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Modifiable Characteristics Associated with Fear of Cancer Recurrence among Colorectal Cancer Survivors

by

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A thesis submitted in partial fulfillment
of the requirements for the degree of
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DEDICATION

To my husband, Bryan, my mom, Shari, my father, Bill, and my sisters, Marissa and Piper,

whose unconditional love and continual support made this project possible.

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ABSTRACT

Fear of cancer recurrence (FCR) is regarded as one of the most common and distressing issues affecting cancer survivors. Observational studies have identified several modifiable characteristics associated with FCR. However, many of the findings are based on post-hoc analyses and come from studies in which FCR was not identified as a primary outcome. This study sought to overcome these limitations by using a model comprised of cognitive, behavioral, and social characteristics as a framework for examining modifiable characteristics associated with FCR. A sample of 120 patients who had been diagnosed with colorectal cancer and completed cancer treatment in the past 6 to 36 months was recruited during routine outpatient visits or by mail for participation in the study. Medical record reviews were conducted to assess clinical variables, and participants filled out a standard demographic questionnaire as well as self-report measures of characteristics resistant to modification (perceived risk of recurrence, neuroticism, conscientiousness), cognitive modifiable characteristics (self-efficacy, positive beliefs about worry, negative beliefs about worry, misinterpretation of symptoms, intolerance of uncertainty and rumination), behavioral modifiable characteristics (reassurance seeking and health-related reassurance seeking), and social modifiable characteristics (social support and social constraints). As hypothesized, results demonstrated that modifiable characteristics (i.e., self efficacy, positive beliefs about worry, negative beliefs about worry, intolerance of uncertainty, rumination, reassurance seeking, health-related reassurance seeking and social constraints) were associated with FCR (all p's < .05). Multivariable regression analyses

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demonstrated that modifiable characteristics accounted for 13% of the variance in FCR beyond that accounted for by non-modifiable characteristics ($p < .001$), with self-efficacy, rumination and health-related reassurance seeking accounting for unique variance in FCR. This study has identified several modifiable characteristics that should be considered as targets for interventions seeking to reduce FCR among cancer survivors.

INTRODUCTION

Fear of cancer recurrence (FCR) is regarded as one of the most common and distressing issues affecting cancer survivors (Vickberg, 2003). Studies conducted among patients with breast, ovarian, colon, lung or prostate cancer demonstrate that FCR is among the top concerns for these survivors (Baker, Denniston, Smith & West, 2005; Fitch, Gray & Franssen, 2000; Mehnert, Berg, Henrich & Herschbach, 2009). Furthermore, greater FCR has been associated with greater psychological distress, more depressive symptoms, greater anxiety, and poorer quality of life (Clayton, Mishel & Belyea, 2006; Skaali et al., 2009; Thewes et al., 2012). Additionally, patients with greater FCR tend to use more healthcare services, which likely results in greater costs to the healthcare system (Lebel, Tomei, Feldstain, Beattie & McCallum, 2013).

Studies have identified a number of characteristics associated with fear of recurrence. As described below, these characteristics can be divided up into characteristics that are generally resistant to modification (e.g., demographic, clinical, and personality characteristics of the individual), which will be referred to as "non-modifiable" characteristics, and modifiable characteristics (e.g., psychological characteristics of the individual). It is important to distinguish between those characteristics that are modifiable versus those that are not so that effective interventions can be developed to target the modifiable characteristics associated with FCR. The purpose of this study is to identify modifiable characteristics associated with FCR in order to inform future development of an intervention.

Systematic reviews of the literature on FCR have identified a number of non-modifiable characteristics related to this construct (Crist & Grunfeld, 2013; Koch, Jansen, Brenner & Arndt,

2013; Simard et al., 2013). These reviews have reported that greater FCR is consistently associated with younger age, worse disease severity, and more intense treatment (Simard et al., 2013). For example, a recent study by McGinty and colleagues (2012) found that breast cancer survivors who were younger, at a more advanced disease stage and reported greater perceived risk of recurrence reported greater FCR. Another study of patients with mixed cancer diagnoses found that greater fear of recurrence was associated with more advanced cancer and administration of adjuvant chemotherapy (Savard & Ivers, 2013). These findings regarding non-modifiable risk characteristics can help clinicians identify those patients who might be most in need of an intervention designed to prevent or relieve FCR. However, to determine what characteristics should be targeted in such interventions, it is important to identify modifiable characteristics associated with FCR.

With regard to modifiable characteristics, two pertinent lines of research will be reviewed: 1) observational studies examining characteristics associated with FCR, and 2) intervention studies on FCR. A useful conceptual framework for categorizing and distinguishing these modifiable characteristics are cognitive behavioral models of health anxiety and generalized anxiety disorder (Dugas, Gagnon, Ladouceur & Freeston, 1998; Dugas, Marchand, Ladouceur, 2005; Langlois,& Ladouceur, 2004). These models focus on the impact that thoughts and behaviors can have on emotional reactions, like FCR. For example, individuals with heightened FCR may be more likely to experience biased cognitions such as misinterpreting benign physical symptoms and engage in reassurance seeking behaviors, such as visits to the doctor. Social characteristics, such as the availability of social support and a lack of social constraints in important relationships, have also been shown to be particularly important for successful emotional adjustment to cancer (Lepore, 2001; Lepore & Revenson, 2007). Therefore,

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the cognitive behavioral model will be expanded upon in this study to include social characteristics as well. With this conceptual framework in mind, we review relevant observational and interventional research to identify cognitive, behavioral and social characteristics that may be related to FCR.

Observational studies have identified a number of modifiable characteristics associated with FCR. In one systematic review of these studies, researchers found that social influences, such as family stressors and having fewer significant others were related to greater FCR (Crist & Grunfeld, 2013). Other studies have identified behaviors associated with FCR, such as frequent visits to the doctors (Lebel et al., 2013; Koch et al., 2014). Additionally, a number of cognitive characteristics have also been found to be related to FCR. Having more intrusive thoughts, misinterpreting benign physical symptoms, engaging in negative thinking styles, making greater use of avoidance coping strategies, using fewer positive reappraisals, and having lower self-efficacy are all associated with higher reported fear of recurrence. (Melchior et al., 2013; Myers et al., 2013; Park, Cho, Blank, & Wortmann, 2013; Thewes, Bell & Butow, 2013).

These studies help identify intervention targets worthy of study, such as coping strategies, misinterpretation of physical symptoms, reassurance seeking, intrusive thoughts, negative thinking styles, the use of cognitive reappraisals, and self-efficacy. However, the studies that produced these findings are characterized by a number of limitations. Many of the findings are based on post-hoc analyses and many come from studies in which FCR was not identified as a primary outcome; consequently, these studies were not specifically designed to assess characteristics associated with FCR, nor were their analyses based on a theoretical or conceptual model of FCR. Additionally, many of the studies were conducted with only breast cancer patients (Melchior et al., 2013; Thewes, Bell & Butow, 2013). Consequently, the generalizability

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of these findings to survivors of other types of cancer and possible gender differences in FCR are unknown.

