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## Mental Health Outcomes during Colorectal Cancer Survivorship: A Review of the Literature

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### Abstract

**Objective**—This article reviews literature on adults' mental health outcomes during acute and long-term colorectal cancer (CRC) survivorship.

**Methods**—We identified articles that included at least one measure of psychological symptoms or mental quality of life or well-being through a search of databases (CINAHL, MEDLINE, PsycINFO, and PsycARTICLES). Articles were published between January 2004 and April 2015.

**Results**—A significant proportion of CRC survivors experience clinically meaningful levels of anxiety and depressive symptoms or reduced mental well-being across the trajectory of the illness. Demographic, medical, and psychosocial predictors of mental health outcomes were identified. However, few studies were theory-driven, and gaps remain in our understanding of risk and protective factors with respect to mental health outcomes, especially during long-term CRC survivorship.

**Conclusions**—Theory-driven longitudinal research with larger samples is required to identify subgroups of CRC survivors with different trajectories of psychological adjustment. Such research would assess adjustment as a function of internal resources (e.g., personality, coping) and external resources (e.g., finances, social support) to inform future interventions for CRC survivors.

### Keywords

colorectal cancer; oncology; mental health; psychological; quality of life; review

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Colorectal cancer (CRC) is the third most common cancer affecting both men and women in the United States, with over 132,000 new cases expected in 2015 [1]. CRC includes malignancies of the colon and rectum for which the majority of patients receive surgery. Chemotherapy alone, or in combination with radiation, also is administered before or after

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surgery to most patients whose cancer has deeply invaded the bowel wall or metastasized to lymph nodes [1]. Additionally, since 2004, several targeted therapies have received FDA approval for the treatment of metastatic CRC [1].

Treatment of CRC results in cure in the majority of affected patients [1], and survivors of this disease often experience a range of medical, practical, and social challenges, which impact their mental well-being. Literature on mental health following a CRC diagnosis and treatment has proliferated in recent years. A critical examination of this literature is essential for guiding future research and informing clinical care.

This review of mental health in CRC survivors is limited to articles published in English between January 1, 2004 and April 28, 2015. We focus on these more recent studies because they are more likely to reflect current practice in CRC treatment and longer survival and show methodological improvement relative to earlier studies. Articles were identified through a search of CINAHL, MEDLINE, PsycINFO, and PsycARTICLES. Search terms used in each database included combinations of *cancer* (including *oncolog\**, *neoplasm*), *colorectal* (including *colon*, *rectal*), and terms related to *quality of life* (including *distress*, *psycho\**, *anxiety*, *depress\**, *\*traumatic stress*, *“psychological stress,” stress*, *emotion\**, *“mental health,” worry*, *fear*, *stigma*, *identity*, *adjustment*, *adaptation*, *well-being*, *symptoms*, *pain*, *fatigue*, *dyspnea*, *breath\**, *sleep*, *sexual*, *urinary incontinence*).

Several criteria were used to guide article selection for this review. Articles had to be published in refereed journals and had to include at least one validated measure of psychological symptoms or mental quality of life (QOL) or well-being. In addition, study participants had to be adult CRC patients or survivors of any disease stage. We excluded articles that focused on interventions for CRC survivors because this research is beyond the scope of this review.

First, we review the literature on mental health during the acute survivorship period, beginning around the time of diagnosis and treatment and continuing 1 to 2 years post-diagnosis. Then we review the literature on mental health during the middle- to long-term survivorship periods, which generally begin around 2 years post-diagnosis. Illustrative studies for the acute and long-term CRC survivorship periods are summarized in Tables 1 and 2, respectively. Finally, we provide a methodological and conceptual critique of prior research along with directions for future research.

## **Mental Health during the Acute Survivorship Period**

### **Anxiety and Depressive Symptoms**

The prevalence of CRC patients' anxiety and depressive symptoms during the acute survivorship period, defined as 1 to 2 years post-diagnosis, has varied across studies. For example, a U.S. study found that 13% of CRC patients at 3 to 6 months post-diagnosis reported moderate to severe depressive symptoms on the Center for Epidemiologic Studies Depression Scale-8 (CES-D-8) [2]. Another study in Australia found a low prevalence of significant anxiety and depressive symptoms on the Brief Symptom Inventory-18 (BSI-18) at 6 and 12 months following CRC diagnosis (range = 7% to 8%) [3]. In contrast, a cross-

sectional study of patients in Southern England who had been diagnosed with CRC during the past year found that 19% showed significant anxiety and 14% showed significant depressive symptoms on the Hospital Anxiety and Depression Scale (HADS) [4].

