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Restrictions in quality of life in colorectal cancer patients over three years after diagnosis: A population based study

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ABSTRACT

Despite the burden and prevalence of colorectal cancer (CRC), there is only limited information regarding quality of life of patients who have survived beyond the first year post treatment. We assessed quality of life in a population-based cohort of 309 patients with CRC from Saarland (Germany) one and three years after diagnosis using the QLQ-C30 questionnaire and the tumour specific module QLQ-CR38. When compared with reference data from the general population, most patients with CRC reported high overall quality of life and only small deficits in physical functioning but deficits in emotional and social functioning persist over years in patients with colorectal cancer. Improvements in quality of life from the first to the third year after diagnosis in patients who remained free of disease were very modest and limited to less financial difficulties, a better future perspective and fewer stoma-related problems.

1. Introduction

With over one million new cases each year colorectal cancer (CRC) is one of the most common malignancies in the world. As a result of advances in early diagnosis and therapy the prognosis of CRC has improved over the last decades. Recent 5- and 10-year relative survival estimates for patients with CRC of 62% and 55%, respectively, indicate that most people diagnosed with CRC today survive the disease.[1]

In the past, prospective studies with CRC patients have focused on remission and survival as primary end-points. During the last decade, quality of life (QOL) has emerged as a further relevant outcome but, despite the high burden and prevalence of colorectal cancer, there is only limited information regarding QOL for patients from representative community settings, in particular for patients who have survived beyond the first year post treatment. The sparse research available indicates that when compared to controls from the

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general population CRC survivors appear to experience only minor deficits with respect to broad measures such as general health and overall QOL, at least as long as there is no serious comorbidity or relapse.[2–6] Other, more specific limitations, such as reduction in energy and weight loss, and psychosocial problems like psychological distress and depressive symptoms appear to be more important in CRC patients.[7,8] It has also been discussed that factors attributable to aging and chronic medical conditions play more dominant roles for long-term survivors in determining physical and mental health than factors related to the initial CRC diagnosis[6] but the impact of age on the QOL of patients with CRC has been barely examined.[9]

Recent findings from our group show that detriments in emotional and social functioning are major factors hampering QOL in CRC patients at one year after the diagnosis and predominantly affect younger patients.[10] The aim of this paper is to address the question, whether these deficits in QOL persist over a longer period and whether younger patients continue to suffer in particular or rather have started to adapt and recover from the psychosocial and physical sequelae of CRC after the end of the primary treatment.

2. Methods

2.1. Study design

Our study is based on a population-based state-wide cohort of cancer patients from Saarland (a state in southwest Germany covering a population of 1 million inhabitants), which we initiated in October 1996 to study risk factors, diagnostic procedures and prognosis in various forms of cancer. In brief, patients with breast, colorectal or gastric cancer diagnosed between October 1996 and February 1998 were recruited within days after diagnosis from all hospitals which offer in-patient cancer treatment in the study region and adjacent counties. Study eligibility criteria for baseline recruitment included: histologically confirmed invasive cancer, age 18–80 years, sufficient knowledge of German language, and resident of the state of Saarland. The protocols for this study as well as for the subsequent follow-up were approved by the local and regional ethics committee. Informed written consent was obtained from each patient.

2.2. Study population, data collection

A total of 439 patients with CRC could be recruited within few days after diagnosis. Baseline sociodemographic data were obtained by structured face-to-face interviews during first hospitalization due to cancer treatment. Information regarding tumour stage at time of diagnosis and initial therapy was abstracted from hospital records.

A first follow-up was initiated one year after diagnosis and we sent a QOL questionnaire (details see below) to each patient. Two years later, i.e. three years after diagnosis of cancer, we repeated the QOL follow-up and sent the same QOL questionnaire to all respondents of the first follow-up to obtain information about potential changes in QOL over time. Non-respondents were mailed up to two reminders, and contacted by phone if they did not respond after three mailings. If necessary, vital status of non-respondents was obtained from the residents' registration office.

