Changes in health-related quality of life, anxiety and depression in patients with colorectal cancer during COVID-19 pandemic

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ABSTRACT:

Aim of the study: The study aimed to assess the changes in health-related quality of life, anxiety and depression in patients with colorectal cancer during COVID-19 pandemic.

Methods: This is an observational study within the ongoing PLCRC cohort. We included 7651 patients, who were required to have at least one questionnaire completed in the year before COVID-19 pandemic. Patients filled out two questionnaires - (EORTC) QLQ-C30 and HADS questionnaire. Clinical data were obtained from the Netherlands Cancer Registry. Linear mixed model analysis was used to assess the three outcomes of interest: HRQoL, anxiety and depression scores. Additionally, we stratified the models by 3 variables – living situation, gender and cancer stage.

Results: In total the analysis included 3646 (44.6%) patients. The scores of quality of life analysis showed an upwards trend for all three variables in the stratified analysis with statistically significant differences on almost all timepoints. Anxiety score changes showed more variability, with still some significant differences. Depression scores showed almost no changes across all timepoints and variables.

Conclusion: To conclude, our study showed increased HRQoL levels, slightly higher (but clinically insignificant) anxiety levels and, no change in depression levels in colorectal cancer patients during the COVID-19 pandemic as compared to the results from the year before the COVID-19 pandemic.

KEYWORDS: health-related quality of life, Sars-Cov-2, colorectal cancer, anxiety, depression, COVID-19, longitudinal analysis

LAYMEN SUMMARY

People with colorectal cancer are usually older and are therefore more vulnerable during the COVID-19 pandemic. Previous research showed that people older than 80 years showed higher chance of dying compared to people aged 50-59 years. The older age and the new hospital policies, such as rescheduling of surgeries and treatments has led to a higher anxiety and depression and it therefore deteriorated the quality of life. Considering that the pandemic is still ongoing, and the cancer patients may be exposed to more pandemics in the future, it is important to establish how the health-related quality of life changed during the different phases of the current pandemic. This would help to develop psychological interventions, and adjustments in communication between health care provider and patient, which could have significant clinical implications for cancer patients. So, we decided to look into this issue during COVID-19 pandemic. The aim of this study was to see how health related quality of life, anxiety and depression levels changed during COVID-19 pandemic. The research was a part of a bigger project done in colorectal cancer patients and the changes that we observed in this study could help us to understand the needs of colorectal cancer patients during the difficult time.

INTRODUCTION

The highly infectious coronavirus disease 2019 (COVID-19) has had an impact on all aspects of life, including cancer care. As cancer patients are typically older aged, they are highly vulnerable during the COVID-19 pandemic. Previous research showed a twenty-fold increased risk of mortality in people aged over 80 years compared to those of age 50–59 years [1, 2]. This, together with national prevention measures such as (partial) lockdowns and adjustments in hospital policies, i.e. rescheduling of surgeries and systemic therapies, has increased the risk of anxiety, depression, and has therefore led to a potentially deteriorated quality of life. Patients were also advised not to visit the hospital to prevent the potential risk of COVID-19 infection. With consultations and treatments being adjusted, postponed, or canceled, cancer centers reported that patients experienced high levels of anxiety and that the demand for counseling and mental health care had increased [3, 4]. Wang et al. (2020) reported a high prevalence of mental health problems and gaps in mental health services during the COVID-19 crisis in China. Another study, done by researchers in Australia showed that the psychological impact of the COVID-19 pandemic causes high levels of uncertainty about future restrictions, the reduced social support networks, and the increasing complexity of caring for people affected by cancer all increase the mental health burden of COVID-19 [6].

Considering that the pandemic is still ongoing, and the cancer patients may be exposed to more pandemics in the future, it is important to establish how the health-related quality of life changed during the different phases of the current pandemic [7]. This would help to develop psychological interventions, and adjustments in communication between health care provider and patient, which could have significant clinical implications for cancer patients. Therefore, we investigated how the health-related quality of life, levels of anxiety, and depression changed in patients with colorectal cancer over time since COVID-19, as compared to the year before COVID-19.