Trajectories of anxiety and depressive symptoms during the acute survivorship period have not been well characterized. Some exceptions are discussed here. First, a study of CRC patients in Taiwan found that anxiety and depressive symptoms on the Memorial Symptom Assessment Scale worsened at 1 month following the diagnosis and then returned to baseline levels at 3 and 6 months post-diagnosis [5]. Conversely, a study in the U.S. and Canada did not find fluctuations in depressive symptoms on the CES-D, which remained at low levels prior to CRC surgery and at 6-, 12-, and 18-months post-surgery [6]. In a study in Hong Kong, the HADS was administered to CRC patients within 12 weeks of diagnosis and at 3- and 12-month follow-ups [7]. Results indicated that the majority of patients (65–67%) showed a resilient trajectory, whereas a fraction showed recovery (13–16%) or delayed distress (10–13%) trajectories. A small minority of patients (7–9%) showed a chronic distress trajectory. Taken together, studies suggest that most patients are within the normative range with respect to anxiety and depressive symptoms during the acute survivorship period. However, these studies did not assess cancer-specific distress (e.g., worry, posttraumatic stress symptoms), which is elevated in some patients who do not show generalized psychological distress.

### Emotional Functioning

Other longitudinal studies have documented changes in emotional functioning on standardized QOL instruments during the acute survivorship period. For example, a Japanese study of CRC patients found that emotional functioning on the European Organization for Research and Treatment of Cancer (EORTC) QLQ-C30 improved between the time prior to surgery and 1–4 months post-surgery [8]. In contrast, Swedish and German studies of rectal cancer patients undergoing surgery found that emotional functioning declined during the acute recovery period (i.e., pre-surgery to discharge or 1 month post-surgery) but then improved at follow-ups of 6 and 24 months, respectively [9, 10]. A Danish study documented changes in emotional functioning on the EORTC QLQ-C30 every 3 months for 24 months following complex rectal cancer surgery [11]. Emotional functioning showed a clinically significant improvement at 12 months post-surgery and then remained stable.

Other studies have examined the emotional functioning of CRC patients undergoing adjuvant treatments. For example, a study in the U.S. prospectively examined change in emotional well-being among locally advanced rectal cancer patients receiving neoadjuvant chemoradiation [12]. Emotional functioning on the EORTC QLQ-C30 did not change over the three studied time points (3 weeks pre-treatment, week 4 of chemoradiation, and 1 month post-chemoradiation). Another U.S. study of CRC patients receiving various treatments found that emotional well-being on the Functional Assessment of Cancer Therapy-Colorectal exceeded population norms at an average of 9 months post-diagnosis [13]. Subsequently, equal numbers of patients showed clinically meaningful decline (26%) or improvement (26%) in emotional well-being at 19 months. Given differences in patient

characteristics, time points, and measures used in these studies, further research is needed before drawing definitive conclusions regarding the trajectory of emotional functioning of CRC survivors in the acute survivorship period.

### **Correlates of Mental Health Outcomes**

Demographic and medical correlates of mental health outcomes during the acute survivorship period have been identified. First, lower socioeconomic status and younger age have been associated with greater anxiety and depressive symptoms and worse emotional well-being [4, 7, 14–19]. One study found depressive symptoms to be stable during the first 18 months post-surgery for CRC, but consistently higher among younger adults than older adults [6]. Furthermore, older adults reported more rapid declines in negative affect than younger adults. Other demographic factors, including gender and marital status, have shown mixed associations with CRC patients' psychological adjustment [4, 6, 7, 15, 20]. Regarding medical factors, greater medical comorbidities, worse self-reported general health, bowel dysfunction, and physical symptom distress have been correlated with worse psychological outcomes [3, 13, 16, 18, 21]. However, CRC stage has shown mixed associations with distress [2–4, 15, 19, 20, 22], and time since diagnosis was unrelated to distress in several studies [4, 15, 20].