The second line of research pertinent to this topic is the intervention literature on FCR. To date, only eight studies have been conducted that were designed specifically to test interventions for FCR. Two studies evaluated a manualized cognitive-existential intervention for FCR. One of these studies by Lebel and colleagues (2014) used a single-arm design to evaluate a cognitive-existential group intervention for FCR among 56 women with breast or ovarian cancer who reported moderate to high levels of FCR. The other study, by Moran and colleagues (2017), used a subset of cancer survivors participating in a larger randomized controlled trial evaluating the efficacy of a manualized cognitive-existential intervention to assess one aspect of the intervention, the worst case scenario exercise, which was adapted to an individual format. In the worst case scenario exercise, participants were asked to write their worst case scenario, then read it out-loud every day and rate their anxiety before and after (Moran et al., 2017). One of the strengths of these studies is that they used a manualized intervention with content based upon two existing theoretical frameworks (Lebel et al., 2014). Specifically, the interventions draw on Leventhal's common sense model (Leventhal, Leventhal & Richard, 1998), which can be used to posit that FCR results when internal and external cues (e.g., physical symptoms or medical appointments) increase perceived risk of recurrence. Increases in perceived risk of recurrence then lead to even more focus on physical symptoms and misinterpretations of them as signs of disease recurrence, which, in turn, can lead to maladaptive behaviors such as reassurance seeking, excessive worry, avoidance, and body checking (Lebel et al., 2014). Therefore, these interventions sought to increase awareness of triggers of FCR, decrease maladaptive coping strategies and increase adaptive coping strategies. The interventions also draw on Mishel's

uncertainty in illness theory (Mishel, 1988), which can be used to posit that FCR is heightened when individuals are uncertain about the outcome of their illness due to treatment complexity or lack of knowledge about which physical symptoms might indicate a recurrence. Therefore, these interventions aimed to increase knowledge regarding symptoms of recurrence and increase tolerance of uncertainty. Additionally, cognitive models of worry emphasize the function of worry as a strategy for avoiding feared outcomes, such as disease recurrence, by interfering with emotional processing (Furer, Walker & Freeston, 2001; Ladouceur et al., 2000; Langlois & Ladouceur, 2004). To this end, the interventions targeted awareness of FCR, catastrophic thoughts about physical symptoms, maladaptive coping strategies, avoidance of feared outcomes, beliefs about the benefits of worrying and toleration of uncertainty (Lebel et al., 2014). Authors of the first study reported significant improvements on measures of FCR, cancer-specific distress and uncertainty (Lebel et al., 2014). However, the study lacked a control group and did not examine mediators, limiting the conclusions that can be drawn from the findings. The second study by Moran and colleagues (2017) found that higher adherence to the worst case scenario homework was significantly related to lower post-intervention FCR. However, this study was comprised of a subset of sample participants (53% of the overall sample) who agreed to share their homework, lacked a control group and could not isolate the effects of the exercises from the overall therapy effects (Moran et al., 2017).

Two studies to date have examined the efficacy of cognitive behavioral therapy for FCR. One of these studies by Herschbach and colleagues (2010), randomly assigned 174 cancer patients to either cognitive behavioral group therapy (CBT) or a supportive-experiential group therapy (SET), and compared them to a control group recruited one year later. Both interventions involved four 90-minutes group sessions. Although a theoretical framework was not identified,

the CBT intervention was based on principles of CBT and therefore targeted awareness of fears and triggers for FCR, coping strategies and the ability to withstand their fears regarding recurrence (Herschbach et al., 2010). The SET intervention was client-centered and non-directive, targeting emotional and social support, but allowing patients to choose topics of discussion (e.g., coping with illness, partnership and social support; Herschbach et al., 2010). Findings showed that fear of progression decreased in both intervention groups as compared to the control group (Hershbach et al., 2010). However, participants in the control group were not randomized and were recruited at a later time, and mediators were not examined to identify effective intervention targets. The other study by van de Wal and colleagues (2017) used a randomized controlled trial to evaluate the efficacy of an individual cognitive behavioral intervention among 88 breast, prostate or colorectal cancer survivors with high FCR. One of the strengths of this study is that it used one existing theoretical framework to inform the intervention content (van de Wal et al., 2017). Similar to the study by Lebel and colleagues (2014), the intervention draws on the theory proposed by Lee-Jones and colleagues (1997) derived from Leventhal's common sense model (Leventhal, Leventhal & Richard, 1998). Therefore, this intervention sought to increase awareness of thoughts, behaviors and emotions related to FCR, decrease maladaptive thinking patterns and beliefs about FCR, and increase adaptive behavioral responses (van de Wal et al., 2015). The intervention was delivered during five face-to-face sessions and three brief online chat or telephone sessions. When compared to the usual care group, patients who received the CBT intervention reported significantly less FCR and exhibited greater clinically significant improvement in FCR (van de Wal et al., 2017). However, the study did not examine mediators nor did it include an active control group, again limiting the conclusions that can be drawn from the findings.

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A single-arm study evaluated a Mindfulness-based Cognitive Therapy (MBCT) group intervention for 19 men with advanced prostate cancer (Chambers, Foley, Galt, Ferguson, & Clutton, 2012). The intervention addressed the following targets in eight weekly two-hour group sessions: intrusive negative thoughts, existential regret, increased hyperarousal and anxiety, experiential avoidance, the extent to which treatment side effects were experienced as bothersome and illness adjustment (Chambers et al., 2012). The authors reported significant improvements on measures of anxiety, avoidance and mindfulness. Additionally, there was a non-significant trend for improvement on a measure of FCR (Chambers et al., 2012). However, this study included only a single arm, so it is unclear whether the improvements occurred as a result of the intervention or due to extraneous factors. Additionally, the investigators did not test for mediators, so no conclusions can be drawn about which intervention targets might be responsible for changes associated with intervention delivery.

A study by Dieng and colleagues (2016) evaluated a psychoeducational intervention for melanoma cancer survivors in which participants were randomly assigned to the intervention comprised of an educational booklet and three individual telephone-based therapy sessions or usual care (Dieng et al., 2016). Development of the educational booklet and the therapy sessions were based on the Transactional Model of Stress and Coping and core principles of brief psychodynamically-oriented psychotherapy. The overall goals of the intervention were to understand the participant using empathic listening and to facilitate development of effective emotional and behavioral coping skills (Dieng et al., 2015). Beneficial effects were found for the intervention group on FCR, stress and melanoma-related knowledge (Dieng et al., 2016). However, limited conclusions can be drawn regarding the active ingredient in the treatment because the study did not examine mediators, nor did it have an active control group.

A study examining the effectiveness of a gratitude intervention on death-related FCR included 67 breast cancer survivors randomly assigned to a 6-week online gratitude intervention or a 6-week online control condition (Otto, Szczesny, Woriano, Laurenceau & Siegel, 2016). All participants were asked to spend 10 minutes writing, with those in the intervention group being prompted to write a letter expressing gratitude and those in the control group being prompted to list and describe activities they had engaged in recently (Otto, et al., 2016). The intervention was hypothesized to exert an influence on FCR through increases in positive affect and weekly goal pursuit, which were included as mediators in the analyses (Otto et al., 2016). Several models were cited as informing the intervention's proposed mechanisms of change including Fredrickson's broaden-and-build theory of positive emotions, terror management theory and meaning management theory (Otto et al., 2016). Findings demonstrated beneficial effects on death worry which was mediated by meaningful goal pursuit, but no significant changes in FCR were found (Otto et al., 2016). Although this study included an active control group and examined mediators, it did not find significant effects on overall FCR.

A more recent study by Lichtenthal and colleagues (2017) examined the efficacy of a computerized cognitive bias modification intervention named the Attention and Interpretation Modification for Fear of Breast Cancer Recurrence (AIM-FBCR). The AIM-FBCR was based on cognitive models of anxiety which posit that cognitive biases, including attention to threat-relevant stimuli and interpreting uncertainty in a threatening manner, are involved in the development and maintenance of anxiety (Lichtenthal et al., 2017). One-hundred and ten breast cancer survivors were randomly assigned to complete the AIM-FBCR intervention, which involved completion of an attention modification task and an interpretation modification task, or a control condition, which involved completion of a similar task without providing reinforcement

aimed at modifying attention or interpretation of stimuli (Lichtenthal et al., 2017). Beneficial effects were found for interpretation cognitive biases and health worries, but not overall FCR (Lichtenthal et al., 2017). However, interpretation of results is limited because the study did not test for mediation.

