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Sexual quality of life, body image distress, and psychosocial outcomes in colorectal cancer: a longitudinal study

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Abstract

Purpose The objectives were to assess changes in sexual QOL and body image distress over time and to examine longitudinal associations between sexual QOL and body image variables with psychosocial outcomes in a sample of colorectal cancer patients.

Methods Participants ($N = 141$) completed a mail-based survey assessing sexual QOL [sexual distress (ISS), treatment impact on sexual function (SFQ), sexual function (FSFI; IIEF)], body image distress (BIS), and psychosocial outcomes [relationship quality (DAS-4), depressive symptoms (CESD-SF), and health-related QOL (HRQOL; FACT-C)]; 88 patients completed 6-month follow-up surveys (62%). Gender and cancer subgroups (male vs. female; rectal vs. colon cancer) were compared and longitudinal models examined associations between sexual QOL and body image variables with psychosocial outcomes over time and by subgroup.

Results Impairments in sexual QOL and body image distress were common. Women and patients with rectal cancer reported worse body image distress compared to men ($p = .005$) and those with colon cancer ($p = .03$), respectively; compared to patients with colon cancer, those with rectal cancer reported worse treatment impact ($p < .001$) and marginally worse sexual function and HRQOL ($p's = .05$). At 6-month follow-up, body image distress decreased ($p = .02$), while sexual QOL was stable (e.g., 58% classified as dysfunctional at both time points, $p = .13$). For most sexual and body image predictors, worse impairment was associated with worse psychosocial outcomes over time. Several significant gender and cancer subgroup effects were found.

Conclusions Sexual QOL and body image are compromised after colorectal cancer and tend to remain impaired if unaddressed. Sexual concerns should be addressed early to limit broader-reaching psychosocial effects.

Keywords Colorectal cancer · Sexuality · Sexual function · Relationship quality · Quality of life · Body image

Background

Colorectal cancers are the third most commonly diagnosed cancers in the USA [1]. Among the multiple negative side effects of colorectal cancer surgeries and treatments, changes

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to patients' sexual function and intimate relationships are common [2, 3]. Sexual complaints reported by colorectal cancer survivors include physical concerns (e.g., erectile dysfunction; vaginal dryness), often due to radiation and pelvic surgery, emotional or motivational changes (e.g., low sexual desire), relational challenges (e.g., loss of intimacy) [4], and body image changes that can impact sexual relationships [5–7]. As survivorship extends for many colorectal cancer survivors, sexual quality of life (QOL) is increasingly recognized as important to understand and address clinically [8].

Although research examining the impact of colorectal cancer on patients' sexual outcomes has been increasing in recent years, there continue to be important gaps. For example, much of the research focuses on sexual function [4] whereas other important components of patients' sexual experiences, such as sexual distress or the perceived impact of the cancer treatment on sexual function, are less well understood [9]. Such data

could add granularity to our understanding of sexual QOL in this population and help to clarify potential intervention targets. Further, with a few notable exceptions [10, 11], much of the research examining sexual outcomes in colorectal cancer has been cross-sectional [6, 12, 13], making it difficult to determine whether sexual QOL or body image remains stable or changes over time after colorectal cancer. Given that sexual problems are known to persist for many cancer survivors, research is needed to examine whether such changes occur and, if so, whether these changes are associated longitudinally with important psychosocial outcomes, such as relationship quality, mood, or health-related QOL (HRQOL).