One medical factor expected to result in greater distress is the presence of a stoma; however, limited research has examined its relation to psychological outcomes [19, 23, 24]. One longitudinal study of CRC patients from 3 to 24 months post-surgery found that stoma patients had higher levels of depressive symptoms than non-stoma patients [24]. Additionally, results from this study suggested that having a stoma made some time after the primary operation was more distressing than having a stoma made during the initial operation. Stoma status and other medical variables (e.g., cancer type, receipt of chemotherapy) warrant further study before conclusions may be drawn regarding their impact on mental health.

Psychosocial resources associated with better psychological adjustment to CRC in the acute survivorship period have included higher levels of optimism [3, 18, 25], reduced cancer threat appraisal [3, 6, 25], greater social support [3, 18], and better family relationship quality [16]. In addition, among Chinese CRC patients, greater personal control and collective control (i.e., control over cancer-related problems in collaboration with close others) were associated with lower levels of depressive symptoms [16]. Conversely, greater rumination was found to be a risk factor for depressive symptoms in Danish colon cancer patients [20]. All of these findings are consistent with other medical and general population literatures on risk and protective factors with respect to mental health [26, 27].

## **Mental Health during the Long-term Survivorship Period**

### **Anxiety and Depressive Symptoms**

Few studies have focused on anxiety and depressive symptoms among long-term CRC survivors, defined as those who are two or more years post-diagnosis [28–30]. One example is an Australian study of CRC survivors which found that the prevalence of clinically

significant distress (i.e., anxiety, depressive symptoms, and somatization) on the BSI-18 was 40% at 2 years post-diagnosis and 42% at 5 years post-diagnosis [28]. However, when the authors used a more stringent cutoff on the BSI-18, only 5% reported significant distress at 5 years post-diagnosis [31]. Four subgroups of survivors were identified, ranging from those with consistently low distress (19%) to those with high distress that gradually decreased over the 5 years post-diagnosis (13%) [28]. The largest group of survivors (39%) showed moderate levels of distress that steadily increased to clinically significant levels over the 5 years post-diagnosis. The authors did not collect sufficient information to ascertain reasons for this increase in distress, such as disease recurrence or progression. Another study in Japan found that 37% of CRC survivors showed significant depressive symptoms and 8% showed significant anxiety on the HADS at an average of 40 months post-surgery [29]. Taken together, findings suggest that a significant proportion of long-term CRC survivors experience meaningful levels of anxiety and depressive symptoms.

### Emotional Functioning

Other studies have used standardized QOL instruments to document emotional functioning among long-term CRC survivors. A population-based German study found that, at 3, 5, and 10 years post-diagnosis, CRC survivors showed deficits in emotional functioning relative to the general population on the EORTC QLQ-C30 [32, 33]. Moreover, survivors' emotional functioning significantly worsened over the 10-year study period. Similarly, an Italian study found that 5-year CRC survivors, all of whom underwent curative surgery, reported significantly worse mental health on the Short Form 36 Health Survey (SF-36) relative to the general population [34]. On the other hand, a few studies have found comparable or better emotional functioning among long-term CRC survivors relative to non-cancer controls [35, 36]. For example, a cross-sectional, population-based study in France recruited three groups of CRC survivors based on survival period (i.e., 5, 10, and 15 years post-diagnosis) and non-cancer controls [35]. No differences in mental health outcomes on the SF-36 and EORTC QLQ-C30 were found between the three groups of CRC survivors and controls. Finally, a population-based study in the Netherlands found that colon cancer survivors who were, on average, 4 years post-diagnosis reported better mental health and fewer role limitations due to emotional problems on the SF-36 relative to norms [36].