2.3. Quality of life questionnaire

Quality of life was assessed with the Quality of Life Questionnaire Core 30 Items (QLQ-C30) of the European Organization for Research and Treatment of Cancer (EORTC)[11] and the tumour specific module QLQ-CR38 also developed by the EORTC.[12] The QLQ-C30 is a validated, brief, self-reporting, cancer-specific measure of health-related quality of life and composed of 5 multi-item functional scales that evaluate physical, role, emotional, cognitive and social functioning and one global health status/quality of life scale. Three multi-item symptom scales measure fatigue, pain and nausea/vomiting and six single items assess further symptoms (dyspnea, insomnia, appetite loss, constipation, diarrhoea) and financial difficulties. The tumour specific module QLQ-CR38 comprises 38 questions assessing disease symptoms, side-effects of treatment, body image, sexuality, and future perspective. The time frame for all scales in the questionnaire was the last week except for items related to sexual activity, where a 4 week time frame was applied.

2.4. Statistical methods

The scoring of the EORTC QLQ-C30 and QLQ-CR38 items was performed according to the EORTC scoring manual.[13] All scores were linearly transformed to a 0–100 points scale. In case of missing items, multi-item scores were calculated as the mean of non-missing items if at least half of the items from the corresponding scale had been completed. In both instruments high functional scores represent better functioning/QOL, whereas a high symptom score indicates more severe symptoms.

2.5. External comparison with reference data (QLQ-C30 only)

We used the age specific QLQ-C30 data for the German general population published by Schwarz and Hinz[14] as external reference. The 1139 women and 889 men of the reference population were selected by nationwide random-route-technique and interviewed in their private homes by skilled interviewers in 1998. Age and gender standardised reference QOL scores were calculated according to the age and gender structure of the CRC patients three years after diagnosis. The weighted means were compared and interpreted in a descriptive way following the findings from Osoba and colleagues[15] and Michelson and colleagues[6] that differences of 10 points and more are clinically meaningful. The external comparison with reference data from the general population was restricted to the core module QLQ-C30 as no reference data are available for the QLQ-CR38, so far.

2.6. Internal comparison

As QOL scores usually do not follow a normal distribution, we applied the Wilcoxon matched pairs signed rank sum to test

whether changes between the two surveys were statistically significant (alpha level 5%). Only patients who provided information in both surveys could be included for the internal comparison. Comparisons were performed in the total cohort but also in subgroups according to age, gender, tumour stage, tumour site, type of surgery and adjuvant therapy, and recurrence of disease. No adjustments for multiple testing were applied, so *p*-values refer to the individual tests rather than a global test for differences and an increased risk of type I error has to be considered.

3. Results

Patients (378 out of 439) survived the first year after tumour diagnosis (86%). Of these, 309 returned the questionnaire (response rate: 82%) and form the study population of the herein presented study. Characteristics of the study population are shown in Table 1. The tumour was confined to the intestine in 58% of all cases but 10% of all patients showed clinical signs of distant manifestation. Overall, the cohort included 186 patients with colon cancer and 119 patients with rectal cancer. The tumour site was not specified in 4 cases. With the exception of one patient, all other patients underwent abdominal surgery. A colostomy was performed in 12 patients with colon cancer and 47 patients with rectal cancer.

Sixty-eight men and women died between the first and third year past diagnosis. These patients more often had advanced tumours with distant metastases (35% vs. 3%; $p < 0.001$), more often had undergone chemotherapy (66% vs. 41%; $p < 0.001$) and reported poorer overall QOL at one year after diagnosis than those 241 men and women with CRC who survived the follow-up (mean score 57.6 vs. 64.3; $p = 0.04$). Overall, 222 study participants (92% of all CRC patients alive) returned the second QOL questionnaire at three years after diagnosis. Respondents and non-respondents were similar with respect to age, tumour stage, and therapy.

Three years after diagnosis most CRC survivors reported high overall QOL and only small deficits in physical and role functioning when compared with controls from the general population (Figs. 1 and 2). Differences of 10 points and more, considered to indicate clinically significant decrements,[15,16] were found for emotional and social functioning and specific symptoms like dyspnea, constipation, and diarrhoea. The differences between CRC patients and men and women from the general population regarding functional scores were largest for most subscales among the younger age groups and diminished with older age (Fig. 3). Similar results were also found for most symptoms (data not shown). Deficits among younger colorectal cancer patients (age < 60 years) were most prominent for role, emotional, cognitive and social functioning, and financial problems.

