?	0	1	2	3	4
3. your ability to participate in social activities?	0	1	2	3	4
4. your household chores?	0	1	2	3	4

5. the things you usually do for fun?	0	1	2	3	4
6. your enjoyment of social activities?	0	1	2	3	4

Appendix 3: Supplementary Tables Study 1

Non-significant interactions from regression models.

Prognosis perception x coping processes on depressive symptoms

	Depressive Symptoms				
	b	*SE*	*t*	*p*	95% CI
Constant	.56	.39	1.44	.80	-2.16, 1.34
Gender	.71	.46	1.55	.13	-.20, 1.61
Prognosis Perception	**1.55**	**.48**	**3.22**	**.002**	**.59, 2.51**
Processing	.30	.36	.84	.41	-.42, 1.02
Prognosis x Processing	-.58	.57	-1.03	.31	-1.71, .55
	F	*p*	R^2 change	*df*	
Interaction Term	1.06	.307	.012	1, 72	
	F	*p*	R^2	*df*	MSE
Model	3.59	.010	.166	4, 72	3.58
	b	*SE*	*t*	*p*	95% CI
Constant	.66	.38	1.74	.085	-.095, 1.42
Gender	.58	.45	1.28	.21	-.32, 1.49

Prognosis Perception	**1.41**	**.47**	**2.98**	**.004**	**.47, 2.36**
Expression	.40	.32	1.23	.22	-.25, 1.04
Prognosis x Expression	-.50	.57	-.89	.38	-1.63, .63
	F	*p*	R^2 change	*df*	
Interaction Term	.783	.379	.009	1,74	
	F	p	R^2	df	MSE
Model	3.11	.02	.144	4,74	3.11
	b	*SE*	*t*	*p*	95% CI
Constant	.72	.39	1.86	.067	-.053, 1.49
Gender	-.62	.44	1.39	.17	-.27, 1.50
Prognosis Perception	**1.47**	**.46**	**3.19**	**.002**	**.55, 2.39**
Acceptance	.21	.39	.53	.596	-.58, 1.0
Prognosis x Acceptance	-.81	.77	-1.04	.301	-2.34, .74
	F	*p*	R^2 change	*df*	
Interaction Term	1.08	.301	.012	1,74	
	F	*p*	R^2	*df*	MSE
Model	2.95	.026	.14	4,74	3.65
	b	*SE*	*t*	*p*	95% CI
Constant	.80	.38	2.12	.037	.048, 1.54
Gender	.54	.44	1.22	.23	-.34, 1.41
Prognosis Perception	**1.21**	**.46**	**2.63**	**.01**	**.29, 2.12**
Avoidance Coping	.87	.60	1.46	.15	-.32, 2.07
Terminal x Avoidance	.96	1.22	.79	.43	-1.47, 3.39
	F	*p*	R^2 change	*df*	
Interaction Term	.62	.434	.007	1, 73	
	F	*p*	R^2	*df*	MSE
Model	4.06	.005	.182	4, 73	3.47

	Anxiety Symptoms				
	b	*SE*	*t*	*p*	95% CI
Constant	.31	.26	1.19	.237	-.21, .81
Gender	**.64**	**.30**	**2.11**	**.038**	**.035, 1.24**
Prognosis Perception	.60	.31	1.92	.059	-.023, 1.23
Expression	.26	.22	1.18	.243	-.18, .69
Prognosis x Expression	-.65	.37	-1.75	.084	-1.38, .09
	F	P	R^2 change	Df	