METHODS

Design and Setting

This is an observational study within the ongoing Prospective Dutch Colorectal Cancer (PLCRC) cohort; a nationwide initiative coordinated by the Dutch Colorectal Cancer Group. PLCRC includes patients over 18 years of age, diagnosed with cancer of the colon and/or rectum (International Classification of Diseases, 10th edition [ICD-10]: C18-20) in the Netherlands. The PLCRC cohort was approved by the Medical Research Ethics Committee Utrecht, the Netherlands, and the study protocol has been described published previously [8]. Upon cohort entry, patients provide informed consent to use clinical data for scientific research and can opt to receive repeated questionnaires. Clinical data was obtained through linkage with the Netherlands Cancer Registry.

Study population

Patients were included in the current longitudinal analysis when at least one questionnaire was completed in the year before the COVID-19 pandemic, i.e., between January 1, 2019 and February 29, 2020. In total, 7651 participants were included in the current analysis (Figure 1).

Data collection

Clinical and sociodemographic data from the Netherlands Cancer Registry included age, sex, date of primary cancer diagnosis, tumor location, stage at diagnosis, primary treatment received, and time since diagnosis (categorized). For the classification of tumor types, we used the ICD-10 and TNM classification system was used to classify the disease stage [9, 10]. Through the questionnaires, we obtained additional patient-reported sociodemographic data, including educational level, marital status or partnership, living situation, height, and weight. Lastly, we also obtained patient-reported clinical variables such as current presence of metastases and presence of comorbidities [by means of the adapted self-administered comorbidity questionnaire] [11].

HRQoL Questionnaire

We used the validated European Organization for Research and Treatment of Cancer (EORTC) QLQ-C30 questionnaire [12], which is used to assess the cancer patients' physical, psychological and social functions. All scales and single items are linearly transformed to a 0-100 scale. Higher scores for the functioning scales and global health status represent a better level of functioning, i.e., a better state of the patient, while higher scores on the symptom and single-item scales indicate a higher level of symptoms, i.e., a worse state of the patient [13].

HADS Questionnaire

The Hospital Anxiety and Depression Scale (HADS) [14] is a self-assessment questionnaire, which is used to measure the levels of anxiety and depression of patients. Both the anxiety and depression scales consist of seven items that are scored from zero to three, leading to a score ranging from 0 to 21. A total score of more than 8 can be interpreted as a clinically relevant level of anxiety or depression [15].

Statistical analysis

We used linear mixed models to assess the three outcomes of interest; health-related quality of life, anxiety and depression. Models included the outcome of interest, a categorical time variable, a random intercept and a random slope. Stratified analyses were performed by living situation (alone vs. living with someone), cancer stage (stage 1-3 vs. stage 4) and gender (male vs. female). In these stratified models, we additionally included an interaction term between the stratification factor and the categorical time variable. The categorical time variable included nine timepoints, where timepoints one through five represent data from the year before the COVID-19 pandemic and timepoints six through nine represent data from 15 March 2020, the start of the COVID-19 pandemic in the Netherlands, onwards. Time points have an approximately three-month interval from January 1, 2019 onwards. These time intervals were estimated based on the number of daily COVID-19 patient

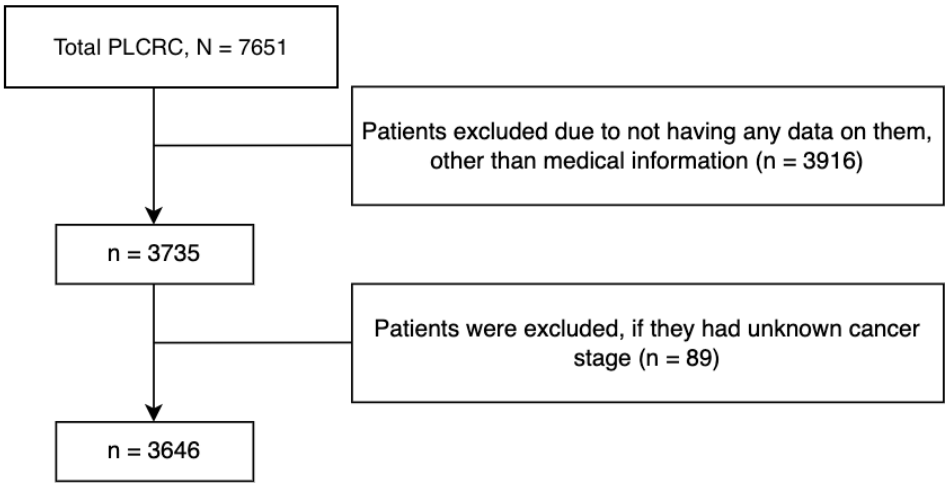
hospitalizations, as we hypothesized this impacted cancer care [16]. The R package “emmeans” was used to obtain estimated marginal means from the model to plot time trends. This function also provided estimated differences per time point between both categorical levels, which allowed us to test the difference between the two. Therefore, we tested the difference between the average score of T1-5, compared to T6-9 to check if there are differences from before the pandemic compared to during the pandemic. The statistical significance was estimated as a P value of less than 0.05. Lastly, the R package “lsmeans” was used to check for statistically significant differences between the time points before and after COVID-19. All analyses were performed in R studio version 4.0.3.