Tables 2 and 3 show the changes in QOL scores between the first and third year after diagnosis in the entire cohort and also according to recurrence of disease. As only patients who provided information in both surveys could be included for this analysis, the herein presented scores slightly differ from the data shown in Figs. 1 and 2. Those who remained free of disease ($n = 196$), reported a QOL very close to that obtained two years earlier but there was an overall tendency towards lower functional and higher symptom scores indicating a gradual reduction in health-related QOL (Table 2). In particular, the prevalence of symptoms such as insomnia and dyspnea increased from the first to the third year after diagnosis. Among the tumour specific items covered by the QLQ-CR38 (Table 3) the most

Table 1 – Description of study population at first year after diagnosis and according to responder status two years later

	Total cohort at first year after diagnosis (*N* = 309)	According to responder status three years after diagnosis		
		Responder (*N* = 222)	Non-responder (*N* = 19)	Deceased (*N* = 68)
Gender				
Male	56%	52%	68%	66%
Female	44%	48%	32%	34%
Age (years)				
18–59	23%	24%	21%	19%
60–69	35%	33%	47%	38%
70+	42%	42%	32%	43%
Mean (standard deviation)	66.1 (9.4) years	66.0 (9.2) years	64.5 (9.6) years	66.6 (10.0) years
Tumour stage				
Local	58%	67%	68%	28%
Regional	32%	30%	32%	37%
Distant	10%	3%	0%	35%
Tumour location				
Colon	61%	61%	53%	63%
Rectum	39%	39%	47%	37%
Therapy during first year after diagnosis				
Abdominal surgery	100%	100%	100%	100%
Colostomy	20%	17%	26%	28%
Radiation	22%	21%	26%	22%
Chemotherapy	47%	41%	42%	66%

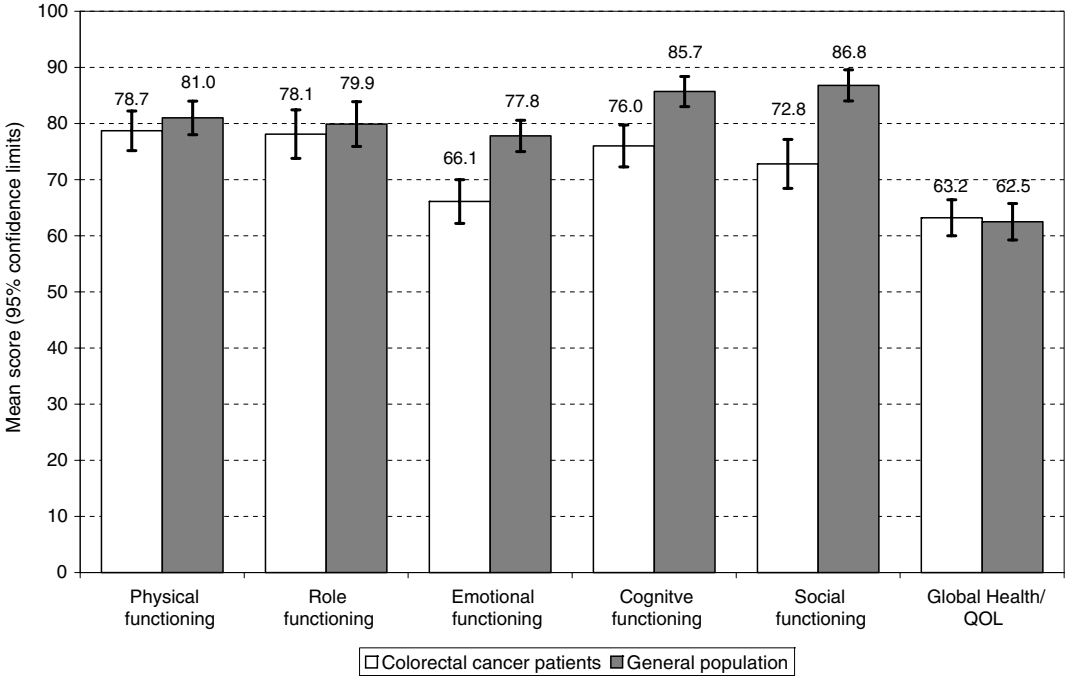

Fig. 1 – Mean functional scores of patients with colorectal cancer three years after diagnosis compared with age and gender adjusted mean scores of controls from the general population (core module QLQ-C30).

