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Trait anxiety as an independent predictor of poor health-related quality of life and post-traumatic stress symptoms in rectal cancer

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Abstract

Objectives—To determine the influence of trait anxiety on patient reports of health-related quality of life (HRQoL) and post-traumatic stress symptoms (PTSS) in a sample of rectal cancer survivors.

Design—Eighty patients who had been diagnosed with rectal cancer were assessed at two points in time in a longitudinal study.

Methods—At Time 1, soon after initial treatment, participants completed the State-Trait Anxiety Inventory and the Temperament and Character Inventory Harm Avoidance scale, which were combined into a composite measure of trait anxiety. At Time 2, 2–5 years following Time 1, participants were assessed for HRQoL using the Functional Assessment of Cancer Therapy-Colorectal scale (FACT-C) and for PTSS using the Impact of Event Scale-Revised (IES-R).

Results—HRQoL and PTSS were generally favourable on average, although many of the patients reported faring poorly. Higher levels of trait anxiety were predictive of poorer scores on all of the FACT-C and the IES-R total and subscale measures. More severe faecal incontinence was associated with poorer scores on the FACT Emotional well-being subscale, the FACT-Colorectal Cancer Scale, and all of the IES-R scales. Males were more likely than females to have poorer scores on the FACT Social well-being subscale, and those patients who were further out from active treatment had more favourable scores on the FACT-Colorectal Cancer Scale. The presence of a colostomy did not impact HRQoL or PTSS.

Conclusion—Trait anxiety had a significant influence on HRQoL and PTSS several years following diagnosis and treatment of rectal cancer.

The number of people who can count themselves as cancer survivors has increased dramatically, due to advances in early detection and successful treatment, the ageing of the population, and broader definitions of ‘survivorship’ (Rowland, Hewitt, & Ganz, 2006). With these changes has come increased interest in the ways in which cancer and its treatment impacts survivors, in terms of both objective and subjective outcomes. Objective outcomes include side-effects of treatment, long-term and late effects of treatment, and economic burden. Subjective (i.e. patient-reported) outcomes include treatment satisfaction, health-related quality of life (HRQoL) and, in some, symptoms of post-traumatic stress (Aziz, 2007; Gotay, Lipscomb, & Snyder, 2005; Kangas, Henry, & Bryant, 2002). Interestingly, objective and subjective outcomes often do not coincide. A common finding is that HRQoL among cancer survivors is more favourable than would be expected, often comparable to healthy controls, even when deleterious biomedical effects persist (Gotay *et al.*, 2005; Schwartz & Sprangers,

2002; Rapkin & Schwartz, 2004). However, most studies report only mean values, which do not reflect the fact that HRQoL data are typically skewed. Although there may be a clustering of patients towards the favourable end of the distribution, the longer tail represents a great number of patients who report relatively poor HRQoL (Curran *et al.*, 2000; Cella *et al.*, 2003). Also, those reporting poor HRQoL might not differ appreciably from their higher HRQoL counterparts in terms of objective health status (Wilson & Cleary, 1995). The question we address in this study is this: why do some cancer survivors report poor HRQoL when their apparent medical status is not different from their peers?

One explanation for the mismatch between subjective and objective outcomes could be that subjective measures are inherently open to the influence of patients' individual perspectives and predispositions, while objective biomedical outcomes are not (Gotay *et al.*, 2005; Schwartz & Sprangers, 2002; Rapkin & Schwartz, 2004; Cella *et al.*, 1993). For example, one possible influence on HRQoL is patients' affective disposition, which would not be expected to significantly influence biomedical outcomes related to cancer. There is a broad base of evidence demonstrating that negative affective traits (i.e. tendencies towards depression, anxiety, and pessimism) have a potent influence on self-reported physical symptoms and well-being, often outweighing the influence of objective markers of functioning (Pennebaker, 2000; Watson & Pennebaker, 1989). In the present study, we hypothesized that a commonly measured form of negative affect (trait anxiety) would predict self reports of well-being (HRQoL and post-traumatic stress symptoms, PTSS), while controlling for objective medical outcomes (stage of disease, presence of colostomy, and severity of faecal incontinence).