Interaction Term	3.07	.084	.035	1, 75	
	F	p	R^2	df	MSE
Model	2.93	.026	.135	4, 75	1.66
	b	*SE*	*t*	*p*	95% CI
Constant	.36	.26	1.37	.17	-.16, .88
Gender	**.64**	**.30**	**2.12**	**.037**	**.039, 1.23**
Prognosis Perception	**.70**	**.31**	**2.26**	**.027**	**.083, 1.32**
Acceptance	.21	.27	.79	.43	-.32, .74
Prognosis x Acceptance	-.81	.52	-1.57	.12	-1.84, .22
	F	P	R^2 change	Df	
Interaction Term	2.48	.12	.028	1, 75	
	F	P	R^2	Df	MSE
Model	2.64	.04	.123	4, 75	1.67
	b	*SE*	*t*	*p*	95% CI
Constant	.33	.27	1.22	.23	-.21, .86
Gender	**.65**	**.31**	**2.12**	**.038**	**.04, 1.26**
Prognosis Perception	**.68**	**.32**	**2.11**	**.038**	**.04, 1.32**
Active Coping	.089	.24	.37	.71	-.39, .57
Terminal x Active/Planning	-.007	.41	-.02	.99	-.82, .80
	F	P	R^2 change	Df	
Interaction Term	.00029	.99	0.00	1, 75	
	F	P	R^2	Df	MSE
Model	2.01	.10	.097	4, 75	1.72
	b	*SE*	*t*	*p*	95% CI
Constant	.30	.26	1.12	.27	-.23, .82
Gender	**.75**	**.31**	**2.43**	**.018**	**.13, 1.36**
Prognosis Perception	**.68**	**.32**	**2.14**	**.036**	**.05, 1.31**
Avoidance Coping	.14	.42	.34	.73	-.70, .98
Terminal * Avoidance	-.79	.86	-.93	.36	-2.49, .91

	F	P	R^2 change	Df	
Interaction Term	.86	.36	.01	1, 74	
	F	P	R^2	Df	MSE
Model	2.32	.065	.111	4, 74	1.71

Pain interference

	b	*SE*	*t*	*p*	95% CI
Constant	10.40	1.48	7.04	<.001	7.45, 13.34
Gender	1.67	1.71	.97	.33	-1.75, 5.08
Prognosis Perception	3.11	1.80	1.72	.089	-.49, 6.7
Processing	.88	1.36	.64	.52	-1.84, 3.59
Prognosis * Processing	1.32	2.14	.62	.54	-2.94, 5.59
	F	P	R^2 change	Df	
Interaction Term	.38	.54	.005	1, 73	
	F	p	R^2	df	MSE
Model	1.23	.31	.063	4, 73	51.35
	b	*SE*	*t*	*p*	95% CI
Constant	10.57	1.42	7.46	< .001	7.75, 13.40
Gender	1.13	1.68	.67	.50	-2.22, 4.48
Prognosis Perception	2.67	1.74	1.54	.13	-.80, 6.13
Expression	1.54	1.21	1.27	.21	-.88, 3.95
Prognosis * Expression	-.83	2.05	-.40	.69	-4.90, 3.25
	F	P	R^2 change	Df	
Interaction Term	.16	.69	.002	1, 75	
	F	p	R^2	df	MSE
Model	1.12	.36	.056	4, 75	50.90
	b	*SE*	*t*	*p*	95% CI
Constant	10.60	1.42	7.49	<.001	7.78, 13.42
Gender	1.35	1.62	.83	.41	-1.88, 4.59
Prognosis Perception	2.73	1.69	1.62	.11	-.62, 6.09
Acceptance	-.90	1.45	-.62	.54	-3.78, 1.99
Prognosis * Acceptance	-4.47	2.81	-1.59	.12	-10.06, 1.12
	F	P	R^2 change	Df	
Interaction Term	2.54	.12	.031	1, 75	

	F	P	R^2	Df	MSE
Model	1.97	.11	.095	4, 75	49.21
	b	*SE*	*t*	*p*	95% CI
Constant	10.26	1.48	6.92	< .001	7.3, 13.21
Gender	1.90	1.69	1.12	.27	-1.47, 5.27
Prognosis Perception	2.13	1.78	1.2	.23	-1.41, 5.68
Active/Planning Coping	.30	1.32	.23	.82	-2.34, 2.94
Terminal * Active/Planning	-.65	2.25	-.29	.77	-5.13, 3.83
	F	P	R^2 change	Df	
Interaction Term	.084	.77	.001	1, 75	
	F	P	R^2	Df	MSE
Model	.62	.65	.032	4, 75	52.63
	b	*SE*	*t*	*p*	95% CI
Constant	10.65	1.44	7.41	<.001	7.78, 13.5
Gender	1.67	1.68	.99	.33	-1.68, 5.02
Prognosis Perception	2.12	1.74	1.22	.23	-1.34, 5.59
Avoidance Coping	2.86	2.30	1.24	.22	-1.73, 7.45
Terminal * Avoidance	-1.87	4.67	-.4	.69	-11.17, 7.44
	F	P	R^2 change	Df	
Interaction Term	.16	.69	.002	1, 74	
	F	P	R^2	Df	MSE
Model	1.07	.38	.055	4, 74	51.18