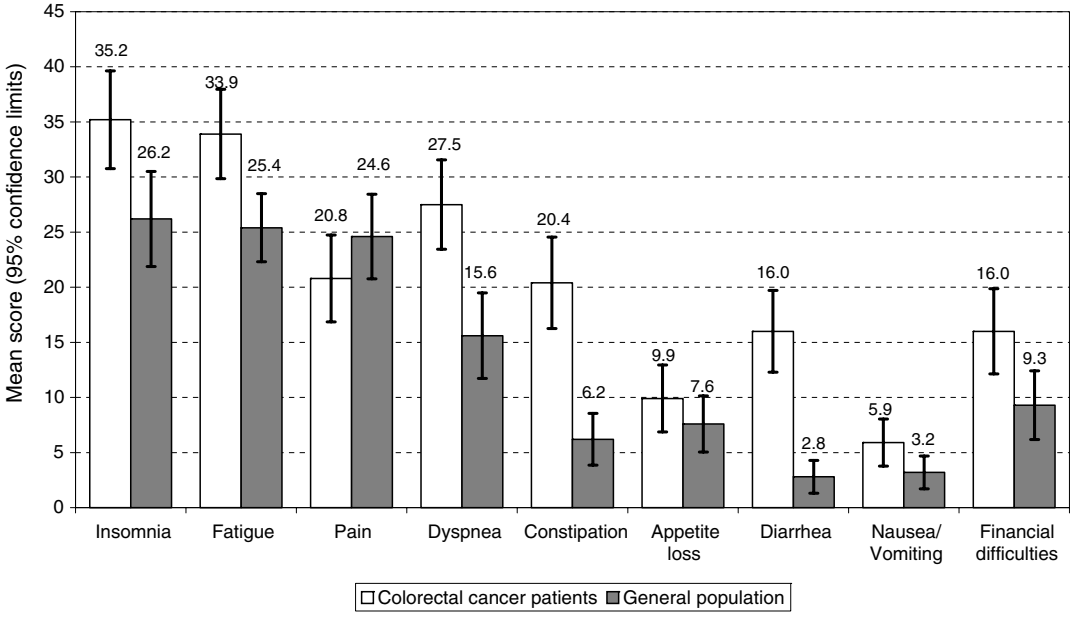

Fig. 2 – Mean symptom scores of patients with colorectal cancer three year after diagnosis compared with age and gender adjusted mean scores of controls from the general population (core module QLQ-C30).

pronounced changes were found for sexual activity, for which a substantial decline during the follow-up became apparent. Improvements in QOL, if any, were very modest and limited to less financial difficulties, a slightly better future perspective and fewer defecation or stoma-related problems. Recurrence of CRC occurred in 26 cancer survivors during the follow-up interval and had a deleterious effect on QOL. Substantial impairments were observed for almost all function scales and all symptoms covered by the QLQ-C30 and the QLQ-CR38 questionnaire in patients with recurrent disease (Tables 2 and 3).

Further in depth analysis, where we compared the changes in QOL between the first and third year after diagnosis in patients free of disease recurrence revealed interesting differences with respect to sociodemographic and clinical subgroups. Whereas older patients with CRC, on