RESULTS

Respondent characteristics

The total PLCRC cohort at the time of the analysis consisted of 7651 patients with CRC (Figure 1). After exclusion of patients due to missing patient-reported outcome data (n = 3916), multiple tumors (n = 537), or incomplete clinical data such as unknown cancer stage (n = 89). In the end, we included 3646 patients (44.6%) in the analysis.

Figure 1. Flowchart of the current study within the PLCRC cohort.



Participants had a mean age of 64.7 (SD = 10.3) and there were 2290 (62.8%) males and 1356 (37.2%) females (Table 1). 2998 (92%) patients had cancer stage between I – III and 262 (8%) patients had cancer stage IV. Additionally, 665 (18.2%) patients lived alone and 2777 (76.1%) lived together with someone else. Majority of patients were diagnosed with colorectal cancer in the 6 months prior to the completion of the questionnaire – 1659 (45.5%). 171 (4.7%) patients were diagnosed between 6 to 12 months before, 470 (12.9%) were diagnosed between 12 to 24 months before, 1084 (29.7%) were diagnosed 24 to 60 months before and 262 (7.2%) patients were diagnosed more than 60 months before the completion of the questionnaire.

Table 1. Sociodemographic and disease characteristics of CRC patients (n = 3646)

Characteristics	Total CRC study population
Total No.	3646
Age (mean, SD), years	64.7 (10.3)
Sex, No. (%)	
Male	2290 (62.8)
Female	1356 (37.2)
Mean (SD) BMI, kg/m^2	26.5 (5.0)
BMI, No (%)	
<18.5	20 (0.5)
18.5-24.9	779 (21.4)
25.0-29.9	807 (22.1)
≥30	355 (9.7)
Education level, No. (%)[a]	
Low	209 (5.7)
Medium	1029 (28.2)
High	2186 (59.9)
Living situation, No. (%)	
Alone	665 (18.2)
Living with someone	2777 (76.1)
Tumor type, No. (%)	
Colon, C18.0-18.9	2287 (62.7)
Rectum, C19.9, C20.9	1359 (37.3)
Cancer stage, No. (%)	
I-III	2998 (92)
IV	262 (8)
Time from diagnosis to pre-COVID-19 questionnaire, No. (%)	
< 6 mo	1659 (45.5)
6 to < 12 mo	171 (4.7)
12 to < 24 mo	470 (12.9)
24 to < 60 mo	1084 (29.7)
> 60 mo	262 (7.2)
Tumor stage at diagnosis, No. (%)	
Stage I	921 (25.3)
Stage II	826 (22.7)
Stage III	1251 (34.3)
Stage IV	262 (7.2)

[a] Low = secondary education (high school) or lower; medium = secondary (vocational) education; high = higher (vocational) education/university.

Table 2 shows the mean results from all ten questionnaires, that were filled out by the patients. The first questionnaire was obtained in the year most recently before COVID-19 and all consecutive questionnaires are during the COVID-19 pandemic. Tables 3, 4, and 5 show the results of HRQoL, anxiety and depression, where HRQoL is further divided into the 15 subsections as well as the quality of life summary score.

Table 2. Mean quality of life, anxiety and depression scores, as reported by CRC patients over time.