Only a few studies have investigated relationships between various measures of negative affect and HRQoL. In the original validation study of the Functional Assessment of Cancer Therapy measure (FACT; Cella *et al.*, 1993), the FACT-G summary score was inversely related to scores on the Brief Profile of Mood States (BPOMS; Cella *et al.*, 1987) as well as to scores on the Taylor Manifest Anxiety Scale (Taylor, 1953). In a study of the FACT-Colorectal measure (FACT-C; Ward *et al.*, 1999), all of the summary and subscale scores were inversely related to the BPOMS (Cella *et al.*, 1987) and the Profile of Mood States - Short Form (McNair, Lorr, & Droppleman, 1992). In a study of patients with colorectal cancer (Yoo, Kim, Eremenco, & Han, 2005), all subscale and total scores on the FACT-C (Ward *et al.*, 1999) were inversely related to scores on both the BPOMS (Cella *et al.*, 1987) and the Neuroticism scale of the Eysenck Personality Questionnaire (Eysenck & Eysenck, 1976). And lastly, in a study of 60 cancer patients conducted at the time of surgical follow-up, patients' global HRQoL as measured by the Quality of Life Questionnaire (Aaronson *et al.*, 1993) was inversely related to their scores on the Negative Affect scale of the Positive and Negative Affect Schedule (Watson, Clark, & Tellegen, 1988), but was not correlated with physicians' ratings of their HRQoL or overall physical condition (Koller *et al.*, 1996).

Another patient-reported outcome that has received increased interest is post-traumatic stress disorder (PTSD). With the introduction of the fourth edition of the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 1994), the criteria for PTSD were altered to allow the inclusion of life-threatening illnesses as traumatic events. Since the publication of DSM-IV in 1994, scores of articles have been published on the relation between various serious illnesses and either PTSD or PTSS. Of the studies that have been done with regard to cancer, most have focused on either breast cancer or on childhood cancer survivors and their parents, while relatively few studies have looked at these issues in colon and rectal cancers (cf. Salsman, Segerstrom, Brechting, Carlson, & Andrykowski, 2009). While most cancer patients never meet diagnostic criteria for PTSD, a high proportion of patients experience subclinical PTSS following diagnosis (Kangas *et al.*, 2002; Deimling, Kahana, Bowman, & Schaefer, 2002). Although PTSS will decline considerably within the first few months, such symptoms can trouble some patients for years (Kangas *et al.*, 2002). Similar to

the discrepancies regarding HRQoL, neither the incidence of PTSD nor the magnitude of PTSS is clearly related to biomedical aspects of the disease, but they have been linked to various measures of negative affect (Kangas *et al.*, 2002; Kangas, Henry, & Bryant, 2005; Palmer, Kagee, Coyne, & DeMichele, 2004). In a longitudinal study of cancer patients, scores on the Beck Depression Inventory (Beck, Steer, & Brown, 1996) and the Trait scale of the State-Trait Anxiety Inventory (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1970), administered within 1 month of diagnosis, were correlated with both PTSD caseness and PTSS severity, which were assessed at 6 months post-diagnosis (Kangas *et al.*, 2005).

All of the studies just described showed that greater levels of negative affect were related to either poorer HRQoL or more problems with PTSS. However, most of those studies were cross-sectional and most used measures of negative mood state rather than trait negative affect, which has made the direction of causality difficult to infer. The purpose of the present longitudinal study was to examine the influence of stable negative affective disposition on both HRQoL and PTSS in a sample of rectal cancer survivors while controlling for objective medical outcomes. With regard to objective outcomes, the treatment of rectal cancer often entails permanent biomedical ramifications, including chronic bowel, urinary, and sexual dysfunction (Vironen, Kairaluoma, Aalto, & Kellokumpu, 2006). In addition, appearance and function are both significantly altered for those patients who receive a permanent colostomy (Bleday & Garcia-Aguilar, 2007). Nevertheless, several reports indicate that mean HRQoL scores for rectal cancer survivors improve within 3-6 months post-surgery to the point that they are comparable to those reported in community studies (Camilleri-Brennan & Steele, 2001; Neuman *et al.*, 2007; Rauch, Miny, Conroy, Neyton, & Guillemin, 2004). Also, there is no clear evidence that individuals with a colostomy have worse HRQoL than those without (Cornish *et al.*, 2007; Pachler & Wille-Jorgensen, 2005). On the other hand, faecal incontinence and chronic diarrhoea have been shown to have a negative effect on certain domains of HRQoL, particularly social functioning (Vironen *et al.*, 2006).