Results of these studies are promising, but there are several limitations. Only two of the studies had an appropriate control group and neither of the studies with active control groups demonstrated beneficial effects on overall FCR. In addition, only one of these studies conducted mediational analyses to evaluate whether or not intervention components changed intended targets, and thereby contributed to improvements in FCR. However, these studies do help identify intervention targets worthy of study, such as intrusive worry, maladaptive thoughts about physical symptoms, maladaptive coping strategies (such as excessive reassurance seeking), beliefs about the benefits of worry, toleration of uncertainty, and social support.

To summarize with regard to non-modifiable characteristics (including ones that are generally resistant to modification), potential contributors to FCR include age, disease severity, treatment intensity, perceived risk of recurrence and personality characteristics. Interventions targeting perceived risk have been largely unsuccessful in altering risk perceptions (Lipkus et al., 2004; Robb, Campbell, Evans, Miles & Wardle, 2008). Two personality traits, neuroticism and conscientiousness will be included as non-modifiable characteristics. Personality traits persist across situations and time, and are generally not considered modifiable. Neuroticism has been associated with fear of cancer recurrence, as well as other mental health problems (Lahey, 2009). Additionally, conscientiousness has been associated with compulsive checking and generalized anxiety disorder (Rosellini & Brown, 2011; Sher, Rossy & Bishop, 2000). Therefore, this study

examined the following non-modifiable characteristics for their relationship with FCR: neuroticism, conscientiousness, perceived risk of recurrence, age, and disease severity.

To summarize with regard to cognitive characteristics, those identified as contributors or potential contributors to FCR in the literature include misinterpretation of physical symptoms, beliefs about the benefit of worry, toleration of uncertainty, negative thinking styles (e.g., rumination), the use of avoidance coping strategies, using fewer positive reappraisals, and lower self-efficacy. In addition, research evaluating cognitive behavioral models of generalized anxiety disorder and health anxiety has identified intolerance of uncertainty, misinterpretation of symptoms, and beliefs about the benefit of worry as key characteristics contributing to intrusive worry and subsequent anxiety (Dugas et al., 1998; Dugas, Marchand, Ladouceur, 2005; Langlois,& Ladouceur, 2004). Research among cancer patients has also found that intolerance of uncertainty is related to psychological distress (Eisenberg et al., 2014; Kurita, Garon, Stanton & Meyerowitz, 2013), and that the misinterpretation of benign symptoms is a key contributor to FCR (Mehnert, Berg, Henrich & Herschbach, 2009; Lee-Jones, Humphris, Dixon & Hatcher, 1997). Therefore, this study examined the following cognitive characteristics for their relationship with FCR: self-efficacy for preventing a cancer recurrence, positive beliefs about the benefits of worry, negative beliefs about the danger and uncontrollability of worry, misinterpretation of symptoms, intolerance of uncertainty, and rumination.

To summarize with regard to behavioral characteristics, the literature on behaviors associated with FCR points to the importance of reassurance seeking behaviors in contributing to greater FCR. Additionally, intervention studies targeting reassurance seeking have demonstrated reductions in FCR (Lebel et al., 2014). Cognitive behavioral models of health anxiety also emphasize the importance of health-related reassurance seeking behaviors, such as visiting the

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doctor, in maintaining health anxiety (Furer, Walker & Freeston, 2001; Langlois & Ladouceur, 2004). Furthermore, studies on FCR have found that survivors with greater FCR visit the doctor more frequently (Lebel, 2013; Koch, 2014). Therefore, health-related reassurance seeking behaviors were examined in the current study for their relationship with FCR. Additionally, threat-related reassurance seeking behaviors were assessed to determine whether FCR is related to the tendency to engage in reassurance seeking specific to health or occurs more generally to the tendency to engage in reassurance seeking in response to any type of threat.

To summarize with regard to social characteristics, observational studies demonstrate that social influences, such as family stressors and having fewer significant others are associated with FCR (Crist & Grunfeld, 2013). In addition, an intervention that targeted social support led to reduced FCR (Hershbach et al., 2010). Furthermore, a large body of literature on psychological distress in cancer patients has shown that the availability of social support and a lack of social constraints in important relationships are important for successful emotional adjustment to cancer (Lepore, 2001). Therefore, social support and social constraints were examined in this study for their relationship with FCR.

In conclusion, this study used a model comprised of cognitive, behavioral, and social characteristics as a framework for examining modifiable characteristics associated with FCR. This is consistent with research on cognitive behavioral models of health anxiety and generalized anxiety disorder, as well as the literature on FCR. The focus was on survivors of colorectal cancer who had completed treatment in the past 6 to 36 months. This patient population was selected for several reasons. First, colorectal cancer is the third most common cancer and third leading cause of cancer mortality in the U.S. (Siegel, DeSantis & Jemal, 2014). Second, studies show that FCR is a common and distressing concern among colorectal cancer survivors (Simard

& Savard, 2009; Taylor, Richardson, Cowley, 2011). Third, an advantage of studying colorectal cancer survivors is that it affects both males and females, so both genders will be represented in the study.

Aims of the Current Study

The overall aim of the current study was to identify modifiable characteristics associated with FCR in order to inform the future creation of an intervention for cancer survivors experiencing clinically meaningful FCR. Additionally, the study sought to evaluate the relative contributions of modifiable and non-modifiable characteristics to FCR.

Aim 1

To characterize non-modifiable characteristics associated with FCR.

Hypothesis Set 1. It was hypothesized that greater FCR would be associated with greater neuroticism, greater conscientiousness, greater perceived risk, younger age and worse disease severity.

Aim 2

To identify modifiable behavioral, cognitive and social characteristics associated with FCR.

Hypothesis Set 2. It was hypothesized that greater FCR would be associated with less self-efficacy for preventing a cancer recurrence, more positive beliefs about worry, more

negative beliefs about worry, more misinterpretation of symptoms, less tolerance of uncertainty and more rumination (cognitive characteristics).

Hypothesis Set 3. It was hypothesized that greater FCR would be associated with more frequent threat-related and health-related reassurance seeking (behavioral characteristics).

Hypothesis Set 4. It was hypothesized that greater FCR would be associated with less social support and greater social constraints (social characteristics).

Aim 3

To determine the relative contributions of behavioral, cognitive, and social characteristics to FCR after accounting for non-modifiable characteristics (i.e., demographic, clinical, and personality characteristics). Toward this end, the study examined whether or not modifiable characteristics account for variance in FCR above and beyond that accounted for by non-modifiable characteristics, and if so, what distinct contributions each modifiable factor makes to the variance explained

METHODS

Participants

Participants were patients who met the following eligibility criteria: 1) diagnosed with stage I-III colorectal cancer, 2) completed treatment for colorectal cancer in the past 6-36 months, 3) no clinical evidence of disease at the time of recruitment, 4) no history of cancer recurrence 5) not diagnosed with any other form of cancer except non-melanoma skin cancer, 6) able to read and speak English, 7) 18 years of age or older, and 8) able to provide informed consent. In order to ensure adequate representation of males and females, patients were recruited such that at least 40% of the sample would be either male or female.