### Correlates of Mental Health Outcomes

Although methodological differences may partially explain disparate findings across studies, evidence suggests that demographic characteristics also account for variance in mental health outcomes [28, 33, 37]. One prospective population-based study of CRC survivors in Australia found that certain patient characteristics (e.g., male gender, younger age, lower levels of education) predicted consistently high global distress on the BSI-18 up to 5 years post-diagnosis [28]. Other studies have documented trajectories of emotional functioning by gender or age group during long-term CRC survivorship. For example, a longitudinal U.S. study of rectal cancer patients found that mental health on the SF-36 did not significantly vary by gender during a 5-year period following surgery [38]. However, women showed improvement in mental health over time, whereas men's mental health did not change over the 5-year period. Another longitudinal study found that younger German CRC survivors (age at diagnosis < 60 years) consistently reported reduced emotional functioning on the

EORTC QLQ-C30 relative to general population controls during the 10 years after diagnosis [33]. In contrast, older CRC survivors' (age at diagnosis  $\geq 70$  years) emotional functioning did not differ from that of controls during the first 5 years post-diagnosis and then became worse than controls at 10 years post-diagnosis. Thus, decrements in emotional functioning in older survivors only became evident during long-term follow-up.

Other studies have focused on medical and psychological predictors of mental health outcomes in long-term CRC survivors. Studied medical predictors have included stoma status, disease stage, tumor location, and cancer treatment [28, 39–42]. Research on stoma status has yielded mixed results [39–42]. Several studies of long-term (mean/median = 3–13 years post-treatment) rectal cancer survivors found that emotional functioning on the EORTC QLQ-C30 did not differ as a function of stoma status [39–41]. However, another study examined rectal cancer survivors at an average of 11 years post-surgery and found that male and female survivors with a permanent stoma reported worse mental health on the SF-36 than controls without a stoma [42]. The relation of disease stage to mental health outcomes has rarely been examined in long-term CRC survivors. One study found that late disease stage predicted high global distress on the BSI-18 up to 5 years following CRC diagnosis [28]. Tumor location and treatment-related factors (i.e., receipt of chemoradiotherapy, presence of surgical complications) have not been found to predict emotional functioning in long-term rectal cancer survivors [39, 41]; however, studies examining such relationships are scarce. Finally, psychological factors, including lower levels of optimism and disease acceptance and higher levels of helplessness, have predicted emotional well-being and anxiety and depressive symptoms in long-term CRC survivors [31, 40]. As longitudinal research with long-term CRC survivors is limited, further research is needed to establish demographic, medical, and psychological predictors of their mental health outcomes.

## Methodological Critique

Although a growing number of longitudinal studies have assessed mental health outcomes at several time points following CRC diagnosis or treatment, many studies are cross-sectional and include patients at various times since diagnosis. In addition, the percentages of CRC patients currently undergoing different types of treatment are often not reported. Furthermore, many studies do not examine important medical factors that may predict distress such as surgery type (laparoscopic vs. open), adjuvant treatment type (chemotherapy vs. none, chemoradiotherapy), cancer location (colon vs. rectal), or disease stage. Sampling CRC patients at different phases of the illness trajectory (e.g., diagnosis, treatment, survivorship, recurrence, palliative phase) would allow us to identify distressed subgroups. For example, a cross-sectional study in Finland included five groups of CRC patients: primary treatment, rehabilitation, remission, metastatic disease, and palliative care [43]. Relative to the general population, depressive symptoms were only found to be greater for the metastatic disease and palliative care groups. To date, scarce research has focused on the palliative care phase of CRC. Studying patients at all phases of the illness, increasing sample size for subgroup analyses, and providing a detailed account of prior and current treatments are important steps for future research.



Demographic diversity also warrants greater attention in the design and reporting of future work. To date, survivorship studies have primarily been conducted in Asia, Europe, Australia, Canada, and the U.S. The majority of patients in CRC studies have been Caucasian, and the ethnicity of minority patients is often not reported. Race and ethnicity have been associated with health-related coping strategies [44], explanations of illness [45], health literacy [46], and patient-provider communication [47]; thus, cross-cultural studies would elucidate the role of context and culture-specific beliefs in psychological adjustment to CRC. Increased incorporation of social class data (e.g., education, income) would allow researchers to examine the intersection of economic and cultural factors on mental health outcomes.

Inconsistency in measurement methodology is another major issue that deserves attention in future research. Although the EORTC QLQ-C30 has been commonly used in studies of CRC patients, researchers have generally relied on diverse instruments to assess QOL and anxiety and depressive symptoms in this population. Although most of these instruments have evidence of reliability and validity, their infrequent use does not allow for comparisons across CRC studies. In an effort to standardize self-report assessments of patient health outcomes across studies, the National Institutes of Health (NIH) funded the development of the Patient Reported Outcomes Measurement Information System (PROMIS). These measures have undergone rigorous reliability and validity testing [48, 49] and have been translated into a number of languages. Additionally, standardized T-scores allow comparisons with general population norms. Cancer patients provided input during the measure development process [50], and a growing body of research has documented the measures' reliability and validity for use with cancer patients [51, 52]. Greater use of these measures with CRC patients may facilitate reporting of clinically meaningful symptom change and aggregation of results across studies.