Table. Treatment goals x coping models

Depression
Emotional Processing

	Unstandardized beta coefficient	*SE*	*t*	*p*	95% CI
Constant	1.56	0.53	2.93	.005	0.50, 2.62
Gender	0.41	0.49	.845	.401	-0.56, 1.39
Treatment Goal	-0.35	0.50	-0.69	.490	-1.35, 0.65
Processing	0.51	0.59	0.87	.389	-0.67, 1.69
Interaction	-0.88	0.67	-1.32	.191	-2.22, 0.45
	F	*p*	R^2 change	*df*	

Interaction Term	1.74	.191	.023	3, 74	
	F	*p*	Total R^2	*df*	MSE
Model	.99	.417	.052	4, 73	4.06

Emotional Expression

	Unstandardized beta coefficient	Standard Error	*t*	*p*	95% CI
Constant	1.51	0.50	3.00	.004	0.51, 2.51
Gender	0.51	0.48	1.05	.296	-0.45, 1.47
Treatment. Goal	-0.41	0.49	-0.84	.404	-1.37, 0.56
Expression	0.11	0.51	0.21	.834	-0.91, 1.12
Interaction	-0.12	0.59	-0.20	.844	-1.30, 1.06
	F	P	R^2 change	Df	
Interaction Term	0.039	.844	.0005	3, 76	
	F	p	R^2	df	MSE
Model	.57	.686	.029	4, 75	4.08

Acceptance

	Unstandardized beta coefficient	Standard Error	*t*	*p*	95% CI
Constant	1.63	0.52	3.15	.002	0.60, 2.66
Gender	0.42	0.47	0.89	.375	-0.52, 1.36
Treatment Goal	-0.44	0.49	-0.89	.374	-1.43, 0.54
Acceptance	0.05	0.77	0.07	.948	-1.49, 1.59
Interaction	-0.002	0.87	-.003	.998	-1.74, 1.73
	F	P	R^2 change	Df	
Interaction Term	0.00001	.998	0.0	3, 76	
	F	p	R^2	df	MSE
Model	0.46	.764	.024	4, 75	4.11

Active

	Unstandardized beta coefficient	Standard Error	*t*	*p*	95% CI
Constant	1.61	0.52	3.12	.003	.58, 2.64
Gender	0.46	0.47	0.99	.326	-.47, 1.39
Treatment. Goal	-0.45	0.49	-0.91	.365	-1.44, .53
Active	-0.03	0.58	-0.06	.956	-1.91, 1.13
Interaction	-0.29	0.67	-0.43	.670	-1.63, 1.06
	F	P	R^2 change	Df	
Interaction Term	0.18	.670	.002	3, 76	

	F	p	R^2	df	MSE
Model	.683	.606	.035	4, 75	4.06

Reappraisal

	Unstandardized beta coefficient	Standard Error	*t*	*p*	95% CI
Constant	1.72	0.61	2.83	.007	0.49, 1.94
Gender	0.13	0.62	0.21	.833	-1.12, 1.38
Treatment Goal	-0.05	0.63	-0.09	.932	-1.32, 1.21
Reappraisal	-0.93	0.62	-1.52	.137	-2.17, .31
Interaction	0.50	0.75	0.67	.504	-1.00, 2.01
	F	P	R^2 change	Df	
Interaction Term	.45	.504	.010	3, 43	
	F	p	R^2	df	MSE
Model	.80	.530	.071	4, 42	4.05

Avoidance

	Unstandardized beta coefficient	Standard Error	*t*	*p*	95% CI
Constant	1.52	0.48	3.14	.002	0.55, 2.48
Gender	0.49	0.45	1.09	.280	-0.40, 1.38
Treatment Goal	-0.39	0.47	-0.83	.410	-1.33, 0.55
Avoidance	2.54	1.33	1.91	.060	-0.11, 5.18
Interaction	-1.51	1.46	-1.04	.303	-4.41, 1.39
	F	P	R^2 change	Df	
Interaction Term	1.08	.303	.013	3, 75	
	F	p	R^2	df	MSE
Model	2.41	.057	.115	4, 74	3.74