In an effort to fill these gaps, using self-report data obtained from a prospective longitudinal study conducted in 141 colorectal patients, the objectives of the current study were the following: (1) assess sexual QOL (i.e., sexual distress, treatment impact on sexual function, and sexual function status as either functional or dysfunctional) and body image distress, (2) examine whether sexual QOL and body image distress are stable over a 6-month time period, and (3) evaluate whether worse sexual QOL and body image distress are longitudinally associated with worse psychosocial outcomes (i.e., relationship quality, depressive symptoms, HRQOL). In addressing these objectives, we also examined whether these associations would change over time or would differ by gender or cancer site (colon versus rectal). Informed by prior research examining sexual outcomes for colorectal cancer survivors [2, 4, 9, 14, 15] and potential differences in such outcomes by gender or cancer site [9, 16], we hypothesized that (1) sexual QOL and body image would be impaired across both genders and cancer sites but would be worse in women and patients with rectal cancer versus men and those with colon cancer, respectively, (2) sexual QOL would be largely stable over time, and (3) worse sexual QOL and body image distress would be associated with worse psychosocial outcomes.

Methods

Participants

Adult men and women older than age 21 with a diagnosis of colorectal cancer who had been treated at the Johns Hopkins Sidney Kimmel Comprehensive Cancer Center were eligible.

Procedure

Participants were recruited to participate in a prospective study of sexual QOL in individuals diagnosed and treated for colorectal cancer through the clinic or through mailings to Johns Hopkins tumor registry patients (diagnosed within the past 5 years). Of the 258 surveys administered, 143 (55%) were returned, two of which were excluded due to

incorrect diagnosis. Thus, a final sample of 141 individuals was available for analysis at baseline; 57% were recruited in the clinic ($n = 80$); the rest ($n = 61$) were recruited through mailings. A mail-based paper survey was administered assessing a range of sexual, relationship, and physical and mental health outcomes at baseline and at 6 months (mean duration of follow-up in weeks = 28.3; SD = 6.5). The majority of participants completed follow-up surveys ($n = 88$; 62%; mean follow-up = 28.3 weeks; SD = .84). Of the participants who did not complete follow-up surveys, 22 entered a separate study pilot testing a couple-based intervention, 23 were lost to follow-up, and 8 died. Institutional Review Board approval was obtained and patients provided informed consent through completing the baseline survey.

Measures

Predictor variables

Sexual distress The Index of Sexual Satisfaction (ISS) [17] consists of 25 gender-neutral items assessing the degree of discord in a couple's sexual relationship [18]. This measure was originally developed as a tool to assess improvement in psychological treatments for couples seeking clinical help for sexual problems [17]. The ISS has shown responsivity to a sexual QOL intervention conducted with colorectal cancer patients and their partners [18]. Sample items include "I feel that my sex life is lacking in quality" and "My partner does not want sex when I do." Positively worded items (e.g., "I feel that our sex life really adds a lot to our relationship") are reverse-scored such that higher scores indicate greater sexual distress.

Treatment impact on sexual function The Treatment Impact subscale of the Sexual Function Questionnaire (SFQ) [19] consists of five questions assessing the impact of the patient's medical condition (in this case "colorectal cancer or its treatment") on aspects of the patient's sex life (i.e., desire, arousal, orgasm, overall impact, and degree of adjustment to sexual difficulties). Higher scores indicate worse impact.

Sexual function Established cut-off scores on gold standard multidimensional measures of sexual function for women (Female Sexual Function Index; FSFI; cut-off score of 26.55) [20, 21] and men (International Index of Erectile Function; IIEF; cut-off score of 25) [22, 23] were used to characterize patients in either the dysfunctional or functional range (0 = functional; 1 = dysfunctional), which facilitates cross-gender analyses.

Body image distress Body image distress was assessed using the Body Image Scale (BIS) [24], a 10-item scale developed for use in cancer patients that assesses body image changes

and distress due to cancer and its treatment. Higher scores indicate worse distress.

Outcome variables

Relationship quality The 4-item version of the Dyadic Adjustment Scale (DAS) [25] was used to measure relationship quality [26–28]. Higher scores signify better relationship quality.

Depressive symptoms The Center for Epidemiologic Studies Depression Scale−Short Form (CESD-SF) is a 10-item, widely used self-report scale designed to measure symptoms of depression [29]. Higher scores indicate more severe depressive symptoms.