But again, even though mean HRQoL among rectal cancer survivors is comparable to population controls, these distributions are usually skewed, with the long tail representing a great number of survivors reporting poor HRQoL (Camilleri-Brennan & Steele, 2002; Engel *et al.*, 2003; Schmidt, Bestmann, Kuchler, Longo, & Kremer, 2005a, b). No previous studies that we could find have looked at the role of PTSD or PTSS in rectal cancer. In the present study, we wanted to investigate whether stable negative affective disposition is related to poor HRQoL or problems with PTSS. With the recent attention given to the specific role of anxiety in issues related to perceptions of health and illness (Cameron, 2003), we investigated longitudinally the relative influence of trait anxiety, demographic and medical variables on HRQoL and PTSS in a group of rectal cancer survivors. It was hypothesized that trait anxiety would predict self-reported HRQoL and PTSS, independent of other characteristics of the person or their disease.

Method

Participants and procedure

A longitudinal study was conducted in which rectal cancer patients were assessed at two points in time. The primary predictor (trait anxiety) was assessed at Time 1, while the primary outcomes (HRQoL and PTSS) were assessed at Time 2. Participants were patients who received treatment for primary rectal tumours at Washington University School of Medicine. At Time 1, between July 1998 and July 2001, 123 patients were recruited at the time of their follow-up visit after initial surgical intervention by one of three clinic nurses. Participants were given a set of paper-and-pencil questionnaires that could be completed at home and returned by mail. Assessment involved gathering information regarding sex, age, race/ethnicity, and education. Also, two measures of trait anxiety were included (see descriptions in the Measures section).

Any additional medical treatment - whether it included chemotherapy, radiation therapy, or both - occurred subsequent to the assessment, with some of the patients eventually receiving a permanent colostomy.

The participants were contacted again at Time 2, between July 2003 and February 2004, and invited to participate in a telephone interview to assess HRQoL and PTSS. The time that elapsed between Time 1 and 2 assessments ranged from about 2 to 5 years. Potential participants were sent a letter from their treating surgeon to introduce the study and to inform them that they would be contacted by telephone. A computer-assisted telephone interview system was used by trained interviewers to administer three standardized measures: the FACT-C (Ward *et al.*, 1999), as a measure of HRQoL, the Impact of Event Scale - Revised (IES-R; Weiss & Marmar, 1997), as a measure of PTSS, and the Faecal Incontinence Severity Index (FISI; Rockwood *et al.*, 1999). Chart reviews were conducted to determine the grade and stage of patients' tumours as well as the types of treatments received. A total of 80 patients participated in the assessment at Time 2, out of the original 123 patients who had participated at Time 1. All aspects of this study had approval from the Institutional Review Board at Washington University.

Measures

Trait anxiety—Trait anxiety was measured at Time 1 with two questionnaires. The first was the Trait scale of the State-Trait Anxiety Inventory (Spielberger *et al.*, 1970), which requires subjects to estimate how much of the time they typically experience various symptoms of anxiety. The Trait scale consists of 20 statements that subjects use to describe how they generally feel, using a 4-point frequency scale ranging from almost never to almost always, resulting in total scores that can range from 20 to 80. This scale has been found to be internally consistent as well as stable over time, with coefficient alphas ranging from .72 to .96 and test-retest correlations ranging from .82 to .94 (Barnes, Harp, & Jung, 2002).

Patients also completed the short form (144 items) of the Temperament and Character Inventory (TCI; Cloninger, Przybeck, Svrakic, & Wetzel, 1994). The TCI Harm Avoidance scale was the scale of interest, since it measures stable individual differences in sensitivity to signals of possible threat (Heath, Cloninger, & Martin, 1994). The Harm Avoidance scale consists of 20 true-false statements in which subjects are asked to determine 'which choice best describes you'. The Harm Avoidance scale has also demonstrated reasonable stability, with test-retest correlations ranging from .76 to .84 over the course of two years (Heath *et al.*, 1994). The Harm Avoidance scale has been found to correlate with several other measures of negative affective traits including the Trait scale of the State-Trait Anxiety Inventory (Carver & White, 1994; Costa & McCrae, 1992; Eysenck & Eysenck, 1976; Spielberger *et al.*, 1970). Six patients missed two or fewer items on one or the other of the two scales, in which case scale scores were calculated as the mean of the nonmissing items multiplied by the number of items in the scale.

Since both the Trait scale of the State-Trait Anxiety Inventory and the TCI - Harm Avoidance scale are quite stable over time, they are considered to be measures of dispositional tendencies towards anxiety. Even though the two measures were highly correlated in our sample (rank correlation = 0.65), they can be seen as complementary measures of trait anxiety, in that the Trait scale of the State-Trait Anxiety Inventory leans towards the somatic aspects of anxiety, while the TCI - Harm Avoidance scale leans towards the cognitive aspect (i.e. worry). The two measures were thus combined into one composite measure by summing their standardized scores. A composite measure such as this is appropriate when the research question involves a broad theoretical construct, i.e. trait anxiety, rather than the idiosyncrasies of the individual scales (Zelenski & Larsen, 2002).