Anxiety

Emotional Processing

	Unstandardized beta coefficient	Standard Error	*t*	*p*	95% CI
Constant	0.53	0.34	1.54	.127	-0.15, 1.22
Gender	0.63	0.32	2.01	.049	0.004, 1.26
Treatment Goal	0.05	0.32	0.15	.878	-0.60, 0.70
Processing	0.29	0.38	0.76	.449	-.47, 1.06
Interaction	-0.71	0.43	-1.63	.107	-1.57, 0.16
	F	P	R^2 change	Df	
Interaction Term	2.67	.107	.032	3, 75	
	F	p	R^2	df	MSE

Model	2.30	.067	.111	4, 74	1.70

Emotional Expression

	Unstandardized beta coefficient	Standard Error	*t*	*p*	95% CI
Constant	0.61	0.33	1.83	.072	-.055, 1.27
Gender	0.59	0.32	1.86	.067	-.041, 1.21
Treatment Goal	-0.02	0.32	-0.06	.952	-0.66, 0.62
Expression	0.20	0.34	0.58	.561	-0.48, 0.87
Interaction	-0.33	0.39	-0.84	.403	-1.11, 0.45
	F	P	R^2 change	Df	
Interaction Term	0.71	.403	.009	3, 77	
	F	p	R^2	df	MSE
Model	1.19	.321	.059	4, 76	1.79

Acceptance

	Unstandardized beta coefficient	Standard Error	*t*	*p*	95% CI
Constant	0.65	0.34	1.90	.062	-0.03, 1.33
Gender	0.57	0.31	1.85	.069	-0.05, 1.19
Treatment Goal	-0.44	0.33	-0.14	.893	-0.70, .61
Acceptance	0.08	0.51	0.16	.870	-0.94, 1.10
Interaction	-0.07	0.58	-0.12	.903	-1.22, 1.08
	F	P	R^2 change	Df	
Interaction Term	.02	.903	.0002	3, 77	
	F	p	R^2	df	MSE
Model	.91	.461	.046	4, 76	1.81

Active

	Unstandardized beta coefficient	Standard Error	*t*	*p*	95% CI
Constant	0.64	0.34	1.88	.065	-0.04, 1.33
Gender	0.57	0.31	1.86	.067	-0.04, 1.19
Treatment Goal	-0.04	0.33	-0.12	.902	-0.70, 0.61
Active	0.07	0.39	0.19	.853	-0.70, 0.84
Interaction	-0.10	0.45	-0.23	.822	-0.99, 0.79
	F	P	R^2 change	df	
Interaction Term	.05	.822	.001	3, 77	
	F	p	R^2	df	MSE
Model	0.92	.458	.046	4, 76	1.81

Reappraisal

	Unstandardized beta coefficient	Standard Error	*t*	*p*	95% CI
Constant	0.66	0.49	1.35	.185	-0.33, 1.65
Gender	0.60	0.50	1.21	.233	-0.40, 1.60
Treatment Goal	0.18	0.51	0.35	.730	-0.85, 1.20
Reappraisal	0.01	0.50	0.01	.992	-1.0, 1.01
Interaction	-0.16	0.69	-0.26	.795	-1.38, 1.06
	F	P	R^2 change	Df	
Interaction Term	.07	.795	.001	3, 44	
	F	p	R^2	df	MSE
Model	.43	.788	.038	4, 43	2.67

Avoidance

	Unstandardized beta coefficient	Standard Error	*t*	*p*	95% CI
Constant	0.63	0.34	1.87	.066	-0.04, 1.30
Gender	0.63	0.31	2.03	.046	0.01, 1.24
Treatment Goal	-0.06	0.33	-0.18	.854	-0.71, 0.59
Reappraisal	0.32	0.92	0.35	.727	-1.52, 2.16
Interaction	-0.33	1.01	-0.33	.745	-2.35, 1.69
	F	P	R^2 change	Df	
Interaction Term	0.11	.745	.001	3, 76	
	F	p	R^2	df	MSE
Model	1.11	.357	.056	4, 75	1.81