Health-related quality of life The total score [30] of the Functional Assessment of Cancer Therapy-Colorectal (FACT-C) [31] was used to assess HRQOL, using items from four subscales (Physical Well-being, Emotional Well-being, Social Well-being, and Functional Well-Being) and a Colorectal Cancer Specific (CCS) module. In order to limit overlap with the sexual QOL variables, the item assessing sexual satisfaction (Social Well-Being Item #7) was removed. Higher scores indicate better HRQOL.

Covariates

Demographic and medical characteristics Socio-demographic characteristics were obtained through self-report. Medical variables were determined through self-report and medical chart review.

Statistical methods

First, descriptive statistics were conducted on baseline socio-demographic and medical variables. Next, baseline socio-demographic characteristics (i.e., age, marital/partnered status, education, race/ethnicity) and medical characteristics (i.e., metastatic disease, currently receiving active treatment, and time since diagnosis) were compared by cancer site (colon versus rectal) and gender using two-sample t tests for continuous variables and Chi-square or Fisher's exact tests for categorical variables. In univariate analyses, study outcomes were compared across cancer site and gender using two-sample t tests or Chi-square tests. Pearson correlation coefficients were calculated to assess associations among study variables at baseline. We then conducted paired t tests or McNemar tests on sexual QOL scores, as appropriate, to examine changes from baseline to 6-month follow-up. As in prior similar studies [5, 14], available data from those who self-identified as partnered (i.e., married or cohabiting) and as unpartnered (i.e., not married or cohabiting) individuals were used in

analyses. Prior to longitudinal linear mixed models, the outcome variables were assessed for normality; depressive symptoms were negatively skewed and thus log-transformed for all mixed model analyses to improve the distribution. Other outcome measures were not transformed. To examine whether sexual QOL variables were associated with psychosocial outcomes and whether these associations changed over time, linear mixed-effect regressions were used including a random intercept to account for within-subject correlation, time of assessment (baseline or follow-up), and time from diagnosis to baseline.[1] The decision to include gender and colon versus rectal cancer site in the models was made based on prior research showing them to be significantly associated with sexual and/or psychosocial outcomes in colorectal cancer [9, 16, 32]. All two-way and three-way interactions between study predictors of gender, time of assessment, and cancer site were evaluated. Analyses were performed using SPSS 22.0 (IBM Corp. 2014) and Stata Version 12.1 (StataCorp, 2011). Statistical significance was considered at the level of $p < .05$, two-tailed.

Results

Sample characteristics

Baseline characteristics of the study sample are shown in Table 1. Overall, the sample was predominantly male, Caucasian, partnered, and highly educated. The majority was diagnosed with colon cancer as opposed to rectal cancer and had undergone surgery and/or chemotherapy, with fewer having undergone radiation therapy or pelvic surgery specifically. Half of the sample had metastatic disease and slightly less than half was currently receiving active treatment at baseline. Forty-three individuals had a history of ostomy use. A greater proportion of patients with rectal cancer (97%) were partnered compared to those with colon cancer (82%), $\chi^2 = 5.4$, $p = .02$. No other significant differences by either cancer site or by gender were found in other socio-demographic characteristics, and no differences in medical characteristics were found.

Baseline scores on sexual and psychosocial variables

Baseline scores on sexual and psychosocial variables are shown by cancer site and gender in Table 2. The majority of the sample fell into the dysfunctional range of sexual function. At baseline, compared to men, women reported worse body image distress ($p = .005$) but did not differ from men on sexual

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[1] Because age was positively correlated with time since diagnosis at baseline ($r = .25$, $p = .003$), to avoid redundancy, age was excluded from longitudinal models. In addition, because a diagnosis of rectal cancer strongly overlapped with ostomy use ($p < .001$), to avoid redundancy, we selected cancer site for inclusion in the regression analyses.