Health-related quality of life—HRQoL was assessed at Time 2 with the FACT-C (Ward *et al.*, 1999), which is a two-part measure of HRQoL. The first component (FACT-G) is a measure of overall HRQoL and is made up of four subscales that cover physical (7 items), social (7 items), emotional (6 items), and functional (7 items) well-being. The second component is the Colorectal Cancer Scale (7 items), which assesses the presence of symptoms that are often experienced by colorectal cancer survivors (e.g. cramps, diarrhoea). Each item requires the patient to indicate ‘how true each statement has been for you during the past 7 days’, with five options ranging from ‘Not at all’ to ‘Very much’. Scores on each subscale range from 0 to 28 (0-24 on the Emotional subscale), with higher scores indicating more favourable functioning. One patient missed 1 item on the Social well-being subscale, so the score was calculated as the mean of the nonmissing items multiplied by the number of items in the subscale.

Post-traumatic stress symptoms—The assessment of PTSS at Time 2 was done with the IES-R (Weiss & Marmar, 1997), which measures the residual psychological impact of having experienced a traumatic or life-threatening situation. The instructions were tailored for this study, so that participants were asked to ‘indicate how distressing each difficulty has been for you during the past 7 days with respect to *your rectal cancer and the treatment you had*’. The avoidance subscale (8 items) asks questions regarding the avoidance of situations related to the experience; the Hyperarousal subscale (8 items) asks questions regarding episodes of physiological arousal related to thoughts about the event; the Intrusiveness subscale (7 items) asks questions regarding intrusive recollections of the experience. Scores for each subscale are calculated as the mean of the non-missing individual items (i.e. 0-4), with higher scores indicating more severe difficulties. The IES (Horowitz, Wilner, & Alvarez, 1979), which is the predecessor of the IES-R, has been used most often in studies of PTSS in cancer (Kangas *et al.*, 2002). However, we decided to use the IES-R since it includes a scale measuring hyperarousal, which is one of the diagnostic criteria for PTSD (American Psychiatric Association, 1994) but which was not included in the original IES.

Faecal incontinence—The FISI (Rockwood *et al.*, 1999), also administered at Time 2, measures both type (gas, mucus, liquid stool and solid stool) and frequency of incontinence. For each type of incontinence, the patient is asked to indicate how often in the past month they experienced accidental bowel leakage. An overall severity rating is calculated by weighting the component scores according to patients’ estimations of severity derived from the original validation study (Rockwood *et al.*, 1999). Scores can range from 0 to 61, with higher scores indicating greater severity.

Statistical analysis

The primary aim of the statistical analysis was to determine the influence of trait anxiety on both HRQoL and PTSS, while accounting for demographic and medical variables. As expected, scores on the outcome measures were skewed, with the majority of patients clustered at the more favourable end of the ranges of all of the FACT and IES-R subscales. A normal distribution could not be approximated by transformation for any of the scales, so each scale was divided into two groups by median split. Logistic regression was used as the primary analytic tool. Logistic models were constructed to predict which patients had poorer scores on the FACT-C or IES-R total and subscale scores. In addition to the trait anxiety composite score, the covariates of interest included demographic information (age at Time 2, sex, and years of education) and medical information (stage of disease at diagnosis, presence of colostomy, and current severity of faecal incontinence). Because there is evidence to suggest that the passage of time following colon resection brings amelioration of HRQoL (Camilleri-Brennan & Steele, 2002), we also included the time elapsed between the Time 1 and Time 2 assessments.

Statistical analyses were conducted in two stages, as has been recommended for HRQoL research (Curran *et al.*, 2000), by first conducting analyses with summary scores as the outcomes, followed by analyses with the individual subscale scores as the outcomes. So, we first included all of the independent variables simultaneously in analyses of the main summary scores: the FACT-G, the FACT-Colorectal Cancer Scale, and the IES-R total score. The second set of analyses was conducted with each of the individual subscale measures as well as the summary scores as the outcome variables. In these analyses, best-fit models were constructed in which covariates were included based on measures of goodness-of-fit (e.g. the Hosmer-Lemeshow test; Hosmer & Lemeshow, 2000) and of information (e.g. Akaike's Information Criterion; Collett, 2003).