## Conceptual Critique

### Understudied Mental Health Outcomes

Although studies have documented general anxiety and depressive symptoms in CRC survivors [2, 3], cancer-specific distress, such as cancer-related posttraumatic stress disorder (PTSD), has received little attention in this population [53]. PTSD symptoms include intrusive thoughts or re-experiencing cancer-related trauma, avoidance of internal or external reminders of the trauma, negative changes in cognition or mood, and hyperarousal [54]. A recent meta-analysis found an average prevalence of 6% for cancer-related PTSD and 13% for lifetime cancer-related PTSD across studies of various cancer types using clinical interview methods [55]. Additionally, younger age and more advanced disease were associated with a higher prevalence of current cancer-related PTSD. Results of another meta-analysis suggested that cancer-related PTSD symptoms are associated with greater general distress symptoms, reduced social support, and poorer physical QOL across cancer types [56]. The degree to which the prevalence and correlates of PTSD differ for CRC survivors relative to other cancer populations is largely unknown. Studies informed by theoretical models of PTSD [57] are needed to determine whether clinical characteristics of CRC (e.g., stoma, surgery type) are associated with PTSD.

Another type of cancer-specific distress that has received scarce attention in the CRC literature is fear of cancer recurrence (FCR). Although definitions of FCR vary, it is generally defined as fear or worry that cancer will return or progress [58]. In a systematic review, survivors were found to report low to moderate levels of FCR, but it was rated as one of their greatest concerns [59]. Another systematic review found that younger age and greater physical symptoms and psychological distress were associated with greater FCR [60]. Despite the growth of research on FCR, key conceptual and methodological issues warrant further study. Developing a consensual definition of FCR and rapid screening tools with clinical cutoffs are important next steps. In addition, although a cognitive-behavioral model of FCR has been proposed [61], no theoretical model has been tested using rigorous, prospective designs. Identifying theory-driven predictors of FCR among CRC and other cancer survivors would inform intervention development.

Other cancer-related worries also have rarely been studied in CRC populations. For example, one study of over 5,000 CRC and lung cancer patients found a high prevalence of worries associated with treatment decision-making [62]. Specifically, over 75% of patients worried about side effects of treatment and 40% worried about the cost of treatment. In addition, 52% worried about time away from work and 50% worried about time away from family. Longitudinal studies are needed to identify the types of cancer-related worry that are most common at different points in the CRC trajectory and their predictors.

### Potential Theoretical Frameworks

Use of a theoretical framework may inform hypothesis testing and measurement selection; however, most studies on mental health in CRC survivors are not guided by theory. Exceptions to this trend include research with acute CRC survivors framed by conservation of resources theory [7, 15]. According to this theory, changes in internal and external resources drive adaptation to stressors such as cancer [63]. Internal resources include personality factors such as optimism, a sense of mastery or control over circumstances, and self-esteem [64]. External resources are derived from the physical environment or interactions with others and include finances, employment, and social support [65]. From this perspective, preventing resource depletion and maintaining or gaining resources should promote healthy psychological adjustment to stress [63]. Future longitudinal research with CRC survivors should consider incorporating relevant internal and external resources as predictors of adjustment outcomes.

Psychological adjustment to CRC may also be understood within the stress and coping framework of Lazarus and Folkman [66]. According to this framework, when an internal or external demand is appraised as exceeding the person's resources, the demand is considered a stressor. The process of coping with stressors affects psychological well-being. Using this framework, future research may examine coping efforts of CRC survivors and the contexts in which these efforts are adaptive. For example, adaptive coping efforts in a palliative care context are likely to differ from those in a long-term survivorship context.