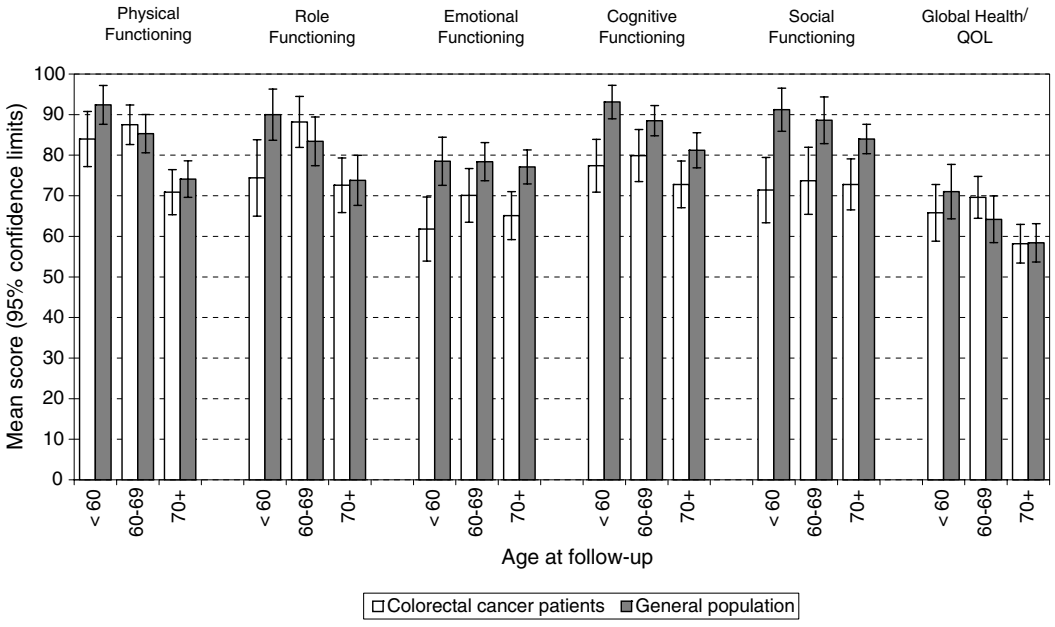

Fig. 3 – Age-specific mean functional scores of patients with colorectal cancer three years after diagnosis in comparison to gender adjusted, age specific mean scores of controls from the general population (core module QLQ-C30).

average, scored their QOL at three years past diagnosis worse than two years earlier, younger patients indicate improvements in physical, role, emotional, and social functioning (Table 4). Similarly, younger patients reported a more favourable change in QOL over time with respect to most symptoms and functions covered by the QLQ-CR38 (data not shown).

Stratification by gender suggested that the temporal change in QOL was somewhat less favourable for men than for women (data not shown). But overall the differences in the temporal development between men and women were relatively modest. The temporal development appeared to be less favourable among patients with advanced disease than among those with local CRC (data not shown). For example, mean physical functioning, sexual activity and overall QOL declined by over 10 points in patients with distant metastases whereas these scores remained almost unchanged in patients with local disease. Patients with CRC who underwent adjuvant therapy and patients who were treated by surgery alone reported very similar levels of most functional scores but role and social functioning seem to be more affected in patients with adjuvant chemo- and/or radiotherapy at one and at three years after diagnosis (data not shown).

Stoma patients reported poorer role functioning than patients with intact sphincter at one year after diagnosis (69.1 versus 78.8; $p = 0.04$). Two years later, i.e. three years after diagnosis, the role functioning has improved in stoma patients up to a mean score of 76.5 whereas no change was observed in patients with intact sphincter (mean score = 78.8). No other substantial difference was observed in the temporal development between stoma patients and non-stoma patients. Also, no substantial differences were observed neither at one nor at three years after diagnosis between colon and rectal cancer patients (data not shown).

4. Discussion

Although three years after diagnosis of CRC most patients report a high overall QOL and only small deficits in physical functioning, the results of our study indicate that deficits in emotional and social functioning and specific limitations like fatigue, dyspnea, insomnia, constipation, diarrhoea, and financial difficulties persist over years. Overall, improvements in QOL from the first to the third year after diagnosis are very modest and limited to improvements concerning financial difficulties, a better future perspective and fewer stoma-related problems.

The results also show that younger patients continue to be more strongly affected by the physical and psychosocial sequelae of CRC even though they regain some functional capacities as time from termination of treatment passes. However, the influence of age on burden of disease is equivocal as older persons consider their physical health in a different reference frame, and tend to assess their health in terms of their age peers rather than in terms of perfect health,[16,17] In contrast, younger patients view cancer as a greater threat to their lives and manifest poorer mental health than older patients.[18] This partly explains why especially younger patients with CRC express more psychosocial deficits and report higher demands of illness.[19] Also, younger patients may possess fewer coping strategies and resources needed to manage a life-threatening disease.[20]