Results

Participants

A total of 150 patients were originally approached to participate in this study at Time 1. Twenty-seven of those patients declined, either because of time constraints or simple lack of interest. Of the 123 patients who participated at Time 1, 16 were deceased prior to the assessment at Time 2, 14 could not be located, and 13 declined to participate. We compared these three groups with the 80 patients who participated in both Time 1 and 2 assessments on age, educational level, trait anxiety, and stage of disease at diagnosis. The 16 patients who died prior to the Time 2 interview tended to have a more severe stage of disease than the participants (Mann-Whitney $z = 1.779$, two-tailed $p = .075$), as did the 14 patients who could not be located (Mann-Whitney $z = 2.840$, two-tailed $p = .005$), so many of them may well have died prior to our attempts to contact them. Those patients who declined to participate were significantly older than the participants at the time of contact (74.7 vs. 67.5, $t = 2.084$, $p = .040$). The span of time that elapsed from Time 1 to Time 2 ranged from 112.1 weeks to 260.6 weeks (approximately 2-5 years), with a mean of 203.2 weeks ($SD = 39.5$). Table 1 shows the socio-demographic and clinical characteristics of the 80 patients who participated in both assessments.

Measures of HRQoL and PTSS

Table 2 shows the descriptive statistics for the FACT-C and IES-R subscale and total scores, with the means and medians for all participants as well as the means and ranges for the groups above and below the medians. As can be seen, all of these measures were skewed with a clustering of scores on the more favourable ends (i.e. higher scores for FACT scales and lower scores for IES-R scales). The skewness is reflected in two ways. First, the mean is less than the median for all of the FACT scales, while the mean is greater than the median for all of the IES-R scales. Second, the range of scores is much greater on the skewed side of the median for all of the scales (e.g. a range of 10-24 below the median on the Physical well-being subscale, but a range of 25-28 at or above the median).

Predictors of HRQoL and PTSS

As noted in Table 1, 7 patients were missing either education or tumour stage information. Inspection revealed that the missing values did not affect the joint distribution of covariates used in modelling HRQoL, and there was no evidence that education or stage was missing for any reason related to HRQoL. As a result, the values were considered to be missing at random. The logistic models were thus developed using the 73 patients who had complete data.

The results from the first stage of data analysis are shown in Table 3, which includes the full multivariate logistic models for the FACT-G summary score, the FACT-Colorectal Cancer Scale, and the IES-R total score. These models include all of the covariates in predictions of those patients who fell on the poorer side of the medians of the outcome measures. Trait anxiety and faecal incontinence were the strongest predictors in all of these models, although faecal

incontinence did not reach the customary .05 level in the FACT-G model. In addition, the time elapsed from Time 1 to 2 was a strong predictor in the model of the FACT-Colorectal Cancer Scale. None of the other predictors were particularly strong in any of the models.

Table 4 shows the best-fitting models for the FACT scales from the second stage of data analysis. As can be seen, higher levels of trait anxiety were closely and consistently related to poorer HRQoL. Each increase of 0.1 units in the trait anxiety score was associated with a 28-56% increase in the probability of having a FACT score below the median (physical well-being, 56%; social well-being, 47%; emotional well-being, 45%; functional well-being, 28%; FACT-G 56%; and FACT-Colorectal Cancer Scale, 42%). Faecal incontinence was more varied in incidence and severity, as well as being measured on a more finely graded scale than trait anxiety. As a result, there is a consistent but smaller effect of FISI scores on the HRQoL measures. Each increase of one unit in the FISI was associated with an increased probability of scores falling below the median on the FACT Emotional Well-Being scale (6% increase in probability) and the FACT-Colorectal Cancer Scale (7% increase in probability). Males were about 3.8 times more likely than females to fall on the poor side of the median on FACT Social Well-Being scores. Time elapsed between Time 1 and 2 was marginally associated with scores on the FACT-Colorectal Cancer Scale, indicating that those patients who were further out from active treatment tended to report fewer gastrointestinal symptoms.

Table 5 shows the best-fitting models for the IES-R subscales and total score. Trait anxiety and faecal incontinence entered the models for all 3 of the subscales and the total IES-R score, although trait anxiety was just marginally significant in the total score model. Each increase of 0.1 units in the trait anxiety score was associated with a greater probability of IES-R scores falling above the median, meaning more difficulties with symptoms of post-traumatic stress (IES-R: avoidance, 41%; hyperarousal, 30%; intrusiveness, 45%; and total score, 24%). Severity of faecal incontinence also had a deleterious impact. Each unit increase in FISI scores was associated with a 5-7% increase in the probability of IES-R scores falling above the median (IES-R: avoidance, 7%; hyperarousal, 6%; intrusiveness, 6%; and total score, 5%).