Table 1 Demographic and clinical characteristics for the study sample ($N = 141$)

Variable	N (%)
Age: mean ± SD, year	57.7 ± 13.2
Female gender	59 (41.8)
Education	
Less than Bachelor's Degree	46 (32.6)
Bachelor's Degree or Advanced Degree	95 (67.4)
Marital status	
Married or cohabiting	121 (85.8)
Ethnicity	
Caucasian	117 (83.0)
African American	11 (7.8)
Asian	9 (6.4)
Other	4 (2.8)
Tumor site	
Colon	104 (73.8)
Rectum	37 (26.2)
Disease stage at survey	
I–II	37 (26.2)
III	34 (24.1)
IV	70 (49.6)
Currently receiving treatment	56 (39.7)
Length of time since diagnosis (months)	31.5 ± 23.0
Treatment received	
Surgery	132 (93.6)
Chemotherapy	106 (75.2)
Radiation	45 (31.9)
Pelvic surgery	50 (35.5)
Ostomy status	
Never had ostomy	98 (69.5)
Past ostomy	18 (12.8)
Current ostomy	25 (17.7)

QOL variables. Compared to those with colon cancer, patients with rectal cancer reported significantly worse treatment impact on sexual function ($p < .001$) and body image distress ($p = .03$). Rectal cancer patients were marginally more likely to be classified as sexually dysfunctional ($p = .049$), and reported marginally poorer HRQOL ($p = .046$) compared to colon cancer patients. No other differences were found.[2]

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[2] Given that the association between cancer site and marital/partnered status were significant, we examined whether group differences on sexual QOL variables were due to partnered status differences by re-rerunning comparisons by both cancer site and gender on sexual QOL variables relevant to partnered sexual activity (sexual distress, treatment impact on sexual function, and sexual function) only in the partnered subsample ($N = 121$). Because the findings were similar, data from the total sample were retained for analyses.

Correlations among study variables

Correlations among study variables at baseline were conducted separately for men and women (see Table 3). Overall, sexual QOL variables were inversely related to the psychosocial outcomes, and correlations were similar across genders. Strong correlations were found between worse sexual distress and poorer relationship quality and between worse body image distress and more severe depressive symptoms and worse quality of life.

Stability of sexual QOL variables and body image distress over time

With the exception of body image distress, which decreased significantly from baseline (M = 7.25; SD = 7.75) to follow-up (M = 5.99; SD = 6.78, $p = .02$), sexual QOL was stable (i.e., did not change) over time. Comparisons of sexual function status at baseline and follow-up were not significant ($p = .13$), indicating no change in the proportions classified as sexually dysfunctional; 58.1 and 32.8% were classified as either dysfunctional or functional, respectively, at both time points. Similarly, neither treatment impact on sexual function nor sexual distress changed significantly from baseline (M = 2.32, SD = 1.10; M = 30.64, SD = 19.04, respectively) to 6-month follow-up (M = 2.26, SD = .98, $p = .43$; M = 30.76, SD = 17.75, $p = .93$, respectively).

Relationships between sexual QOL variable multiple domains of psychosocial function

Significant interactions are depicted graphically in Fig. 1. Main effects of the covariates of cancer site, gender, and time since diagnosis were not significant in any of the models.

Relationship quality As shown in Table 4, we found a significant main effect of sexual distress ($\beta = -.11$, CI $-.15$, $-.08$, $p < .001$) indicating that worse sexual distress was associated with poorer relationship quality. As shown in Fig. 1a, the interaction between time of assessment and sexual distress ($\beta = .06$, CI $.02$, $.11$, $p = .005$) indicates that the association between worse sexual distress and poorer relationship quality was attenuated at follow-up compared to baseline. The effect of sexual distress on relationship quality did not differ by gender or cancer site.