Recurrence of CRC has a deleterious effect on QOL. While our results are in agreement with those of a recently published study in that respect,[21] we also found that CRC survivors who remain free of disease recurrence continue to suffer from psychosocial deficits, which might be related to decreases in emotional support and the decline in functional support as time after diagnosis passes.[22,23] It has been reported that psychological distress and depressive symptoms

Table 2 – Changes in self-reported quality of life in colorectal survivors between the first and the third year after diagnosis depending on recurrence of disease: core module QLQ-C30

Item	Scale polarity[a]	Entire cohort (N = 222)					No disease recurrence (N = 196)					With disease recurrence (N = 26)				
		Mean score at			Difference	p^b	Mean score at			Difference	p^b	Mean score at			Difference	p^b
		N	1 year	3 year			N	1 year	3 year			N	1 year	3 year		
Physical functioning	F	212	82.6	78.3	−4.3	<0.01	186	82.6	79.7	−2.9	0.03	26	82.1	68.8	−13.3	0.03
Role functioning	F	210	76.9	77.9	1.0	0.69	185	77.6	80.0	2.4	0.30	25	72.0	62.0	−10.0	0.27
Emotional functioning	F	214	67.8	66.1	−1.7	0.67	189	68.4	68.4	0.0	0.65	25	63.7	49.0	−14.7	0.02
Cognitive functioning	F	216	79.0	76.2	−2.8	0.12	191	79.8	77.5	−2.3	0.29	25	73.3	66.0	−7.3	0.04
Social functioning	F	215	77.4	72.9	−4.5	0.02	191	78.4	75.7	−2.7	0.15	24	68.8	51.4	−17.4	<0.01
Global health, quality of life	F	217	65.4	63.3	−2.1	0.29	192	66.3	64.2	−2.1	0.33	25	58.3	56.3	−2.0	0.82
Insomnia	S	214	30.4	35.5	5.1	0.02	188	30.0	34.2	4.2	0.08	26	33.3	44.9	11.6	0.13
Fatigue	S	213	32.4	34.3	1.9	0.51	188	32.1	32.4	0.3	0.63	25	35.1	48.4	13.3	<0.01
Pain	S	213	17.2	20.9	3.7	0.06	188	17.1	19.2	2.1	0.30	25	18.0	33.3	15.3	0.02
Dyspnea	S	210	22.4	27.9	5.5	<0.01	185	23.1	27.9	4.8	0.01	25	17.3	28.0	10.7	0.09
Constipation	S	208	17.1	20.5	3.4	0.09	183	17.7	19.9	2.2	0.29	25	13.3	25.3	12.0	0.03
Appetite loss	S	212	6.6	9.9	3.3	0.02	187	6.8	8.6	1.8	0.16	25	5.3	20.0	14.7	0.06
Diarrhoea	S	206	17.5	16.3	−1.2	0.63	183	18.4	16.6	−1.8	0.48	23	10.1	14.5	4.4	0.22
Nausea, vomiting	S	210	3.7	6.1	2.4	0.31	185	3.7	5.1	1.4	0.70	25	4.0	13.3	9.3	0.08
Financial difficulties	S	213	19.4	16.0	−3.4	0.05	188	18.6	13.8	−4.8	0.01	25	25.3	32.0	6.7	0.37

a F = Function scale (higher values indicate better QOL); S = ;Symptom scale (higher values indicate worse QOL).
b *p*-Value derived from Wilcoxon signed rank sum test.

Table 3 – Changes in self-reported quality of life in colorectal survivors between the first and the third year after diagnosis depending on recurrence of disease: colorectal cancer specific module QLQ-CR38