Discussion

The present study examined the influence of trait anxiety on HRQoL and PTSS in a sample of rectal cancer survivors, while simultaneously considering the effects of the medical ramifications of illness (stage of disease, presence of permanent colostomy, presence/severity of faecal incontinence) and socio-demographic characteristics. The mean FACT subscale scores were comparable to those reported by 304 participants in a representative sample of U.S. citizens with no history of specified illness (Cella *et al.*, 2003; Holzner *et al.*, 2004). Mean scores from the present study versus the population study, respectively, were: physical well-being (23.6 vs. 24.8); Social well-being (22.9 vs. 20.3); Emotional well-being (20.5 vs. 19.8); Functional well-being (20.5 vs. 21.5). Thus, long-term HRQoL among this sample of rectal cancer survivors was quite favourable 2-5 years following post-operative assessment. About half of these patients had scores of zero on the IES-R, suggesting no discernible problems with PTSS.

On the other hand, there were many individuals who were faring rather poorly. Several variables were investigated for their associations with the poorest levels of HRQoL and PTSS, and two consistent findings emerged. First, higher levels of trait anxiety were associated with the poorest scores on every one of the outcome measures. This finding was consistent with the primary hypothesis as well as with a broad array of findings that indicate that dispositional negative affect has a potent influence on self-assessments of health and well-being (Cameron, 2003; Pennebaker, 2000; Watson & Pennebaker, 1989). Watson and Pennebaker (1989) posited that the correlations between negative affect and self-reported functioning 'reflect a common,

underlying disposition of somatopsychic distress' (p. 235). Their 'symptom perception hypothesis' states that subjects who are high in negative affect are also more likely to notice and complain about negative changes in physical functioning. Similarly, it has been suggested that reports of PTSS in cancer survivors might reflect generalized distress (Deimling *et al.*, 2002; Palmer *et al.*, 2004). In follow-up analyses, we looked at the relationship between FACT-G scores and the IES-R total score using Fisher's exact test, and found that the two measures were significantly related ($p < .0001$). Thus, those patients who reported poorer HRQoL were also more likely to have problems with PTSS, and both of those measures were significantly related to trait anxiety.

Second, the one biomedical predictor of poorer HRQoL was severity of faecal incontinence, showing a relationship with the Emotional well-being subscale and the FACT-C Colorectal Cancer Scale. This finding is similar to other studies showing that lingering problems with bowel control can have a negative impact on certain domains of HRQoL (Vironen *et al.*, 2006). Faecal incontinence also had a negative impact on PTSS, which fits with reports that PTSS in cancer survivors is related to current physical symptoms, but not to severity of the original illness or the complexity of treatment (Deimling *et al.*, 2002). On the other hand, the presence of a colostomy did not enter any of the models. It may be that incontinence represents an uncontrollable and chronic stressor in one's life, while a colostomy can be routinely managed with experience. Other patient characteristics were less consistent predictors. For example, male patients were more likely to report poorer social functioning, and the passage of time following active treatment brought decreased problems related to gastrointestinal functioning.

There are several weaknesses of this study. The first weakness is in the timing of the assessments of trait anxiety, which took place following initial treatment. One might argue that patients with worse disease consequently had greater levels of psychological distress, causing higher scores on the anxiety measures as well as poorer HRQoL, which would leave open the question of causality. However, further analyses showed that neither the stage of disease nor the grade of the tumour was related to trait anxiety or to any of the HRQoL measures. Also, both measures of trait anxiety used here have been shown to be quite stable over time. In that regard, the anxiety measures were strongly related to the HRQoL measures taken 2-5 years later, so there was apparently something captured by the anxiety measures that persisted long enough to be related to the outcome measures. Clearly, a longitudinal study that included baseline measures of HRQoL and PTSS would provide better answers. Second, we did not measure all variables that could have an impact on HRQoL and PTSS, such as the nature and extent of adjuvant treatments. However, it is difficult to know how one would characterize the various permutations in adjuvant treatment in a way that they could be included as valid predictors in regression analyses, although this is not to say that some metric could not be devised. In the current study, the authors chose to include stage of disease as an imperfect proxy for intensity and duration of treatment. While it is expected that the inclusion of information regarding adjuvant treatment would have accounted for more variance in the outcome measures, it would most likely not supplant variance accounted for by the trait anxiety measures, since trait anxiety had been measured prior to any adjuvant treatment. A third weakness is in the attrition of participants from Time 1 to 2. Compared to the Time 2 participants, the deceased and lost patients had worse disease, and those who were unwilling to participate were older. These losses of participants may thus have contributed to the skewness of the HRQoL measures. Lastly, the relatively modest sample size, as well as the small proportions of certain subgroups of patients (e.g. African-American, patients with colostomy), did not allow for more rigorous tests of associations with the outcome measures.