We also found a significant main effect (see Table 4) of body image distress, indicating that greater body image distress was associated with poorer relationship quality ($\beta = -.18$, CI $-.27$, $-.09$, $p < .001$). The specific subgroup effects (i.e., combinations of main and interaction effects) were significant for male colon cancer patients at baseline and for female colon and female rectal cancer patients at follow-up. In the models for treatment impact on sexual

Table 2   Baseline scores on study variables by cancer site and gender

Variable	Colon cancer Mean (SD)	Rectal cancer Mean (SD)	p	Men Mean (SD)	Women Mean (SD)	p
Treatment impact on sexual function	2.25 (1.04)	3.12 (.85)	<.001	2.47 (1.04)	2.57 (1.12)	.64
Sexual distress	31.76 (18.76)	30.87 (19.85)	.83	30.23 (17.65)	33.74 (21.32)	.39
Male sexual function	43.20 (24.11)	32.12 (23.55)	.06	–	–	–
Female sexual function	16.65 (11.26)	12.95 (10.58)	.34	–	–	–
Body image distress	6.70 (7.39)	9.85 (7.21)	.03	6.03 (6.85)	9.62 (7.79)	.005
Relationship quality	16.46 (3.08)	16.94 (2.96)	.43	16.58 (3.06)	16.64 (3.04)	.92
Depressive symptoms	6.51 (6.09)	6.93 (5.60)	.70	6.18 (5.50)	7.24 (6.53)	.31
Quality of life	104.57 (18.49)	97.73 (17.08)	.05	104.65 (17.33)	100.10 (19.42)	.16
Level of sexual concerns	N (%)		–	N (%)		–
Sexual function status, Dysfunctional	51 (62.2%)	29 (80.6%)	.05	49 (64.5%)	31 (73.8%)	.30

The available cases and actual ranges of scores on study measures were as follows: treatment impact on sexual function [$n = 113$; .40–4.88]; sexual distress [$n = 106$; 0–82.67]; female sexual function [$n = 42$; 2–32.80]; male sexual function [$n = 76$; 5–75]; body image distress [$n = 141$; 0–30]; relationship quality [$n = 117$; 6–21]; depressive symptoms [$n = 140$; 0–25]; quality of life [$n = 137$; 54–132]

function and sexual function status on relationship quality, neither the main effects nor the interaction effects were significant.

Depressive symptoms In three separate models with depressive symptoms as the outcome, there were significant main effects of predictors such that worse sexual QOL or body image distress was each associated with more severe depressive symptoms: treatment impact on sexual function ($\beta = .26$, CI .07, .44, $p = .008$), sexual distress ($\beta = .02$, CI .01, .03, $p < .001$), and body image distress ($\beta = .07$, CI .05, .10, $p < .001$). None of these effects varied over time or across gender or cancer site. While there was no significant main effect found for sexual function status on depressive symptoms, the interaction between sexual function status and gender was significant ($\beta = .77$, CI .10, 1.44, $p = .02$; see Fig. 1c), such that the effect of being classified in the dysfunctional range of sexual function on depressive symptoms was