Item	Scale polarity[a]	Entire cohort (N = 222)					No disease recurrence (N = 196)					With disease recurrence (N = 26)				
		Mean score at			Difference	p^b	Mean score at			Difference	p^b	Mean score at			Difference	p^b
		N	1 year	3 year			N	1 year	3 year			N	1 year	3 year		
Future perspective	F	209	50.9	53.0	2.1	0.46	185	52.3	55.5	3.2	0.29	24	40.3	33.3	−7.0	0.06
Body image	F	207	77.8	76.1	−1.7	0.15	184	79.5	79.5	0.0	0.92	23	64.7	48.8	−15.9	0.02
Sexual activity	F	182	38.3	30.3	−8.0	<0.01	160	38.3	30.8	−7.5	<0.01	22	37.9	26.5	−11.4	0.03
Sexual enjoyment (if sexually active)	F	57	70.8	71.9	1.1	0.67	51	73.2	73.9	0.7	0.75	6	50.0	55.6	5.6	0.99
Male sexual problems	S	50	41.7	48.3	6.6	0.14	42	37.7	42.1	4.4	0.42	8	62.5	81.3	18.8	0.13
Female sexual problems	S	20	22.5	30.0	7.5	0.15	17	18.6	24.5	5.9	0.35	3	44.4	61.1	16.7	0.50
Systemic therapy side-effects	S	208	14.3	14.7	0.4	0.46	185	13.4	12.8	−0.6	0.97	23	21.7	30.0	8.3	0.14
Weight loss	S	211	7.7	9.0	1.3	0.21	189	7.9	8.6	0.7	0.29	22	6.1	12.1	6.0	0.50
Micturition problems	S	208	30.8	31.5	0.7	0.73	184	30.7	30.0	−0.7	0.64	24	31.9	42.8	10.9	0.05
Gastrointestinal symptoms	S	210	21.7	23.3	1.6	0.22	187	21.2	21.8	0.6	0.58	23	25.5	36.2	10.7	0.05
Defecation problems[c]	S	150	17.9	16.5	−1.4	0.27	140	18.5	16.4	−2.1	0.07	10	8.1	18.6	10.5	0.06
Stoma-related problems	S	32	45.8	42.5	−3.3	0.17	24	43.1	38.8	−4.3	0.13	8	54.2	53.6	−0.6	0.99

a F = Function scale (higher values indicate better QOL); S = symptom scale (higher values indicate worse QOL).
b *p*-Value derived from Wilcoxon signed rank sum test.
c Patients with intact sphincter only.

may persist over years[7,8] and remain a problem even among long-term survivors who achieve remission from CRC[4] and our study adds further evidence to this observation. In addition, bowel problems may persist[24] and may severely affect functional and social well-being across all stages and times from diagnosis.[25] Also the sexual functioning of male as well as of female patients was found to be impaired over several years in our and in other studies.[26]

The finding that the temporal development of QOL appears to be less favourable among patients with advanced disease than among those with local CRC is not too surprising. In contrast, other clinical or demographic factors, such as tumour site, sphincter saving surgery versus colostomy, or gender do not seem to have a strong influence on the temporal development of QOL among CRC patients. With respect to the question of whether the QOL of cancer patients after sphincter saving surgery is superior to that of patients with permanent colostomy, a recent Cochrane review concluded that there is no firm answer.[27] Several studies have reported that stoma patients express reduced well-being and body image as well as more urinary and sexual problems, greater distress and lower social functioning[26,28,29] and that a lot of these problems do not improve, if no sphincter-conserving therapy was conducted.[30] Other studies reported that these problems seem to diminish over time and that several years after surgery both stoma and non-stoma patients experience similar levels of psychosocial well-being.[3,31]

It has also been reported that QOL improves for survivors of CRC as they lived for longer periods.[4,8,25] This has been explained by a reduction in illness-related demands and by patient adjustment to the disease.[19] However, this reasoning may be flawed as the underlying studies either relied on cross-sectional data or excluded patients with disease progression without controlling for an intrinsic bias arising from the tendency to include healthier patients into the QOL analysis at later time points.[32,33] With the exception of the study by Engel and colleagues,[30] we did not find any other genuine longitudinal study with multiple QOL assessments beyond the first year. Our herein presented results do not support the aforementioned conclusion of better QOL as survival time passes.