Procedure

After a review of medical records for initial screening, potentially eligible patients were approached during a scheduled follow-up visit in the Moffitt Cancer Center Gastrointestinal Oncology Clinic to have the study protocol explained. If eligible and interested, participants were asked to sign an IRB-approved informed consent form. They were then given the option of filling out the study measures during their outpatient visit, taking them home and returning the completed measures in a self-addressed stamped envelope, or completing the measures at home via a secure web-based survey. Patients identified as eligible but not scheduled to come in for a follow-up appointment within the next three months were contacted by phone or e-mail to determine if they were eligible and interested in participating in the study. Those who expressed

interest were mailed a packet containing an IRB-approved informed consent form, a study

questionnaire, and a postage paid return envelope. If patients preferred to complete the study

online, instructions for accessing a secure web-based survey were e-mailed to them for

completion.

Measures

Measures of Non-Modifiable Characteristics

Demographic characteristics. The following demographic characteristics were assessed

using a standardized self-report form: age, gender, race, ethnicity, marital status, income,

employment status, number of minor children, and education.

Clinical characteristics. The following clinical characteristics were assessed by

conducting a medical chart review: cancer site, cancer stage at diagnosis, date of diagnosis,

date(s) of treatment(s), and type(s) of treatment(s), date(s) of cancer surveillance tests,

genetic/inherited risk factors.

Perceived Risk. Perceived risk of cancer recurrence was assessed using participants'

estimates of their absolute and comparative risk with items adapted from prior research

(Valdimarsdottir et al., 1995). To assess absolute risk participants were asked, "How likely do

you think you are to have colorectal cancer again during your lifetime?" To assess comparative

risk participants were asked, "What do you think your chances are of having colorectal cancer

again in your lifetime compared to other individuals your age with colorectal cancer who

received the same treatment for the same type of colorectal cancer? The absolute risk item was

rated on a six-point response scale from 1 = *extremely unlikely* to 6 = *extremely likely*, and the

comparative risk item was rated on a five-point scale from 1 = *much higher* to 5 = *much lower*. Absolute and comparative risk scores were converted to the same metric and then summed to create a total perceived risk score. This measure has demonstrated adequate internal consistency with a Cronbach's alpha of 0.79 (McGinty, Goldenberg & Jacobsen, 2012). In the present study, this measure demonstrated marginal internal consistency reliability (α = .65), which is not inconsistent with its length.

Neuroticism. Neuroticism was assessed using the neuroticism subscale of the NEO Five- Factor Inventory-3 (NEO-FFI-3; McCrae & Costa, 2004). The neuroticism subscale is comprised of 12 items that are rated on a five-point response scale ranging from 0 = *strong disagreement* to 4 = *strong agreement*. The NEO-FFI-3 has demonstrated good convergent validity with other validated measures of pathological worry and trait anxiety and adequate internal consistency reliability, with a Cronbach's alpha ranging from 0.82 to 0.88 (McCrae & Costa, 2004). In the present study, this subscale demonstrated adequate internal consistency reliability (α = .88).

Conscientiousness. Conscientiousness was assessed using the conscientiousness subscale of the NEO-FFI-3 (McCrae & Costa, 2004). The conscientiousness subscale is comprised of 12 items that are rated on a five-point response scale ranging from 0 = *strong disagreement* to 4 = *strong agreement*. The NEO-FFI-3 has demonstrated good convergent validity with other validated measures of pathological worry and trait anxiety and adequate internal consistency reliability, with a Cronbach's alpha ranging from 0.79 to 0.87 (McCrae & Costa, 2004). In the present study, this subscale demonstrated adequate internal consistency reliability (α = .87).

Measures of Cognitive Characteristics

Self-Efficacy. Self-efficacy for preventing a cancer recurrence was assessed using one item adapted from prior research (Clark & Dodge, 1999). Participants were asked, "How confident are you that you can do things to prevent a cancer recurrence?" This item was rated on a ten-point scale from 1 = *not at all confident* to 10 = *very confident*.

Positive Beliefs about Worry. Positive beliefs about worry was assessed using the positive beliefs about worry subscale of the 30-item Metacognitions Questionnaire (MCQ-30; Wells & Cartwright-Hatton, 2004). The positive beliefs subscale is comprised of six items that are rated on a four-point response scale ranging from 1 = *do not agree* to 4 = *agree very much*. The positive beliefs subscale has demonstrated good convergent validity with other validated measures of pathological worry and trait anxiety and adequate internal consistency reliability, with a Cronbach's alpha of 0.92 (Wells & Cartwright-Hatton, 2004). In the present study, this subscale demonstrated adequate internal consistency reliability ($\alpha = .91$).

Negative Beliefs about Worry. Negative beliefs about worry was assessed using the negative beliefs about the danger and uncontrollability of worry subscale of the 30-item Metacognitions Questionnaire (MCQ-30; Wells & Cartwright-Hatton, 2004). This subscale is comprised of six items that are rated on a four-point response scale ranging from 1 = *do not agree* to 4 = *agree very much*. The negative beliefs subscale has demonstrated good convergent validity with other validated measures of pathological worry and trait anxiety and adequate internal consistency reliability, with a Cronbach's alpha of 0.89 (Wells & Cartwright-Hatton, 2004). In the present study, this subscale demonstrated adequate internal consistency reliability ($\alpha = .87$).

Misinterpretation of Symptoms. Misinterpretation of bodily symptoms was assessed using the Multidimensional Inventory of Hypochondriacal Traits (MIHT) hypochondriacal absorption subscale (Longley, Watson & Noyes, 2005). The nine-item MIHT hypochondriacal absorption subscale asks respondents to rate items on a five-point scale ranging from 1 = *strongly disagree/definitely false* to 5 = *strongly agree/definitely true*. The subscale has demonstrated good concurrent validity with validated measures of hypochondriacal cognitions, and adequate internal consistency reliability, with Cronbach's alpha ranging from 0.81 to 0.86 (Longley, Watson & Noyes, 2005). In the present study, this subscale demonstrated adequate internal consistency reliability ($\alpha = .87$).

Intolerance of Uncertainty. Intolerance of uncertainty was assessed using the 27-item Intolerance of Uncertainty Scale (IUS; Buhr & Dugas, 2002). Items are rated on a five-point scale ranging from 1 = *not at all characteristic of me* to 5 = *entirely characteristic of me*. The IUS has demonstrated good convergent validity with validated measures of worry, depression, and anxiety, and adequate internal consistency reliability, with a Cronbach's alpha of 0.94 (Buhr & Dugas, 2002). In the present study, this measure demonstrated adequate internal consistency reliability ($\alpha = .95$).

Rumination. Rumination was assessed using the Rumination-Reflection Questionnaire (RRQ) rumination subscale (Trapnell & Campbell, 1999). The 12-item rumination subscale asks participants to indicate their level of agreement or disagreement with items on a five-point response scale ranging from 1 = *strongly disagree* to 5 = *strongly agree*. The rumination subscale has demonstrated good convergent validity with validated measures of neuroticism and depression, and adequate internal consistency reliability, with Cronbach's alpha ranging from

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0.88 to 0.90 (Siegle, Moore & Thase, 2004; Trapnell & Campbell, 1999). In the present study, this measure demonstrated adequate internal consistency reliability ($\alpha = .91$).

Measures of Behavioral Characteristics

Threat-related Reassurance Seeking. Reassurance seeking behavior was assessed using the Threat-related Reassurance Seeking Scale (TRSS). The TRSS is an eight-item measure that asks about an individual's tendency to engage in reassurance seeking behaviors (Cougle et al., 2012). Respondents rate each item on a seven-point scale from 1 = *no, not at all* to 7 = *yes, very much.* The scale has been shown to have good convergent validity with a validated measure of depressive reassurance seeking and acceptable internal consistency reliability, with Cronbach's alpha of 0.93 (Cougle et al., 2012). In the present study, this measure demonstrated adequate internal consistency reliability ($\alpha = .94$).