	Pre-COVID-19	During COVID-19								
Patient-reported outcome	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**	**T8**	**T9**	**T10**
Total No.	2016	515	900	1310	1130	908	415	180	93	28
HRQoL - EORTC QLQ-C30, 0-100, mean (SD)										
QoL summary score	83.3 (13.8)	85.3 (12.8)	86.9 (12.3)	88.9 (10.8)	88.4 (11.8)	88.4 (11.4)	89.9 (9.6)	89.0 (11.3)	89.7 (11.4)	89.3 (11.1)
Global quality of life	72.3 (19.9)	75.4 (18.8)	77.8 (17.1)	80.0 (16.3)	79.5 (17.1)	79.6 (17.1)	80.7 (16.3)	80.3 (16.6)	81.5 (16.1)	82.2 (16.3)
Physical functioning	87.5 (16.2)	84.6 (16.4)	86.4 (16.3)	88.4 (15.1)	88.3 (15.5)	88.2 (15.7)	88.2 (15.2)	87.9 (17.5)	87.2 (16.9)	81.7 (21.2)
Role functioning	75.0 (30.1)	75.6 (28.2)	80.2 (25.5)	84.6 (22.8)	85.3 (22.0)	85.4 (23.1)	86.2 (21.1)	84.8 (25.0)	84.9 (21.6)	85.7 (23.4)
Emotional functioning	80.4 (20.0)	84.9 (18.1)	84.8 (18.3)	86.1 (16.6)	86.4 (17.7)	86.8 (17.4)	88.8 (14.7)	88.8 (15.8)	88.0 (17.3)	92.6 (14.4)
Cognitive functioning	87.7 (17.5)	87.2 (17.7)	86.5 (18.1)	88.6 (15.4)	87.8 (17.1)	87.8 (16.3)	89.2 (15.4)	87.7 (15.8)	87.9 (19.0)	89.9 (15.3)
Social functioning	80.4 (23.4)	81.5 (23.9)	85.4 (22.3)	89.1 (18.2)	89.1 (19.1)	90.1 (18.5)	91.6 (16.5)	88.7 (18.8)	90.8 (19.6)	90.0 (16.6)
Fatigue	28.0 (24.9)	26.7 (24.0)	22.8 (22.3)	19.4 (20.3)	22.2 (23.1)	23.1 (23.2)	21.5 (21.5)	23.6 (23.4)	21.2 (25.6)	23.4 (19.4)
Nausea and vomiting	7.0 (16.5)	5.4 (13.0)	3.9 (11.6)	2.7 (9.0)	2.9 (9.2)	2.5 (9.2)	1.9 (8.2)	2.0 (6.2)	1.8 (7.5)	3.0 (11.2)
Pain	17.53 (23.9)	13.7 (20.8)	12.2 (21.2)	10.2 (18.5)	10.6 (18.8)	11.0 (18.3)	9.5 (17.6)	9.1 (18.3)	8.0 (17.7)	10.7 (15.2)
Dyspnea	11.4 (20.6)	12.5 (21.0)	11.6 (19.7)	10.0 (18.7)	11.3 (21.2)	11.3 (20.7)	10.2 (18.4)	10.7 (20.1)	9.9 (20.6)	16.7 (23.1)
Insomnia	23.6 (38.6)	19.5 (26.5)	19.3 (25.4)	17.7 (24.3)	17.7 (23.9)	16.7 (23.7)	14.7 (22.8)	16.5 (23.2)	18.8 (24.7)	13.1 (16.6)
Appetite loss	13.2 (24.5)	9.8 (21.5)	6.4 (17.4)	4.3 (14.7)	5.0 (15.4)	4.6 (14.7)	2.5 (10.5)	4.4 (15.9)	1.8 (9.0)	2.4 (8.7)
Constipation	11.7 (22.1)	9.0 (18.7)	8.4 (18.4)	7.0 (16.3)	8.1 (17.7)	9.3 (18.5)	5.6 (13.5)	6.6 (15.8)	5.8 (16.1)	4.8 (11.9)
Diarrhea	17.4 (25.5)	12.8 (23.0)	9.8 (20.0)	10.5 (20.5)	10.2 (19.6)	10.7 (19.8)	9.8 (18.2)	8.4 (17.2)	10.0 (21.9)	4.8 (11.9)
HADS, 0-21, mean (SD)										
Anxiety	12.8 (2.1)		13.2 (2.1)	13.1 (1.9)	13.2 (2.0)	13.3 (2.0)	13.6 (1.7)	13.4 (1.8)	13.5 (1.8)	13.8 (1.7)
Depression	8.9 (1.5)		9.1 (1.7)	8.9 (1.5)	9.0 (1.6)	8.9 (1.5)	9.0 (1.5)	9.0 (1.3)	8.9 (1.3)	9.3 (2.2)

T1 is a baseline measure pre-COVID-19, T2-10 are time points during COVID-19. HRQoL, health-related quality of life; QoL, quality of life; SD, standard deviation; HADS, hospital anxiety and depression scale.