This is one of the first population-based studies assessing QOL among CRC survivors at different times over a longer period. Particular strengths of our study are the high overall response rate, the state-wide recruitment of patients from a wide range of hospitals and the application of a well-established instrument to assess health-related QOL. In addition to a very high overall participation rate, the participation rate did not depend on tumour stage. However, CRC patients who reported a somewhat better overall health/QOL at the end of the first year after diagnosis were more likely to participate in the second follow-up. Therefore, our findings might describe a slightly too optimistic picture of the situation of CRC patients three years after diagnosis. Also, they do not reflect the situation of those patients who have died during the follow-up period and of those who already refused to participate in the first round. Another limitation refers to the fact that no QOL data were collected from the study participants at baseline, i.e. prior to treatment. It has to be kept in mind

Table 4 – Changes in self-reported quality of life in colorectal survivors free of disease recurrence between the first and the third year after diagnosis by age: core module QLQ-C30

Item	Scale polarity[a]	Age < 60 years					Age 60–69 years					Age 70 + years				
		Mean score at			Difference	p^b	Mean score at			Difference	p^b	Mean score at			Difference	p^b
		N	1 year	3 year			*N*	1 year	3 year			*N*	1 year	3 year		
Physical functioning	F	48	81.9	84.9	3.0	0.15	60	89.3	89.0	−0.2	0.64	78	78.0	69.2	−8.8	<0.01
Role functioning	F	48	64.6	77.1	12.5	0.02	60	85.0	89.2	4.2	0.27	77	79.9	74.7	−5.2	0.14
Emotional functioning	F	48	58.7	63.4	4.6	0.07	62	71.5	73.0	1.5	0.36	79	71.8	67.9	−3.9	0.15
Cognitive functioning	F	49	79.9	79.3	−0.7	0.85	62	82.5	81.2	−1.3	0.66	80	77.5	73.5	−4.0	0.50
Social functioning	F	48	67.4	73.3	5.9	0.28	62	81.2	79.3	−1.9	0.51	81	82.9	74.3	−8.6	<0.01
Global health, quality of life	F	48	66.1	67.7	1.6	0.17	63	70.2	68.5	−1.7	0.61	81	63.3	58.8	−4.4	0.12
Insomnia	S	48	37.5	33.3	−4.2	0.04	61	26.8	29.0	2.2	0.54	79	27.8	38.8	11.0	<0.01
Fatigue	S	48	38.4	31.3	−7.2	0.01	62	25.0	23.5	−1.5	0.66	78	33.8	40.2	6.3	0.03
Pain	S	48	28.1	18.4	−9.7	<0.01	62	13.2	12.4	−0.8	0.49	78	13.5	25.2	11.8	<0.01
Dyspnea	S	46	18.8	19.6	0.7	0.78	62	16.7	24.2	7.5	0.01	77	30.7	35.9	5.2	0.10
Constipation	S	48	12.5	17.4	4.9	0.16	61	13.7	11.5	−2.2	0.34	74	24.3	28.4	4.1	0.24
Appetite loss	S	48	6.3	5.6	−0.7	0.80	61	4.4	6.6	2.2	0.17	78	9.0	12.0	3.0	0.60
Diarrhoea	S	48	21.5	18.1	−3.5	0.52	61	18.6	15.3	−3.3	0.12	74	16.2	16.7	0.5	1.00
Nausea, vomiting	S	48	1.4	4.9	3.5	0.34	60	3.3	4.4	1.1	0.30	77	5.4	5.8	0.4	0.89
Financial difficulties	S	48	29.9	10.4	−19.0	<0.01	62	12.4	13.4	1.1	0.31	78	16.7	16.2	−0.4	0.99

a F = Function scale (higher values indicate better QOL); S = Symptom scale (higher values indicate worse QOL).
b *p*-Value derived from Wilcoxon signed rank sum test.

that the EORTC QOL-C30 was developed for oncological patients and its use in a "normal population" may contain some methodological difficulties.[34] However, it is widely recognised that the use of population-based reference values is relevant and provides an important aid to the interpretation of QOL scales.[16,35–37]

Despite these limitations, our study shows that although patients three years after diagnosis of CRC report overall good QOL, substantial deficits in emotional and social functioning and specific problems such as constipation, diarrhoea, sleeping disorders and fatigue persist over years. The differences between CRC patients and men and women from the general population were predominantly found in younger ages but absolute prevalence of functional limitations and symptoms is higher in the elderly. As the individual's perception of the impact of cancer may change over time and the number of long-term survivors will continue to increase, further longitudinal studies addressing the long-term consequences of CRC and the possibilities for intervention to enhance QOL are necessary.

Conflict of interest statement

None declared.

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