Stigma theory [67, 68] may also be a useful framework for understanding CRC survivors' coping and mental health outcomes. Survivors may perceive CRC as stigmatizing for a number of reasons. First, some CRC survivors have a colostomy or ileostomy which may



limit social interaction [69] and prompt reactions of disgust [70]. Indeed, rectal cancer survivors with a stoma feel more stigmatized [71], experience worse social well-being, and report greater symptoms of depression than those without a stoma [42]. Second, incontinence and other defecation-related problems may contribute to body image disturbances and impaired QOL [72]. Third, CRC survivors may have difficulty adapting to physical limitations, changes in roles (e.g., loss of ability to work) [73], and altered sexual functioning [74], all of which may increase perceptions of stigma. Furthermore, the “cancer patient” role is associated with disability and death and, thus, is likely to be stigmatized or devalued by others [75]. Finally, men have voiced concerns that colonoscopy or examinations of the rectum are embarrassing or a threat to masculine identity, thereby increasing their perceptions of stigma [76, 77]. In support of stigma theory, a U.S. study of male veterans with CRC found that 31% endorsed at least one item assessing cancer-related stigma, and 25% reported some degree of self-blame with respect to their illness [78]. In cross-sectional analyses, cancer stigma and self-blame were positively associated with depressive symptoms. Further studies with more diverse samples are needed to determine the extent to which CRC survivors perceive stigma and its association with mental health outcomes.

Finally, as the majority of CRC survivors exhibit resilience with respect to psychological adjustment, it is important to identify factors that promote positive mental health outcomes. For example, the strength and vulnerability integration model (SAVI) may be used to understand older adults’ greater psychological resilience relative to younger adults [79]. This model posits that age differences in distress are small at the time of a negative event (e.g., cancer diagnosis) and then increase over time. Explanations for this trend include the greater use of adaptive emotion regulation strategies among older adults. For example, older adults’ appraisals of events and recollections of experiences are less negative than those of younger adults, and these cognitive strategies may lead to reduced negative mood [80]. One longitudinal study largely supported this model in a CRC population [6]. Specifically, older adults reported more rapid declines in negative affect than younger adults during the first 18 months after CRC surgery, and this age difference was mediated by older adults’ more adaptive appraisals of the cancer experience. Greater understanding of individual and contextual factors that contribute to positive psychological sequelae (e.g., perceived personal growth, positive emotions) in CRC survivors would contribute to theory and intervention development [25, 53].

## Conclusions

Accumulating evidence suggests that a significant minority of CRC survivors experience clinically meaningful distress across the trajectory of the illness. Theory-driven longitudinal research is needed to identify predictors of cancer-specific distress and general mental health outcomes in this population. Patterns of psychological adjustment could also be identified and compared at various points in the illness trajectory. Enrolling larger samples with greater demographic and medical diversity will enable subgroup comparisons and enhance generalizability of findings. Incorporating standardized mental health measures (e.g., NIH PROMIS measures) will facilitate comparisons across studies. Ultimately, such research will

inform tailored interventions to prevent and reduce poor mental health outcomes in this growing population of cancer survivors.

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**Table 1** Illustrative studies examining mental health outcomes during acute colorectal cancer survivorship