Table 3A. Estimated marginal means for quality of life, stratified by living situation, stage, and sex (n= 3646)

	Pre-COVID-19					During COVID-19			
Time points	T1	T2	T3	T4	T5	T6	T7	T8	T9
Living situation									
Alone	79.8 (0.77)	81.3 (0.79)	81.6 (0.75)	81.7 (0.70)	82.6 (0.72)	87.0 (0.62)	86.2 (0.59)	86.9 (0.56)	86.6 (0.54)
With others *	82.2 (0.67)	83.7 (0.68)	84.0 (0.64)	84.1 (0.59)	85.0 (0.61)	89.3 (0.49)	88.6 (0.44)	89.2 (0.41)	89.0 (0.38)
Stage									
I-III	82.1 (0.70)	83.3 (0.70)	83.1 (0.63)	85.0 (0.53)	86.1 (0.46)	88.4 (0.29)	87.8 (0.30)	88.4 (0.33)	89.0 (0.34)
IV	78.8 (0.95)	80.0 (0.94)	79.8 (0.90)	81.7 (0.84)	82.8 (0.80)	85.1 (0.71)	84.5 (0.72)	85.1 (0.73)	85.7 (0.74)
Sex									
Men	82.4 (0.66)	83.7 (0.66)	84.0 (0.60)	85.2 (0.52)	86.4 (0.46)	88.7 (0.31)	88.1 (0.31)	88.8 (0.34)	89.5 (0.35)
Women	80.1 (0.67)	81.5 (0.69)	81.7 (0.63)	83.0 (0.55)	84.2 (0.50)	86.5 (0.40)	85.9 (0.37)	86.5 (0.40)	87.2 (0.40)

T1-5 are pre-COVID-19, T6-9 are time points during COVID-19. Time points have an approximate 90-day interval *With others includes living only with a partner, only with kids or both, partner and kids.

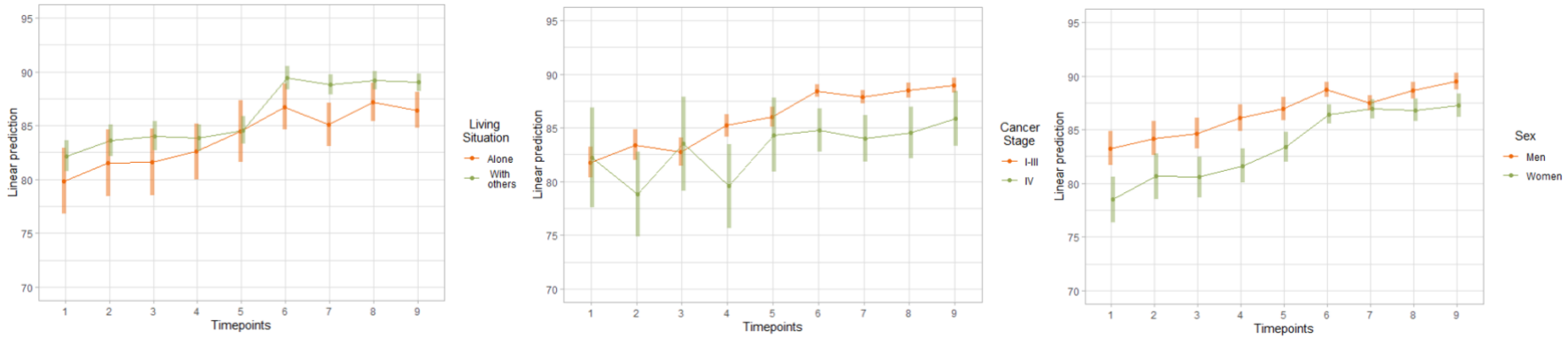


Figure 2A. The three graphs represent the estimated marginal means score for health-related quality of life over time and each graph shows one stratified variable – living situation, cancer stage and sex.

Table 3B. Estimated marginal means for anxiety, stratified by living situation, stage, and sex (n= 3646).