Health-related Reassurance Seeking. Health-related reassurance seeking behavior was assessed using the Multidimensional Inventory of Hypochondriacal Traits (MIHT) hypochondriacal reassurance subscale (Longley, Watson & Noyes, 2005). The MIHT hypochondriacal reassurance subscale is comprised of eight items that are rated on a five-point scale. Respondents rate items on a scale from 1 = *strongly disagree/definitely false* to 5 = *strongly agree/definitely true*. The measure has been shown to have good concurrent validity with other validated measures of hypochondriacal behavior and adequate internal consistency reliability, with Cronbach's alpha ranging from 0.82 to 0.86 (Longley, Watson & Noyes, 2005). In the present study, this subscale demonstrated adequate internal consistency reliability ($\alpha = .89$).

Measures of Social Characteristics

Social Support. Social support was assessed using the 12-item Interpersonal Support Evaluation List (ISEL-12). The ISEL-12 is comprised of three subscales, appraisal, belonging and tangible support (Cohen, 2008). Respondents rate items on a four-point scale from 1 = *definitely false*, to 4 = *definitely true*. The scale has demonstrated good concurrent validity with other validated measures of social support, and adequate internal consistency reliability, with Cronbach's alpha ranging from 0.80 to 0.90 (Cohen, 2008). In the present study, this measure demonstrated adequate internal consistency reliability (α = .93).

Social Constraints. The degree of relationship strain was assessed using the 15-item Social Constraints Scale (SCS-15). This scale asks about the degree of strain individuals experience with the most important person in their life (Lepore, Silver, Wortman & Wayment, 1996). Respondents rate items on a four-point scale from 1 = *never* to 4 = *often*. This scale has demonstrated good convergent validity among cancer patients with validated measures of cancer-related distress, and adequate internal consistency reliability, with Cronbach's alpha ranging from 0.85 to 0.95 (Lepore et al., 1996; Lepore & Revenson, 2007). In the present study, this measure demonstrated adequate internal consistency reliability (α = .94).

Outcome Measure

Fear of Cancer Recurrence. FCR was assessed using the 42-item Fear of Cancer Recurrence Inventory (FCRI; Simard & Savard, 2009). The FCRI includes the following

subscales: triggers, severity, psychological distress, coping strategies, functioning impairments, insight, and reassurance (Simard & Savard, 2009). It has demonstrated good convergent validity with measures of psychological distress and quality of life, and adequate internal consistency reliability with Cronbach's alpha of 0.95 (Simard & Savard, 2009). The severity subscale served as the main outcome variable, as it is highly related (r = 0.84) to the total FCRI score (Simard & Savard, 2009). In the present study, the total FCRI scale (α = .92) and the severity subscale (α = .81) demonstrated adequate internal consistency reliability.

Statistical Analyses

Prior to conducting the main analyses, descriptive statistics were computed for demographic, clinical and psychological characteristics to characterize the study sample. Log transformations were computed for those variables demonstrating skewness as defined by kurtosis less than -1 or greater than 1. However, after performing the main analyses with both untransformed and log transformed variables and obtaining similar findings with regard to statistical significance, it was decided to report results using the untransformed variable to retain the interpretability of results. Sporadic missing data points (*n* = 33) were addressed using sample mean imputation.

The first aim was to identify non-modifiable characteristics associated with fear of recurrence and hypothesis set 1 asserts that greater FCR would be associated with greater neuroticism, greater conscientiousness, greater perceived risk, younger age and worse disease severity. To test this hypothesis, Pearson's r correlations were calculated to determine if there were significant relationships between FCR as measured by the FCRI, and neuroticism,

conscientiousness, perceived risk, age and disease severity, as well as gender for which no hypothesis was offered.

The second aim was to identify modifiable behavioral, cognitive and social modifiable characteristics associated with FCR. Hypothesis set 2 asserts that greater FCR would be associated with less self-efficacy for preventing a cancer recurrence, more positive beliefs about worry, more negative beliefs about worry, more misinterpretation of symptoms, less intolerance of uncertainty and more rumination (cognitive characteristics). Pearson's r correlations were calculated to determine if there were significant relationships between FCR as measured by the FCRI and self-efficacy, positive beliefs about worry as measured by the MCQ-30 positive beliefs subscale, negative beliefs about worry as measured by the MCQ-30 negative beliefs about the danger and uncontrollability of worry subscale, misinterpretation of symptoms as measured by the MIHT hypochondriacal absorption subscale, and intolerance of uncertainty as measured by the IUS. Hypothesis set 3 asserts that greater FCR would be associated with more frequent threat-related and health-related reassurance seeking (behavioral characteristics). Pearson's r correlations were calculated to determine if there were significant relationships between FCR as measured by the FCRI, and threat-related and health-related reassurance seeking behaviors as measured by the TRSS and MIHT hypochondriacal subscale, respectively. Hypothesis set 4 states that greater FCR would be associated with less social support and greater social constraints (social characteristics). Pearson's r correlations were calculated to determine if there were significant relationships between FCR, as measured by the FCRI and social support, as measured by the ISEL-12, and social constraints, as measured by the SCS-15.

The third aim was to determine the relative contributions of behavioral, cognitive, and social characteristics to FCR after accounting for non-modifiable characteristics (i.e.,

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demographic, clinical, and personality characteristics). To achieve this aim, hierarchical multiple linear regression analyses were conducted. Measures of non-modifiable characteristics that were found to be significantly correlated with FCR were entered into the analysis on the first step. Measures of the behavioral, cognitive and social characteristics that were found to be significantly correlated with FCR were entered into the model simultaneously in a subsequent step. Change in R^2 was used to determine whether or not the modifiable characteristics account for variance above that accounted for by non-modifiable characteristics. In addition, p-values were examined to determine which modifiable variables accounted for the most unique variance in FCR.

A power analysis was conducted using G*Power (Faul, Erdfelder, Lang & Buchner, 2007) to determine the number of participants needed to detect a Pearson's $r = 0.30$ (medium effect size) with a power of 80% and an alpha = .05 (two-tailed). It was determined that a total sample size of 84 participants would be needed. A second power analysis was conducted to determine the number of participants needed to obtain power of .80 using multiple linear regression with an alpha = .05 (two-tailed) to detect an effect size in which two covariates (i.e., non-modifiable characteristics) initially account for 5% of the outcome variance, and upwards of four cognitive, behavioral or social characteristics account for 9% of the remaining variance in FCR. It was determined that 120 participants would be needed. Therefore, the current study enrolled and obtained data on 120 participants.

RESULTS

Participants

Participant flow is shown in Figure 1. One thousand four hundred eighty-six patients were screened for this study; of these, 1,239 were ineligible based on medical record reviews (e.g., no colorectal cancer, stage IV or metastatic disease, history of cancer recurrence, history of other cancer diagnosis) and 49 were unable to be contacted by phone or were not scheduled for a follow-up appointment. The remaining 198 participants were approached for participation; of these, 41 refused to participate, and 17 verbally agreed to participate but never signed consent. One hundred forty patients signed consent (71% of those able to be contacted). Of those who consented, 13 never completed the study measures and could not be reached, 3 were found to be ineligible after they consented, and 4 withdrew their consent. Thus, analyses were conducted on the 120 patients who had evaluable data. Thirty-one percent of participants completed the online version, while 69% completed the written version of the study questionnaire.