Reference	Sample demographics at baseline	Cancer site and stage	Study design	Theoretical framework	Mental health measures	Results
Emmertsen and Laurberg, 2013 [21]	N = 260, 60% male, mean age = 66 years, Denmark	100% rectal cancer, 29% stage I, 35% stage II, 36% stage III	Longitudinal, surveyed at diagnosis and 3 and 12 months post-surgery	None	EORTC QLQ-C30: Emotional functioning scale	At 3 and 12 months post-surgery, those with major bowel dysfunction reported reduced emotional functioning compared to those without major bowel dysfunction.
Hart and Charles, 2013 [6]	N = 139, 55% male, mean age = 59 years, 76% Caucasian, USA and Canada	60% rectal cancer, 40% colon cancer, 60% stage III or IV	Longitudinal, surveyed at baseline (pre- surgery) and 6, 12, and 18 months post-surgery	Strength and Vulnerability Theory Integration	CES-D, PANAS	Compared to younger adults, older adults reported more rapid decrease in negative affect; in contrast, positive affect did not significantly change over time and was not related to age. Depressive symptoms also did not significantly change over time; however, younger adults reported more depressive symptoms than older adults. Older adults' more adaptive appraisals of their cancer accounted for their more rapid decrease in negative affect relative to younger adults.
Hou et al., 2010 [7]	N = 234, 62% male, mean age = 64 years, Hong Kong	53% colon cancer, 47% rectal cancer, 3% stage I, 20% stage II, 57% stage III, 20% stage IV	Longitudinal, surveyed within 12 weeks of diagnosis (baseline) and 3 and 12 months post-baseline	Conservation of Resources Theory	HADS	Four different classes of survivors were identified: (1) those in the <i>chronic distress</i> class reported consistently high distress (7%-9%); (2) those in the <i>delayed distress</i> class reported an increase from normative to high distress (10%-13%); (3) those in the <i>recovery</i> class reported a decrease from high to normative distress (13%-16%); and (4) those in the <i>resilient</i> class reported consistently normative distress (65%–67%).
Lynch et al., 2008 [3]	N = 1,822, 60% male, 72% between 60 and 80 years, Australia	70% colon cancer, 30% rectal cancer, 29% Dukes A, 35% Dukes B, 33% Dukes C, 3% Dukes D	Longitudinal, surveyed at 6 and 12 months post-diagnosis, population-based	None	BSI	Rates of anxiety and depressive symptoms were low at both 6 and 12 months post-diagnosis (range = 7%- 8%). Controlling for distress at 6 months, greater distress at 12 months was associated with more comorbidities, less optimism, greater cancer threat appraisal, and less social support.
Quach et al., 2015 [22]	N = 349, 46% male, all 65 years, mean age = 75 years, 79% non-Hispanic White, USA	At follow-up: 70% colon cancer, 18% rectal cancer, 12% rectosigmoid, 53% stage I or II, 78% stage III, 72% stage IV	Longitudinal, surveyed at baseline (pre- diagnosis) and 2 years post- baseline (mean time since CRC diagnosis = 12 months), population-based, case-controlled (N = 1,745 controls)	None	SF-36; MCS, VR- 12; MCS; 3 items from MHOS to assess risk for major depressive disorder (MDD)	At baseline, those who would develop CRC before 2-year follow-up had a similar risk of MDD compared to non-cancer controls (28% and 24%, respectively); however, at 2-year follow-up, CRC survivors were at an increased risk of MDD compared to non-cancer controls (34% and 25%, respectively). Relative to stage I and II survivors, stage IV survivors had an increased risk of MDD. Moreover, compared to non-cancer controls, survivors

Reference	Sample demographics at baseline	Cancer site and stage	Study design	Theoretical framework	Mental health measures	Results
Walling et al., 2015 [2]	N= 3,011, USA	Type of CRC not reported, 81% early stage, 19% late stage	Cross-sectional, between 3 and 6 months post-diagnosis	None	CES-D-8	reported greater declines in mental health at 2-year follow-up. Moderate-to-severe depressive symptoms were reported by 13% of early-stage survivors and 14% of late-stage survivors.

BSI, Brief Symptom Inventory; CES-D, Center for Epidemiologic Studies Depression Scale; CRC = colorectal cancer; EORTC QLQ-C30, European Organization for Research and Treatment of Cancer Quality-of-Life Questionnaire-Core 30; HADS, Hospital Anxiety and Depression Scale; MHOS = Medicare Health Outcomes Survey; PANAS, Positive and Negative Affect Scale; SF-36: MCS, Medical Outcomes Study 36-Item Short-Form Health Survey; Mental Component Summary; VR-12: MCS, Veterans RAND 12-Item Health Survey; Mental Component Summary.