Still, this study could inform research designed to understand the complex nature of HRQoL. The self-assessment of HRQoL is primarily a process of cognitive appraisal, and is thus open

to the influence of psychological factors (Rapkin & Schwartz, 2004). The present study suggests that more attention should be given to the role of affective disposition. It must be emphasized, however, that such findings would not relieve health care providers of the responsibility to help patients improve their HRQoL. From the surgical standpoint, long-term HRQoL will likely benefit from new techniques that will reduce the likelihood and severity of faecal incontinence (Wise & Kodner, 2006). And, while personality traits might influence patient-reported outcomes, providers still need to work to alleviate survivor distress. Such work in medicine and psychology will add to our growing understanding of HRQoL such that future efforts towards improving the quality of patients' lives will be individually tailored and thus more effective.

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Table 1

Sociodemographic and clinical characteristics

Characteristic	
Sex, <i>n</i> (%)	
Female	35 (43.8)
Male	45 (56.2)
Age, mean years $\pm$ SD (range)	67.5 $\pm$ 12.0 (29.1-88.3)
Race/ethnicity, <i>n</i> (%)	
Caucasian	73 (91.2)
African-American	6 (7.5)
Hispanic	1 (1.2)
Educational level, mean years $\pm$ SD ^a	
< High school, <i>n</i> (%)	15 (18.8)
High school graduate, <i>n</i> (%)	29 (36.2)
Some college or college graduate, <i>n</i> (%)	22 (27.5)
Post-graduate, <i>n</i> (%)	10 (12.5)
Stage of disease, <i>n</i> (%) ^b	
Stage I	37 (46.2)
Stage II	24 (30.0)
Stage III	15 (18.8)
Stage IV	1 (1.2)
Permanent colostomy, <i>n</i> (%)	19 (23.8)

^a Education unavailable on 4 patients

^b Stage unavailable on 3 patients.

Table 2
Descriptive statistics for FACT and IES-R, total and after median split

Measure	All participants		Median split [mean (range)]	
	Mean	Median	Below median	Above median
FACT-G subscales				
Physical	23.6	25	19.5 (10-24)	26.8 (25-28)
Social	22.9	24	18.6 (5-23)	26.3 (24-28)
Emotional	20.5	22	16.6 (5-21)	23.5 (22-24)
Functional	20.5	21	15.2 (4-20)	25.0 (21-27)
FACT-G total	87.4	92	73.4 (38-90)	100.4 (92-107)
Colorectal Cancer Scale	20.7	22	16.7 (9-21)	24.5 (22-28)
IES-R subscales				
Avoidance	0.5	0	0.00 (0.0-0.0)	1.10 (0.1-3.3)
Hyperarousal	0.35	0	0.00 (0.0-0.0)	0.90 (0.1-3.1)
Intrusiveness	0.37	0.1	0.02 (0.0-0.1)	0.86 (0.3-2.7)
IES-R total	1.22	0.4	0.08 (0.0-0.4)	2.61 (0.5-8.6)

Less favourable scores are below the median for the FACT and above the median for the IES-R.

Table 3
Full multivariate logistic models of FACT-G, FACT Colorectal Cancer Scale, and IES-R total