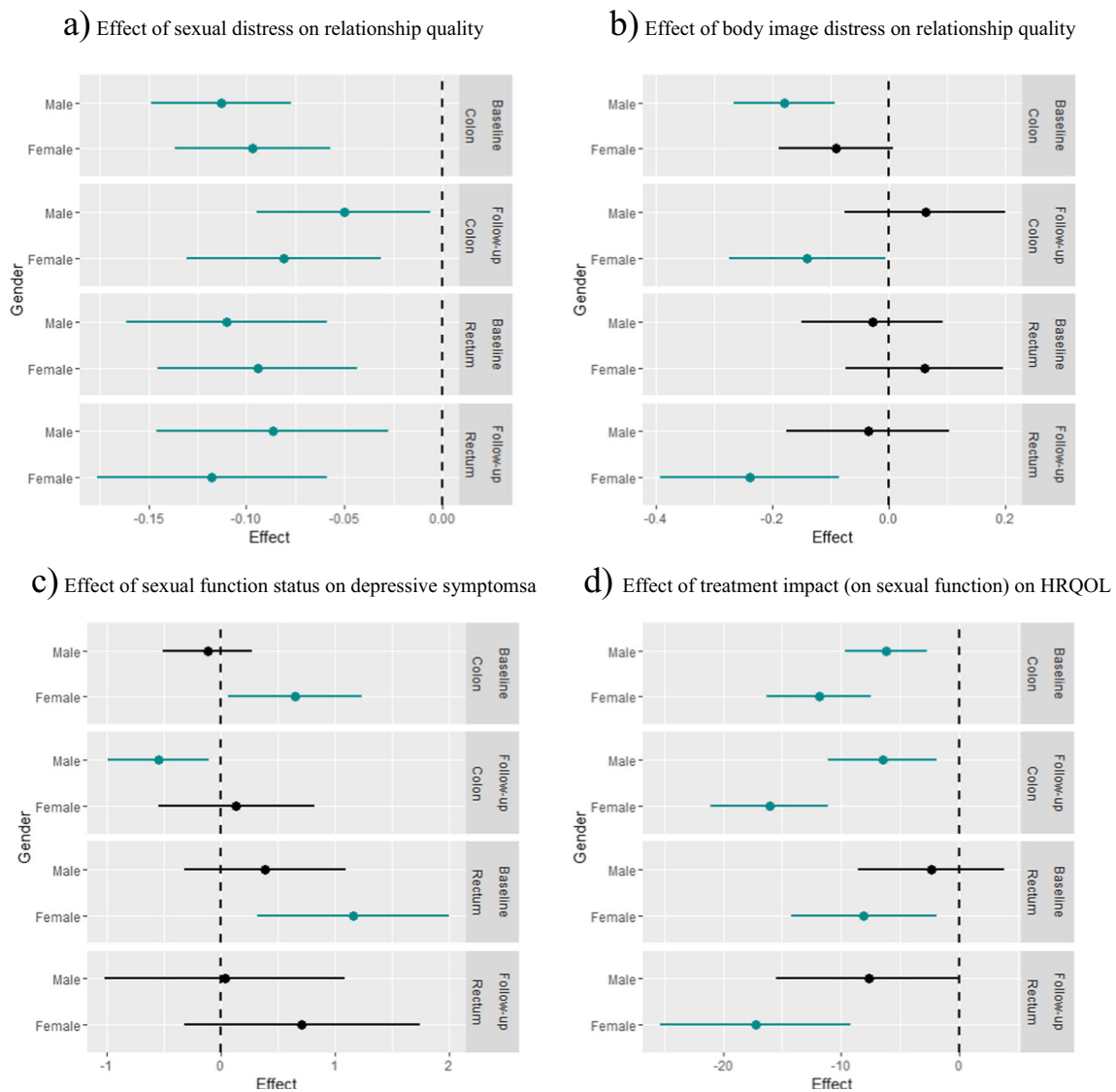consistently greater for women than for men. No other effects emerged as significant.

Health-related quality of life There was a significant effect of treatment impact on HRQOL ($\beta = -6.19$, CI -9.65, -2.72, $p < .001$), such that worse treatment impact was associated with poorer HRQOL. Further, there was a significant interaction between treatment impact and gender ($\beta = -5.70$, CI -10.82, $-.58$, $p = .03$), such that the effect of worse treatment impact on poorer quality of life was more pronounced for women compared to men (see Fig. 1d). The effect of treatment impact on sexual function on HRQOL did not vary by time of assessment or by cancer site. The main effect of sexual distress was significant ($\beta = -.31$, CI 0.55, $-.06$, $p = .02$) suggesting that worse sexual distress was associated with poorer HRQOL, and this effect did not vary over time or across gender or cancer site. Sexual function status did not emerge as significant in the model, nor were any interactions with sexual function status found to be significant.