	Pre-COVID-19					During COVID-19			
Time points	T1	T2	T3	T4	T5	T6	T7	T8	T9
Living situation									
Alone	12.8 (0.11)	13.0 (0.12)	12.9 (0.12)	12.9 (0.11)	13.1 (0.11)	13.3 (0.10)	13.4 (0.10)	13.4 (0.10)	13.3 (0.09)
With others *	12.7 (0.10)	12.9 (0.11)	12.8 (0.10)	12.8 (0.09)	13.0 (0.08)	13.2 (0.08)	13.3 (0.08)	13.3 (0.07)	13.2 (0.07)
Stage									
I-III	12.8 (0.10)	13.0 (0.11)	12.7 (0.10)	12.8 (0.09)	13.1 (0.09)	13.2 (0.06)	13.3 (0.06)	13.3 (0.06)	13.3 (0.06)
IV	12.5 (0.15)	12.7 (0.15)	12.4 (0.15)	12.5 (0.14)	12.8 (0.14)	12.9 (0.12)	12.9 (0.12)	12.9 (0.12)	12.9 (0.13)
Sex									
Men	12.9 (0.10)	13.1 (0.10)	12.9 (0.09)	13.0 (0.09)	13.3 (0.08)	13.4 (0.06)	13.4 (0.06)	13.4 (0.06)	13.4 (0.06)
Women	12.4 (0.11)	12.6 (0.11)	12.4 (0.10)	12.5 (0.09)	12.7 (0.09)	12.9 (0.07)	12.9 (0.06)	12.9 (0.07)	12.9 (0.07)

T1-5 are pre-COVID-19, T6-9 are time points during COVID-19. * With others includes living only with a partner, only with kids or both, partner and kids.

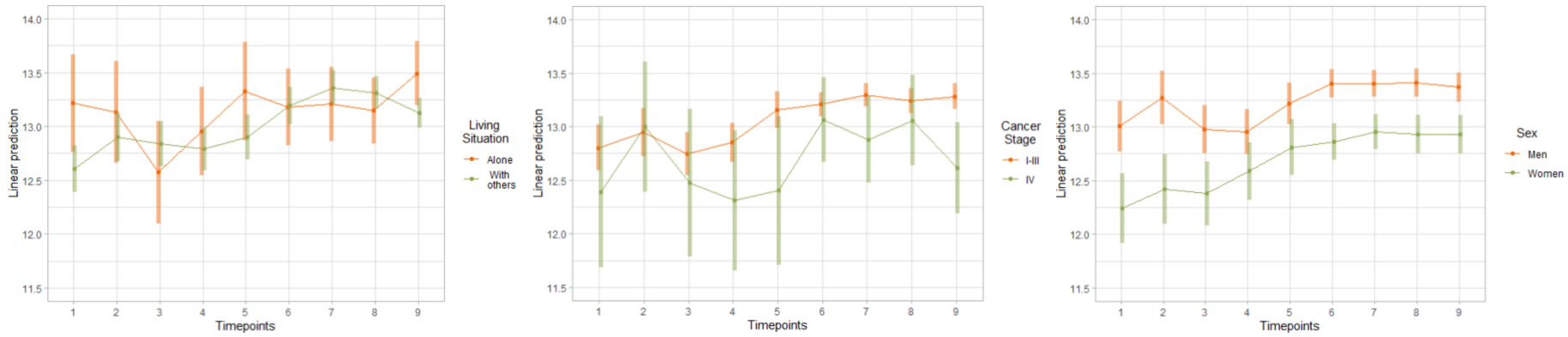


Figure 2B. The three graphs represent estimated marginal means score for anxiety over time and each graph shows one stratified variable – living situation, cancer stage and sex.

Table 3C. Estimated marginal means for depression, stratified by living situation, stage, and sex (n= 3646)