Participant demographic and clinical characteristics are shown in Table 1. Participants ranged in age from 33 to 94 years (M = 61.28; SD = 12.54). The majority were college-educated (82%), currently employed (52%), female (51%), married (61%), White (93%) and did not have minor children (81%). Seventy-seven patients (64%) were diagnosed with rectal cancer and 43 (36%) were diagnosed with colon cancer. On average, participants were 25.45 months (SD = 11.17) from their original cancer diagnosis, 17.46 months (SD = 9.60) from their most recent cancer treatment, and 2.56 months (SD = 4.13) from their most recent cancer surveillance test.

Thirty-six participants (30%) had surgery only, 22 (18%) had surgery and chemotherapy, four (3%) had radiation and chemotherapy, and 58 (48%) had surgery, chemotherapy and radiation. Four patients (3%) had Lynch Syndrome, an inherited condition associated with increased risk for colorectal cancer.

Participant scores on the primary outcome, the FCRI severity subscale, ranged from one to 30 (M = 14.13; SD = 6.50). Using an empirically validated cut-off score of 13, 67 participants (56%) were identified as meeting criteria for clinically significant FCR (Simard & Savard, 2015).

Participants (n = 120) were compared to non-consenters (n = 58; i.e., those who were approached but did not provide written consent) on demographic characteristics. Participants were significantly more likely to be white than non-consenters (p < .05). There were no significant differences between participants (n = 120) and those who failed to complete measures (n = 13) on demographic characteristics.

Relationships between Non-Modifiable Characteristics and Fear of Cancer Recurrence

To address Aim 1, Pearson's r correlations were conducted to determine if FCR was related to perceived risk, age, disease severity, neuroticism and conscientiousness (see Table 2). As hypothesized, age, disease severity and neuroticism were associated with FCR in the expected direction (all p values $\leq$ .05). That is, younger age, worse disease severity and greater neuroticism were related to higher levels of FCR. Contrary to hypotheses, perceived risk of cancer recurrence was not related to FCR. Conscientious was associated with FCR, but not in the expected direction ($p \leq$ .05), in that lower levels of conscientiousness were related to greater

FCR. Additionally, it was found that gender was associated with FCR, such that females reported greater FCR ($p \leq .01$).

Relationships between Modifiable Characteristics and Fear of Cancer Recurrence

To address Aim 2, Pearson's r correlations were conducted to determine if FCR was related to modifiable behavioral, cognitive and social characteristics (see Table 3).

Cognitive Characteristics

Consistent with hypothesis set 2, self-efficacy for preventing a cancer recurrence, positive beliefs about worry, negative beliefs about worry, intolerance of uncertainty and rumination were related to FCR in the expected direction (all p values $\leq .05$). That is, less self-efficacy for preventing a cancer recurrence, more positive beliefs about worry, more negative beliefs about worry, more intolerance of uncertainty and more rumination were associated with greater FCR. In contrast, misinterpretation of symptoms was not related to FCR ($p = .86$).

Behavioral Characteristics

Consistent with hypothesis set 3, threat-related reassurance seeking and health-related reassurance seeking were related to FCR in the expected direction (p values $\leq .001$). That is, greater threat-related and greater health-related reassurance seeking were related to greater FCR (p values $\leq .001$).

Social Characteristics

Consistent with hypothesis set 4, social constraints were related to FCR in the expected direction ($p \leq .01$) such that greater social constraints were associated with greater FCR (see Table 3). However, contrary to expectation, social support was not related to FCR ($p = .38$).

Non-Modifiable and Modifiable Contributors to Fear of Cancer Recurrence

In order to determine the relative contributions of behavioral, cognitive, and social characteristics to FCR after accounting for non-modifiable characteristics (i.e., demographic, clinical, and personality characteristics) hierarchical multiple linear regression analyses were conducted. Measures of non-modifiable characteristics that were found to be significantly correlated with FCR were entered into the analysis on the first step (i.e., age, gender, disease severity, neuroticism and conscientiousness) and measures of the modifiable characteristics that were found to be significantly correlated with FCR were entered into the model simultaneously in a subsequent step (i.e., self-efficacy for preventing a cancer recurrence, positive beliefs about worry, negative beliefs about worry, intolerances of uncertainty, reassurance seeking, health-related reassurance seeking and social constraints). Multicollinearity statistics did not indicate the presence of significant intercorrelations (i.e., VIF ≥ 4, see Table 4). Step one of the regression analysis that comprised non-modifiable characteristics (i.e., age gender, disease severity, neuroticism and conscientiousness) was statistically significant ($\Delta R^2 = .33$, $F(5, 114) = 11.19$, $p < .001$). Addition of modifiable characteristics (i.e., self-efficacy for preventing a cancer recurrence, positive beliefs about worry, negative beliefs about worry, intolerance of uncertainty, reassurance seeking, health-related reassurance seeking and social constraints) in step two significantly increased the amount of variance accounted for by the model beyond what was accounted for by the non-modifiable characteristics alone ($\Delta R^2 = .13$, $F(13, 106) = 6.96$, p

<.001). Among the modifiable characteristics, self-efficacy for preventing a cancer recurrence (B = -.554; $p < .05$), rumination ($B = .157$; $p < .05$), and health-related reassurance seeking ($B = .194$; $p < .05$) significantly accounted for unique variance in FCR, such that less self-efficacy for preventing a cancer recurrence, greater rumination and greater health-related reassurance seeking were related to greater FCR.

Table 1

Participant demographic and clinical characteristics

Characteristic	Mean (SD)/ N (%)
Age (in years)	61.28 (12.54)
Female	61 (51)
White	111 (93)
Non-Hispanic	109 (91)
Married	73 (61)
Years of education	
12 or less	22 (18)
13 to 16	72 (60)
17 or more	26 (22)
Current employment	
Working	62 (52)
On leave	4 (3)
Not employed	53 (44)
Annual gross income	
< $40,000	33 (28)
$40,000-$100,000	52 (43)
>$100,000	25 (21)
Cancer site	
Rectal	77 (64)
Colon	43 (36)
Cancer stage at diagnosis	
I	33 (28)
II	41 (34)
III	46 (38)
Lynch Syndrome	4 (3)
Time since diagnosis (in months)	25.45 (11.17)
Treatment type	
Surgery	36 (30)
Surgery + chemotherapy	22 (18)
Radiation + chemotherapy	4 (3)
Surgery + chemotherapy + radiation	58 (48)
Time since most recent treatment (in months)	17.46 (9.60)
Time since most recent cancer surveillance (in months)	2.56 (4.13)

$N = 120$

Table 2

Correlations of non-modifiable characteristics with the Fear of Cancer Recurrence Inventory

Severity Subscale

Non-modifiable characteristics	FCRI
Perceived risk	.12
Age	-.36***
Gender	.26**
Disease severity	.18*
Neuroticism (NEO-FFI-3)	.41***
Conscientiousness (NEO-FFI-3)	-.22*

* $p \leq .05$, **p $\leq .01$, *** $p \leq .001$
Note: FCRI = Fear of Cancer Recurrence Inventory; NEO-FFI-3 = NEO Five-Factor Inventory-3

Table 3

Correlations of modifiable characteristics with the Fear of Cancer Recurrence Inventory

Severity Subscale

Modifiable characteristics	FCRI
Cognitive characteristics	
Self-efficacy	-.41***
Positive beliefs about worry (MCQ-30)	.22*
Negative beliefs about worry (MCQ-30)	.32***
Misinterpretation of symptoms (MIHT)	-.02
Intolerance of uncertainty (IUS)	.30***
Rumination (RRQ)	.45***
Behavioral characteristics	
Reassurance seeking (TRSS)	.34***
Health-related reassurance seeking (MIHT)	.37***
Social characteristics	
Social support (ISEL-12)	-.08
Social constraints (SCS)	.28**