Pain Interference

Emotional Processing

	Unstandardized beta coefficient	Standard Error	*t*	*p*	95% CI
Constant	50.45	2.79	18.08	<.001	44.89, 56.01
Gender	2.39	2.56	.94	.352	-2.70, 7.49
Treatment Goal	.72	2.63	.28	.784	-4.53, 5.97
Processing	-1.48	3.12	-.48	.636	-7.68, 4.73
Interaction	3.50	3.52	.99	.324	-3.52, 10.52
	F	P	R^2 change	Df	
Interaction Term	.99	.324	.013	3, 75	
	F	p	R^2	df	MSE
Model	.63	.642	.033	4, 74	112.36

Emotional Expression

	Unstandardized beta coefficient	Standard Error	*t*	*p*	95% CI
Constant	50.72	2.61	19.44	< .001	45.52, 55.91
Gender	1.43	2.48	.58	.567	-3.51, 6.37
Treatment Goal	0.93	2.52	.37	.713	-4.09, 5.96
Expression	0.19	2.66	.07	.943	-5.10, 5.49
Interaction	2.01	3.08	.65	.516	-4.13, 8.15
	F	P	R^2 change	Df	
Interaction Term	.43	.516	.006	3, 77	
	F	p	R^2	df	MSE
Model	.62	.647	.032	4, 76	111.13

Acceptance

	Unstandardized beta coefficient	Standard Error	*t*	*p*	95% CI
Constant	50.40	2.64	19.07	< .001	45.14, 55.67
Gender	2.13	2.39	.89	.378	-2.64, 6.89
Treatment Goal	0.62	2.53	.25	.806	-4.41, 5.65
Acceptance	**-8.83**	**3.96**	**-2.23**	**.029**	**-16.72, -.94**
Interaction	8.69	4.45	1.95	.055	-.18, 17.56
	F	P	R^2 change	Df	
Interaction Term	3.81	.055	.046	3, 77	
	F	p	R^2	df	MSE
Model	1.50	.211	.073	4, 76	107.82

Active

	Unstandardized beta coefficient	Standard Error	*t*	*p*	95% CI
Constant	50.37	2.71	18.56	< .001	44.97, 55.77
Gender	2.33	2.44	0.96	.343	-2.53, 7.18
Treatment Goal	.55	2.60	0.21	.832	-4.63, 5.73
Reappraisal	-3.41	3.07	-1.11	.270	-9.53, 2.70
Interaction	3.54	3.54	1.0	.321	-3.51, 10.59
	F	P	R^2 change	Df	
Interaction Term	1.0	.321	.012	3, 77	
	F	p	R^2	df	MSE
Model	.55	.697	.028	4, 76	113.04

Reappraisal

	Unstandardized beta coefficient	Standard Error	*t*	*p*	95% CI

Constant	49.82	3.09	16.14	< .001	43.59, 56.04
Gender	1.10	3.11	.35	.725	-5.18, 7.38
Treatment Goal	2.30	3.19	.72	.475	-4.13, 8.72
Reappraisal	-4.11	3.13	-1.31	.197	-10.43, 2.21
Interaction	7.15	3.80	1.88	.066	-0.50, 14.81
	F	P	R^2 change	Df	
Interaction Term	3.55	.066	.075	3, 44	
	F	p	R^2	df	MSE
Model	1.13	.355	.095	4, 43	105.34

Avoidance

	Unstandardized beta coefficient	Standard Error	*t*	*p*	95% CI
Constant	50.94	2.60	19.59	< .001	45.76, 56.11
Gender	1.60	2.39	.67	.505	-3.16, 6.36
Treatment Goal	0.65	2.54	.26	.799	-4.40, 5.70
Reappraisal	3.54	7.15	.50	.622	-10.70, 17.78
Interaction	2.15	7.84	.27	.785	-13.46, 17.75
	F	P	R^2 change	Df	
Interaction Term	.08	.785	.001	3, 76	
	F	p	R^2	df	MSE
Model	1.07	.379	.054	4, 75	108.48