	Pre-COVID-19					During COVID-19			
Time points	T1	T2	T3	T4	T5	T6	T7	T8	T9
Living situation									
Alone	8.96 (0.09)	8.84 (0.09)	9.01 (0.09)	9.02 (0.08)	8.83 (0.09)	8.97 (0.08)	8.98 (0.08)	8.94 (0.07)	8.91 (0.07)
With others *	8.98 (0.07)	8.87 (0.08)	9.03 (0.07)	9.04 (0.07)	8.85 (0.07)	8.99 (0.06)	9.00 (0.06)	8.96 (0.06)	8.93 (0.06)
Stage									
I-III	8.97 (0.08)	8.87 (0.08)	9.07 (0.08)	9.04 (0.07)	8.84 (0.07)	9.08 (0.05)	9.09 (0.04)	9.00 (0.05)	8.96 (0.05)
IV	8.85 (0.11)	8.74 (0.11)	8.94 (0.11)	8.91 (0.11)	8.72 (0.11)	8.95 (0.09)	8.97 (0.09)	8.87 (0.09)	8.83 (0.09)
Sex									
Men	9.05 (0.07)	8.95 (0.08)	9.10 (0.07)	9.11 (0.07)	8.91 (0.07)	9.14 (0.05)	9.15 (0.05)	9.06 (0.05)	9.00 (0.05)
Women	8.84 (0.08)	8.74 (0.08)	8.89 (0.08)	8.90 (0.07)	8.69 (0.07)	8.93 (0.05)	8.94 (0.05)	8.85 (0.05)	8.79 (0.05)

T1-5 are pre-COVID-19, T6-9 are time points during COVID-19. * With others includes living only with a partner, only with kids or both, partner and kids.

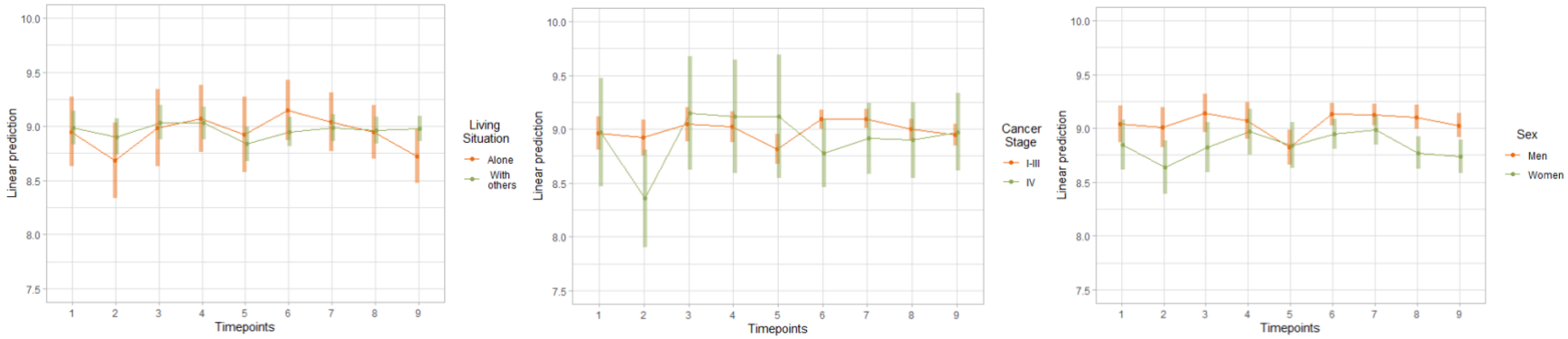


Figure 2C. The three graphs represent estimated marginal means score for depression over time and each graph shows one stratified variable – living situation, cancer stage and sex.

Changes in quality of life during COVID-19

We analyzed the quality of life changes from before the COVID-19 pandemic to the period during COVID-19. Table 3A presents the estimated marginal means of the summary QoL scores, divided over nine time points. The scores show an upwards trend for all three variables in the stratified analysis by living situation, cancer stage and gender. This can also be observed in figure 2. All four time points between T6 and T9 showed statistically significant differences as compared to the average score of T1-5 for those living alone ($p = 0.0004$ for T1-5 compared to T6, $p = 0.0321$ for T1-5 compared to T7 and $p < 0.0001$ for T1-5 compared to T8 and T9) and for those living with others where the significance level stayed the same for all comparisons ($p < 0.0001$). The cancer stage analysis for stages I-III showed the same significance levels ($p < 0.0001$), while the analysis for stage IV showed significance for T1-5 compared to T6 ($P = 0.00369$) and T9 ($p = 0.0207$); T7 ($p = 0.2221$) and T8 ($p = 0.1522$) were not significant. Lastly, we look at the differences between sexes and we found significant differences between all time points ($p < 0.0001$) and for both males and females.