Table 3   Correlation coefficients for domains of functioning at baseline by gender

Measures	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) Treatment impact on sexual function	–	.53**	−.62***	.50**	−.10	.43**	−.53***
(2) Sexual distress	.40**	–	−.65***	.27	−.64***	.48**	−.33*
(3) Sexual function	−.54***	−.28	–	−.11	.29+	−.35*	.29+
(4) Body image distress	.40***	.35**	−.05	–	−.18	.51***	−.59***
(5) Relationship quality	−.07	−.59***	.03	−.30*	–	−.53***	.38*
(6) Depressive symptoms	.24*	.40**	−.05	.64***	−.16	–	−.80***
(7) Quality of life	−.40**	−.31*	.18	−.60***	.17	−.76***	–

*$p < .05$, **$p < .01$, ***$p < .001$

Correlation coefficients above the diagonal line are for female participants; below the diagonal line are for male patients

a) Effect of sexual distress on relationship quality

b) Effect of body image distress on relationship quality

c) Effect of sexual function status on depressive symptomsa

d) Effect of treatment impact (on sexual function) on HRQOL

Fig. 1 Effects of a 1 unit increase in predictors on outcomes. Significant interactions are depicted graphically in Fig. 1 as effects of a 1 unit increase in the predictor on the outcome by each cancer site and gender subgroup according to time point (baseline or follow-up). Model-based estimates for effects within subgroups are shown with respective confidence intervals, with green lines representing significant subgroup effects (i.e., subgroups with effects significantly different from 0)

Conclusions

Findings of the current study supported the hypothesis that sexual QOL and body image distress would be impaired for patients with colorectal cancer. The impairment was evident across a range of measures assessing distinct dimensions of patients' sexual health. For example, average scores on the sexual distress measure were comparable to those reported by a clinically distressed sample [17]. Findings suggest that for patients with colorectal cancer, sexual health is impacted in a number of ways, extending beyond function to include distress, perceived impact, and body image distress. The additional hypothesis that sexual and body image outcomes would

be worse for women and for patients with rectal cancer was partially supported; women reported worse body image distress compared to men in the study sample, but did not report worse sexual QOL. By contrast, patients with rectal cancer reported impaired sexual QOL and body image distress, as well as worse HRQOL. These findings echo findings of prior research [3, 5, 7, 33] and are likely due in part to receiving treatments (e.g., preoperative radiation therapy, pelvic surgery) known to interfere with physiological sexual response and other domains of physical function [34, 35].

In light of research suggesting that sexual problems can persist for many cancer survivors [14, 15, 36], we hypothesized that sexual QOL and body image distress would be

Table 4 Summary of main effects and significant interaction effects from longitudinal linear mixed regression models

Sexual QOL predictors	Psychosocial outcomes								
	Relationship quality			Depressive symptoms			HRQOL		
	β [CI]	P value	Significant interactions (p < .05)	β [CI]	P value	Significant interactions (p < .05)	β [CI]	P value	Significant interactions (p < .05)
Treatment impact on sexual function (TI)	−.47 [−1.11, .17]	.15	–	.26 [.07, .44]	.008	–	−6.19 [−9.65, −2.72]	<.001	1. TI × gender
Sexual distress (SD)	−.11 [−.15, −.08]	<.001	1. SD x time	.02 [.01, .03]	<.001	–	−.31 [−.55, −.06]	.02	–
Sexual function status (SFS)	.21 [−1.19, 1.61]	.77	–	−.12 [−.51, .28]	.56	1. SFS × gender	.03 [−8.2, 8.25]	.99	–
Body image distress (BID)	−.18 [−.27, −.09]	<.001	1. Time × gender 2. BID × time 3. BID × cancer site 4. BID × cancer site × time 5. BID × time × gender	.07 [.05, .10]	<.001	–	−1.66 [−2.17, −1.16]	<.001	–

Standardized coefficients (β) and confidence intervals (CI) are shown for main effects. Significant P values are italicized

largely stable for the study duration. Findings partially supported these hypotheses. While sexual QOL did not improve over a 6-month period, by contrast, body image distress decreased significantly over the same period of time. Taken alongside findings of previous studies examining change in sexual outcomes and body image [11, 14, 15], these results suggest potentially different post-treatment trajectories for sexual outcomes compared to body image distress for colorectal cancer survivors, with body image emerging as possibly more amenable to improvement over time as compared to sexual QOL. Findings of significant unexpected time by predictor interactions in several analyses further suggest that studies using longitudinal designs may be preferable to those using cross-sectional designs because the longitudinal design can capture changes in the associations between sexual QOL or body image and psychosocial outcomes that might occur over time.