Predictor	Odds ratio	95% CI	Wald χ^2	P-value
<i>FACT-G</i>				
Trait anxiety (per 0.1 unit increase)	1.8	(1.28, 2.54)	11.4	.0007
Sex				
Female	1			
Male	2.52	(0.70, 9.03)	2.01	.16
Age (per year increase)	1.02	(0.96, 1.07)	0.32	.57
Education (per year increase)	1.06	(0.89, 1.27)	0.41	.52
Tumour stage				
I	1			
II	0.74	(0.16, 3.30)	0.16	.69
III/IV	0.52	(0.11, 2.53)	0.65	.42
Ostomy				
None	1			
Permanent	1.54	(0.38, 6.32)	0.36	.55
FISI score (per unit increase)	1.04	(0.996, 1.09)	3.28	.07
Time elapsed (per year increase)	0.99	(0.98, 1.01)	1.06	.3
<i>FACT Colorectal Cancer Scale</i>				
Trait anxiety (per 0.1 unit increase)	1.61	(1.16, 2.24)	8.1	.0044
Sex				
Female	1			
Male	1.63	(0.46, 5.70)	0.58	.45
Age (per year increase)	1.02	(0.97, 1.07)	0.46	.5
Education (per year increase)	1.1	(0.92, 1.32)	1.03	.31
Tumour stage				
I	1			
II	1.31	(0.30, 5.75)	0.13	.72
III/IV	1.06	(0.23, 4.88)	0.01	.94
Ostomy				
None	1			
Permanent	0.77	(0.18, 3.18)	0.13	.71
FISI score (per unit increase)	1.08	(1.03, 1.14)	8.48	.0036
Time elapsed (per year increase)	0.98	(0.969, 0.999)	4.14	.042
<i>IES-R total</i>				
Trait anxiety (per 0.1 unit increase)	1.35	(1.01, 1.80)	4.21	.04
Sex				
Female	1			
Male	0.92	(0.28, 3.02)	0.02	.89
Age (per year increase)	1.01	(0.96, 1.06)	0.13	.72

Predictor	Odds ratio	95% CI	Wald χ^2	P-value
Education (per year increase)	1.1	(0.92, 1.32)	1.19	.28
Tumour stage				
I	1			
II	2.29	(0.58, 9.05)	1.39	.24
III/IV	0.57	(0.12, 2.65)	0.51	.48
Ostomy				
None	1			
Permanent	1.16	(0.30, 4.40)	0.05	.83
FISI score (per unit increase)	1.07	(1.02, 1.12)	7.94	.0048
Time elapsed (per year increase)	0.99	(0.98, 1.004)	1.87	.17

All odds ratios correspond to participants in the poor versus better score groups, i.e. below (vs. above) median for FACT, above (vs. below) median for IES-R.

Table 4
Best-fit multivariate logistic models of all FACT scales

Predictor	Odds ratio	95% CI	Wald χ^2	P-value
<i>Physical well-being</i>				
Trait anxiety (per 0.1 unit increase)	1.56	(1.21, 2.02)	11.75	.0006
<i>Social well-being</i>				
Trait anxiety (per 0.1 unit increase)	1.47	(1.14, 1.88)	9.05	.0026
Sex				
Female	1			
Male	3.81	(1.21, 11.99)	5.25	.022
<i>Emotional well-being</i>				
Trait anxiety (per 0.1 unit increase)	1.45	(1.12, 1.88)	8.02	.0046
FISI score (per unit increase)	1.06	(1.01, 1.10)	6.95	.0084
<i>Functional well-being</i>				
Trait anxiety (per 0.1 unit increase)	1.28	(1.04, 1.57)	5.24	.022
<i>FACT-G</i>				
Trait anxiety (per 0.1 unit increase)	1.56	(1.20, 2.02)	11.28	.0008
<i>Colorectal Cancer Scale</i>				
Trait anxiety (per 0.1 unit increase)	1.42	(1.08, 1.87)	6.26	.012
FISI score (per unit increase)	1.07	(1.02, 1.12)	8.21	.0042
Time elapsed (per year increase)	0.987	(0.973, 1.001)	3.55	.06

Table 5
Best-fit multivariate logistic models of all IES-R scales

Predictor	Odds ratio	95% CI	Wald χ^2	P-value
<i>Avoidance</i>				
Trait anxiety (per 0.1 unit increase)	1.41	(1.09, 1.82)	6.7	.0096
FISI score (per unit increase)	1.07	(1.03, 1.12)	9.83	.0017
<i>Hyperarousal</i>				
Trait anxiety (per 0.1 unit increase)	1.3	(1.03, 1.64)	4.91	.027
FISI score (per unit increase)	1.06	(1.02, 1.10)	7.48	.0062
<i>Intrusiveness</i>				
Trait anxiety (per 0.1 unit increase)	1.45	(1.12, 1.88)	8	.0047
FISI score (per unit increase)	1.06	(1.01, 1.10)	6.82	.009
<i>Total score</i>				
Trait anxiety (per 0.1 unit increase)	1.24	(0.99, 1.55)	3.57	.059
FISI score (per unit increase)	1.05	(1.01, 1.09)	6.38	.012