Changes in anxiety during COVID-19

We repeated the same process for the analysis of changes in anxiety. Living situation while living alone was significant only when comparing T1-5 to T9 ($p = 0.0300$). In all other cases it was not significant (T6 ($p = 0.8545$), T7 ($p = 0.7608$), T8 ($p = 0.8974$)). Living with someone else showed significant results (T6 ($p =0.0002$), T7 ($p < 0.0001$), T8 ($p < 0.0001$), T9 ($p = 0.0003$)). Cancer stage scores were significant at all time points for stage I-III ($p < 0.0001$). On the other hand, stage IV showed no significant differences between timepoints when compared to T1-5 (T6 ($p = 0.0615$), T7 ($p = 0.2999$), T8 ($p = 0.0882$) and T9 ($p = 0.9572$)). The analysis of timepoints differences for sex showed significant results for both men and women, across all timepoints ($p < 0.0001$).

Changes in depression during COVID-19

Lastly, we analyzed the depression levels. Living situation showed no significance for living alone, nor for living with others (Living alone: T6 (p = 0.4052), T7 (p = 0.8314), T8 (p = 0.9949), T9 (p = 0.4081); living with others: T6 (p = 0.9990), T7 (p = 0.9532), T8 (p = 0.9992), T9 (p = 0.9834)). Cancer stage analysis for I-III showed significance for comparing T1-5 to T6 (p = 0.0493) and T7 (p = 0.0314). T8 (p = 0.8251) and T9 (p = 0.9987) were not significant. Similarly, analysis of stage IV was also not significant (T6 (p = 0.7731), T7 (p = 0.9959), T8 (p = 0.9904), T9 (p = 0.9960)). The last analysis was for the timepoints differences between males and females. The differences were not significant for any of the sexes (Men: T6 (p = 0.2473), T7 (p = 0.2396), T8 (p = 0.4730), T9 (p = 0.9952); women: T6 (p = 0.3788), T7 (p = 0.1513), T8 (p = 0.9031), T9 (0.6914)).

DISCUSSION

As we know, the COVID-19 pandemic impaired medical care, including cancer care. Therefore, our study aimed to evaluate how all of these changes affected the patients' health-related quality of life, depression and anxiety levels. As seen in the results, the findings are not what we thought when setting up this study. Based on some similar, previous studies we expected lower health-related quality of life, and higher anxiety and depression levels. However, our results showed an improvement in the HRQoL, slight worsening of anxiety levels and no change in depression levels as compared to results from before COVID-19. The change in HRQoL showed on average between 6 to 7 point change whereas a change of at least 5 points already indicates a clinically significant change, however that is only valid for when looking into the global quality of life scores [17]. In our case, we looked into the summary score of HRQoL and for that, there is currently no known cut-off for clinically significant changes in scores. The changes in anxiety levels were estimated to be approximately 0.5 points, however, the change would have to be at least 3 points, to be clinically significant [18]. Even though our results are not what we expected, some other studies, which were done very recently found similar results. For example, a study by Baffert et al. (2021) in a population of patients with several

cancer types found that the anxiety levels remained low and that the proportion of patients with higher anxiety is similar to the anxiety levels described in adults with cancer [20]. Moreover, they also showed preserved quality of life levels during the COVID-19 pandemic. As mentioned, our results for HRQoL showed an increase and that has not been shown in any previous paper. Additionally, we did not observe any significant change in depression levels. These findings could mean that the colorectal cancer patients in our cohort had a good support system and did not feel like the pandemic had a huge effect on them.

The current study has some limitations. First, we did not include new patients in the study. Participants could only be included if they filled out a questionnaire in the year before COVID-19 started. This means that we did not include any patients who found out that they have cancer during the pandemic – this could cause biased results. Additionally, the analysis does not include a non-cancer comparative group. Without the comparison group, we can not be sure that the observed changes in wellbeing are due to COVID-19, or also cancer-related. Lastly, the T10 time point results might not be fully representative as it only included 28 participants.

The current study also has numerous strengths, including a large patient cohort, prospective data collection, and longitudinal assessment of HRQoL, anxiety and depression scores. Furthermore, HRQoL was assessed with one of the most widely used cancer-specific questionnaires – EORTC QLQ-C30.

To conclude, our study showed increased HRQoL levels, slightly higher (but clinically insignificant) anxiety levels and, no change in depression levels in colorectal cancer patients during the COVID-19 pandemic as compared to the results from the year before the COVID-19 pandemic. The changes that we observed in this study could be important in the event of a new pandemic, as they could help us to understand the needs of colorectal cancer patients during the difficult times.

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