**Table 2** Illustrative studies examining mental health outcomes during long-term colorectal cancer survivorship

Reference	Sample demographics at baseline	Cancer site and stage	Study design	Theoretical framework	Mental health measures	Results
Caravati-Jouvenceaux et al., 2011 [35]	N = 542, 57% male, mean age = 71 years, France	63% colon cancer, 37% rectal cancer, 41% stage I, 26% stage II, 19% stage III, 2% stage IV, 12% unknown	Cross-sectional, population-based, case-controlled (N = 1,181 controls), surveyed at 5, 10, and 15 years post-diagnosis	None	SF-36; MCS, EORTC QLQ-C30; Emotional functioning scale, STAI	There were no significant differences between survivors and non-cancer controls in overall mental health or anxiety.
Dunn et al., 2013 [28]*	N = 1,703, 60% male, 71% aged between 60 and 80 years, Australia	Type of CRC not reported, 55% stage 0, I, or II, 35% stage III or IV, 11% unknown	Longitudinal, surveyed at 5, 12, 24, 36, 48, 60 months post-diagnosis, population-based	None	BSI	Rates of high psychological distress were between 32% and 44% over the 5-year study period. Four different distress trajectories were identified, including: (1) constantly low distress (19%); (2) medium distress that fluctuated across time points (30%); (3) medium distress that increased gradually over time (39%); and (4) high decrease in distress over time (13%). Men reported more distress than women. The most distressed men were more likely to be younger and have lower levels of education, poor social support, and late-stage disease.
Goldzweig et al., 2009 [37]	N = 339, 55% male, mean age = 71 years, Israel	Type of CRC not reported, 18% stage 0 or I, 62% stage II, 20% stage III	Cross-sectional, surveyed between 2 and 6 years post-treatment	None	BSI, IES, MAC	Unmarried, male survivors reported the highest rates of distress and helplessness. Levels of family support were comparable between married and unmarried survivors; however, greater family support was only related to less distress among married survivors.
Jansen et al., 2011 [33]	N = 439, 57% male, mean age = 65 years, Germany	59% colon cancer, 41% rectal cancer, 51% local, 31% regional, 17% distal, 1% unknown	Longitudinal, surveyed at 1, 3, 5, and 10 years post-diagnosis, population-based, case-controlled (N = 2,028 controls)	None	EORTC QLQ-C30; Emotional functioning scale	At 1, 3, and 10 years post-diagnosis, survivors reported significantly worse emotional functioning compared to controls; however, the differences were not clinically meaningful (i.e., >10 points). Compared to older survivors (age > 70 years at diagnosis), younger survivors (age < 60 years) reported significantly worse emotional functioning at 1 and 3 years post-diagnosis, and these differences were clinically meaningful.
Krouse et al., 2009 [42]	N = 491, 62% male, mean age = 72 years, 76% non-Hispanic White, USA	100% rectal cancer, 53% local, 41% regional, 1% distal, 5% unknown	Cross-sectional, surveyed at least 5 years post-diagnosis, case-controlled: ostomies (n = 246 cases) vs. anastomoses (n = 245 controls)	None	Modified COH-QOL-Ostomy, SF-36 version 2; MCS	Females with ostomies reported worse psychological well-being compared to females with anastomoses. Male and female survivors with ostomies were also more likely to report depressive symptoms following their surgery compared to those with anastomoses.

Reference	Sample demographics at baseline	Cancer site and stage	Study design	Theoretical framework	Mental health measures	Results
Thong et al., 2013 [30]	N= 1,419, 53% male, mean age = 70 years, Netherlands	59% colon cancer, 41% rectal, 33% stage I, 38% stage II, 26% stage III, 2% stage IV, 1% unknown	Cross-sectional, surveyed at an average of 8 years post-diagnosis (minimum of 5 years post- diagnosis), population-based, case-controlled (N = 338 normative population controls)	None	HADS	Using a cut-off of 8 on the HADS, 20% of survivors reported clinical levels of anxiety compared to 10% of the normative population; similarly, 18% of survivors reported clinical levels of depressive symptoms compared to 12% of the normative population. Using a more stringent cut-off of 11, 8% of survivors reported clinical levels of anxiety compared to 3% of the normative population; additionally, 7% of survivors reported clinical levels of depressive symptoms compared to 3% of the normative population.

BSL, Brief Symptom Inventory; COH-QOL-Ostomy, City of Hope Quality of Life-Ostomy; CRC = colorectal cancer; EORTC QLQ-C30, European Organization for Research and Treatment of Cancer Quality-of-Life Questionnaire-Core 30; HADS, Hospital Anxiety and Depression Scale; IES, Impact of Event Scale; MAC, Mental Adjustment to Cancer; SF-36: MCS, Medical Outcomes Study 36-Item Short-Form Health Survey; Mental Component Summary; STAI, State-Trait Anxiety Inventory.

\* Study sample overlaps with Lynch et al., 2008 [3] sample.