* $p \leq .05$, **p $\leq .01$, *** $p \leq .001$
Note: FCRI = Fear of Cancer Recurrence Inventory; MCQ-30 = Metacognitions Questionnaire; MIHT = Multidimensional Inventory of Hypochondriacal Traits; IUS = Intolerance of Uncertainty Scale; RRQ = Rumination-Reflection Questionnaire; TRSS = Threat-related Reassurance Seeking Scale; ISEL-12 = Interpersonal Support Evaluation List; SCS = Social Constraints Scale

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Table 4

Two-step hierarchical linear regression

	B	SE	β	t (*p*-value)	Δ R² (*p*-value)	VIF	Model Adj R²
Step 1		5.44			.33 (<.001)		.30
Gender	.46	1.04	.04	.45 (.66)		1.26	
Age	-.16	.04	-.30	-3.77 (<.001)		1.24	
Disease severity	.37	.22	.13	1.65 (.10)		1.15	
Neuroticism	.16	.08	.21	1.89 (.06)		2.35	
Conscientiousness	-.06	.09	-.06	-.62 (.54)		1.57	
Step 2		5.05			.13 (<.001)		.39
Self-efficacy	-.55	.21	-.22	-2.61 (.01)		1.36	
Positive beliefs about worry	.16	.19	.08	.82 (.41)		1.87	
Negative beliefs about worry	-.05	.16	-.03	-.30 (.77)		2.12	
Intolerance of uncertainty	-.09	.05	-.22	-1.84 (.07)		2.82	
Rumination	.16	.07	.23	2.37 (.02)		1.87	
Reassurance seeking	.06	.06	.08	.92 (.36)		1.60	
Health-related reassurance seeking	.19	.08	.20	2.36 (.02)		1.41	
Social constraints	-.03	.06	-.05	-.52 (.60)		1.60	

Note: B = unstandardized regression coefficient; SE = standard error and standard error of the estimate for step 1 or step 2; β = standardized regression coefficient; VIF = variance inflation factor
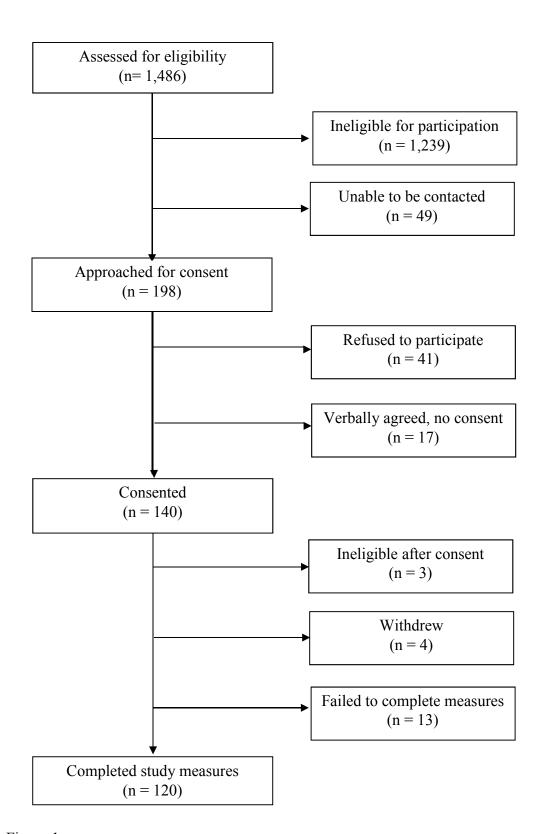
Figure 1

Participant flow chart

DISCUSSION

The primary purpose of the current study was to identify modifiable characteristics associated with FCR in order to inform the future creation of an intervention for cancer survivors experiencing FCR. This was accomplished by first examining non-modifiable and modifiable characteristics associated with FCR and then evaluating the relative contributions of modifiable and non-modifiable characteristics to FCR.

Consistent with prior research findings (Simard et al., 2013, McGinty et al., 2012; Savard & Ivers, 2013; Crist & Grunfeld, 2013; Koch, Jansen, Brenner & Arndt, 2013; Lahey, 2009), this study found significant relationships between non-modifiable characteristics (i.e., demographic, clinical and personality characteristics) and FCR, such that patients who were younger, female, had worse disease severity and reported greater neuroticism, reported greater FCR. Contrary to expectations and prior research findings (McGinty et al., 2012), perceived risk was not associated with FCR. Conscientiousness was related to FCR, but not in the direction hypothesized. That is, the current study found that those who reported lower conscientiousness, reported greater fear of cancer recurrence. This last finding is consistent with a recent study among Chinese cancer survivors, which also demonstrated an inverse relationship between conscientiousness and FCR (Liao, Yeung, Wong, Warmoth & Lu, 2017). This study also reported that the relationship was mediated by a greater sense of hopelessness. Consistent with this idea, research suggests that those low on conscientiousness tend to report a lower internal locus of control and are less likely to engage in health behaviors (Christensen, Moran, & Wiebe,

1999; Molloy, O'Carroll & Ferguson, 2014). Taken together, these findings suggest that those low in conscientiousness may perceive that they have limited ability to influence a cancer recurrence and, therefore, experience greater FCR.

Consistent with hypotheses regarding modifiable characteristics, the current study found that cognitive, behavioral and social characteristics were associated with FCR. In regards to cognitive characteristics, self-efficacy for preventing a cancer recurrence, positive beliefs about worry, negative beliefs about worry, intolerance of uncertainty and rumination were related to FCR in the expected direction. That is, survivors who reported heightened FCR, tended to feel less confident in their ability to prevent a cancer recurrence, tended to view worry as beneficial yet also more dangerous and uncontrollable, tended to be less tolerant of uncertainty and tended to report more rumination. Similarly, a recent study by Butow and colleagues (2015) examining relationships between metacognitions and FCR found that among breast and prostate cancer survivors, those with greater FCR had more positive beliefs about worry (e.g., worrying helps me cope) and more negative beliefs about worry (e.g., my worrying is dangerous for me). In addition, findings are consistent with a study by McGinty et al. (2016) which showed that lower coping self-efficacy was associated with heightened FCR among breast cancer survivors. Among novel findings from the current study are results showing that survivors who tend to be less tolerant of uncertainty and engage in more rumination reported greater FCR. These finding are consistent with the literature on psychological distress in cancer survivors which has shown that survivors reporting greater distress tend to be less tolerant of uncertainty (Eisenberg et al., 2014; Kurita, Garon, Stanton & Meyerowitz, 2013) and tend to report greater rumination (Galfin & Watkins, 2012; Hill & Watkins, 2017). Contrary to hypotheses and prior research (Mehnert,

Berg, Henrich & Herschbach, 2009; Lee-Jones, Humphris, Dixon & Hatcher, 1997), misinterpretation of symptoms was not related to FCR in the current study.

Results from the current study demonstrated that behavioral characteristics, including threat-related and health-related reassurance seeking were associated with FCR. That is, greater threat-related and health-related reassurance seeking were related to greater FCR. These findings are consistent with prior research on health anxiety, which emphasizes the importance of reassurance seeking in maintaining health anxiety (Furer, Walker & Freeston, 2001; Langlois & Ladouceur, 2004). Prior research on FCR suggests that those with greater FCR visit the doctor more often (Lebel, 2013; Koch, 2014) and engage in more reassurance seeking behaviors (McGinty, Small, Laronga & Jacobsen, 2016). Also consistent with study findings, intervention studies targeting reassurance seeking behaviors have demonstrated reductions in FCR (Lebel et al., 2014). However, this is the first study to differentiate between threat-related and health-related reassurance seeking.