One of the most striking findings from this study pertained to the significant associations found between most of the sexual QOL variables and body image distress and worse psychosocial outcomes. Though such associations were predicted, they were noteworthy in that they were seen across different and distinct predictor and outcome variables and because they tended to hold after accounting for gender, cancer site, and time since diagnosis. Although the current findings cannot confer causality, the directionality of these associations is consistent with prior research demonstrating negative consequences of cancer-related sexual sequelae on psychosocial outcomes (e.g., QOL, mood) in cancer [14, 37]. The associations found here are also consistent with research evidence of a causal pathway both from sexual dysfunction to worse psychological well-being [38], and, conversely, from improved sexual function to improved mood [39], in non-cancer populations. Also intriguing, the findings of gender interactions in two models (i.e., sexual function on depressive symptoms; treatment impact on HRQOL) suggest that women may be particularly vulnerable to negative effects of worse sexual QOL on their mood and overall well-being. Other researchers have similarly found that women with colorectal cancer reported worse sexual QOL [40] and greater psychological distress [7] compared to men, and that associations between sexual QOL and psychological distress were strongly linked for women [12]. Large well-designed research studies on sexual QOL in women with colorectal cancer could help clarify these associations, yet such studies are challenging to conduct because of low recruitment and inadequate survey completion [15, 18, 41]. Therefore, well-funded multi-site studies are needed.

Clinical implications

These findings suggest the importance of identifying and addressing colorectal cancer patients' sexual concerns and

body image distress early in care in order to limit the negative effects on patients' intimate relationships and well-being. Further, it is critical that patients be assessed regardless of their gender, age, partnered status, specific cancer site, or treatment status [42]. A simple brief validated sexual concern screener [43, 44] could be used to identify patients with sexual or body image concerns and lead to timely treatments. Recent work offers guidance to clinicians to assess and refer patients who report sexual and body image concerns once identified [44, 45], and a few small intervention studies offer promising findings for interventions addressing sexual outcomes in samples of patients with colorectal cancer [18, 41]. Interventions are particularly needed to help ensure that the sexual concerns of women treated for cancer are addressed given that compared to men with cancer, women are significantly less likely to have sexual concerns discussed in their care [46].

Study limitations

This study has several limitations, primary of which is that the findings cannot be interpreted as causal in nature. Another limitation is the heterogeneity of the study sample in their clinical characteristics. We controlled for time from diagnosis and examined subgroups by cancer site and gender, but additional studies should assess sexual outcomes at treatment-specific time points, consider outcomes according to different patient subgroups by stage of disease, and use a longer duration of follow-up. Further, while the study was designed to assess sexual QOL in this colorectal cancer sample, it was not powered to detect modest interaction effects and future studies should be powered to find such effects. Additionally, the study sample was fairly homogenous with respect to race/ethnicity and was highly educated. Finally, sexual orientation was not queried and future studies could consider to examine these important outcomes for sexual minority groups. Larger sample sizes and oversampling to ensure diversity could help determine whether these findings would hold for patients from racial/ethnic or sexual minority backgrounds. Despite these limitations, the current study contributes to the research by assessing multiple domains of sexual QOL in colorectal cancer and by examining associations between sexual and psychosocial outcomes over time. Sexual QOL is of importance to the growing number of individuals facing long-term survivorship after a diagnosis of colorectal cancer [8].

Compliance with ethical standards

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