With regard to social characteristics, greater social constraint was associated with greater FCR in the current study. Although no study to date has examined the relationship between social constraints and FCR, this is consistent with prior research demonstrating the detrimental impact of social constraints on emotional adjustment among cancer survivors (Lepore, 2001; Lepore & Revenson, 2007) and a recent study which found that social isolation was related to FCR (Koch-Gallenkamp, Bertram, Eberle, Holleczek & Schmid-Hopfner et al., 2016). Contrary to expectation, social support was not associated with FCR. Prior research findings on this topic are mixed (Crist & Grunfeld, 2013; Thewes, Bell, Butow, Beith, & Boyle et al., 2013). Taken together, findings from this study suggest that perceptions of strained interpersonal relationships

with important others (i.e., social constraints), rather than lack of social support, contributes to greater FCR.

Findings from multivariate analyses indicated that modifiable characteristics (i.e., positive beliefs about worry, negative beliefs about worry, intolerances of uncertainty, threat-related reassurance seeking, health-related reassurance seeking and social constraints) accounted for approximately 13% of the variance in FCR after controlling for non-modifiable characteristics (i.e., age, gender, disease severity, neuroticism and conscientiousness). Among the modifiable characteristics in the model, self-efficacy for preventing a cancer recurrence, rumination and health-related reassurance seeking accounted for unique variance in FCR, such that less self-efficacy for preventing a cancer recurrence, greater rumination and greater health-related reassurance seeking were related to greater FCR. These findings are consistent with cognitive behavioral models of health anxiety which emphasize the role that reassurance seeking behaviors and cognitive processes, such as rumination, play in maintaining health anxiety (Furer, Walker & Freeston, 2001; Langlois & Ladouceur, 2004; Norris & Marcus, 2014). These findings also lend support to a cognitive processing model of FCR recently proposed by Fardell et al. (2016). This model identifies problematic styles of information processing, such as rumination, as contributors to heightened FCR, and proposes a bidirectional relationship between heightened FCR and emotional, behavioral (e.g., reassurance seeking) and cognitive responses to cancer. Other key components of the Fardell model, which are supported by findings from the current study, include the crucial role that metacognitions or unhelpful beliefs about worry play in the development and maintenance of FCR (Fardell et al., 2016).

The current study has several strengths. First, it evaluated a theoretical model of clinically relevant modifiable contributors to FCR comprised of cognitive, behavioral and social

characteristics. Second, this study included both males and females, allowing us to examine gender as a potential non-modifiable characteristic impacting FCR and making its findings generalizable to both genders. Third, it addressed the general lack of prior research on predictors of FCR among colorectal cancer survivors, which is among the most common cancers in U.S. adults.

In addition, several study limitations should be considered. First, this study used a cross-sectional design. This feature does not allow causal conclusions to be drawn about relationships between FCR and modifiable characteristics. Studies using longitudinal research designs should be conducted to examine the temporal direction of these relationships and consider potential bidirectional relationships between FCR and cognitive, behavioral and social characteristics in order to deepen our conceptual understanding of FCR. Second, due to the homogeneity of race and ethnicity in the sample, findings may not generalize to populations of cancer patients with more diverse backgrounds. Accordingly, future studies should recruit more heterogeneous samples of cancer patients. Third, although the participation rate for this study was relatively high (71% of those able to be contacted), it is possible that our sample is not representative of the colorectal cancer population. For example, it could be that those with higher levels of FCR chose not to participate due to discomfort with questions or their preference to avoid thinking about the potential for a recurrence.

Findings from the present study have numerous implications for clinical practice. First, given that approximately 56% of colorectal cancer survivors in the current study met criteria for clinically significant FCR, these results suggest that FCR is relatively common among colorectal cancer survivors. Therefore, oncologists and mental health professionals treating colorectal cancer patients should consider screening for FCR in their patients. Second, these findings can

assist clinicians in identifying those patients who might be most in need of an intervention designed to address FCR. Results of the current study suggest that this is a particularly relevant discussion for those patients who are younger, female, have poorer disease prognosis, report greater neuroticism and report lower conscientiousness. Third, the findings regarding modifiable characteristics have implications for intervention development. Specifically, they suggest that interventions to address FCR should target self-efficacy for preventing a cancer recurrence, rumination and health-related reassurance seeking.

Although no intervention studies have examined self-efficacy for preventing a cancer recurrence as a mediator, motivational interviewing and social-cognitive interventions have demonstrated positive effects on behavior change via self-efficacy in other populations. For example, one study examining the efficacy of a brief motivational interview on drinking behaviors found that the relationship between the intervention and heavy drinking was mediated by increases in self efficacy (Magill et al., 2017). Another randomized controlled trial evaluating a social-cognitive intervention for fruit and vegetable consumption identified self-efficacy as a mediator for facilitating dietary changes (Kreausukon, Gellert, Lippke & Schwarzer, 2012). Future studies should examine the effects of motivational interviewing and social-cognitive interventions for influencing FCR via self-efficacy.

Cognitive behavioral therapy (CBT), metacognitive therapy (MCT) and mindfulness-based approaches have all shown efficacy for targeting rumination in other populations. For example, in randomized controlled trials assessing the efficacy of CBT among depressed patients, rumination has been shown to mediate improvements in depressive symptoms (Teismann, von Brachel, Hanning, Grillenberger, & Hebermehl, et al., 2014; Watkins, Mullan, Wingrove, Rimes & Steiner et al., 2011). Although MCT is a relatively novel treatment

approach, a recent meta-analysis showed that MCT is effective in reducing rumination, anxiety and depression. (Normann, van Emmerik & Morina, 2014). Similarly, randomized controlled trials evaluating mindfulness-based interventions among other populations (i.e., lung, cervical and breast cancer survivors, depressed patients) have demonstrated beneficial effects on psychological distress through the mechanism of rumination (Boyle, Stanton, Ganz, Crespi & Bower, 2017; Schellekens, van den Hurk, Prins, Donders, Molema et al., 2017; Shahar, Britton, Sbarra, Figueredo & Bootzin, 2010; Shao, Gao & Cao, 2016). It is quite possible that these findings may extend to FCR.

Behavioral therapy and cognitive-existential therapy have shown efficacy for targeting reassurance seeking behaviors. A study conducted by Weck and colleagues (2014) which compared the effectiveness of cognitive therapy and exposure therapy in treating health anxiety, found that those who underwent exposure therapy were significantly less likely to engage in safety behaviors (i.e., reassurance seeking, body checking). A similar randomized controlled trial of behavioral therapy (applied relaxation versus worry exposure) in GAD patients, demonstrated beneficial treatment effects via reductions in reassurance seeking behaviors (Beesdo-Baum, Jenjahn, Hofler, Leuken, Becker & Hoyer, 2012).

In conclusion, the current study adds to the literature on FCR by identifying non-modifiable and modifiable factors related to FCR and distinguishing those modifiable factors which uniquely explain variance in FCR. Specifically, this study found that when accounting for non-modifiable factors (i.e., age, gender, disease severity, neuroticism and conscientiousness), modifiable factors (i.e., self-efficacy, positive beliefs about worry, negative beliefs about worry, intolerance of uncertainty, rumination, reassurance seeking, health-related reassurance seeking and social constraints) significantly contribute to variance in FCR, with self-efficacy, health-

related reassurance seeking and rumination contributing unique variance. These findings provide support for a cognitive behavioral model of FCR and suggest that FCR interventions target self-efficacy, health-related reassurance seeking and rumination.

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