QUALITY OF LIFE AND PERSONALITY TRAITS IN PATIENTS WITH COLORECTAL CANCER

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SUMMARY

　　Background: The aim of this study was to determine whether it is possible to predict quality of life in patients with colorectal cancer on the basis of personality dimensions from the Five-factor model.

　　Subjects and methods: The study included 56 patients with colorectal cancer (40 men and 16 women), aged 48-87. The following instruments were used: the Questionnaire on General Information and Lifestyle Habits, the Quality of Life Scale, and the Neo Five-Factor Inventory.

　　Results: The results of overall quality of life estimations of colorectal cancer patients were comparable to those of healthy people. Contrary to expectations, extraversion was not a significant quality of life predictor. Neuroticism as a personality trait was the only variable which consistently proved to be highly significant across analyses in the prediction of total quality of life, satisfaction with past life, future expectations, and comparison with others. Key determinants of neuroticism are a proneness to experiencing negative affects which makes adaptation difficult, a proneness to irrational ideas, reduced impulse control, ineffective coping strategies, the perception of poor control over oneself and others, and deeming one's own resources to be insufficient to adequately cope with stress, thus resulting in a more negative quality of life estimation.

　　Conclusion: These results support the conclusion that cognitive-behavioral interventions aimed at changing negative attributions, reducing tension and negative affects, acquiring more effective coping strategies, strengthening perceived personal control, redefining and re-conceptualizing quality of life, and seeking/receiving more adequate social support could lead to an improved quality of life in patients with colorectal cancer.

Key words: colorectal cancer - personality traits – neuroticism - quality of life

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INTRODUCTION

　　Malignant gastrointestinal tract diseases are amongst the most frequent carcinoma in developed countries (Dunn et al. 2013). In men, the incidence of colorectal cancer fourth and stomach cancer ranks third among gastrointestinal cancers. In women, colorectal cancer is the third and stomach cancer the fifth most frequent gastrointestinal cancer (Tardivo et al. 2005). Since advanced treatment and/or early diagnosis increases the chance of survival, numerous studies in the past twenty years addressed the quality of life in individuals with malignant gastrointestinal tract diseases. The significance of assessing the quality of life in individuals suffering from malignant diseases has been shown through a series of studies indicating that quality of life or certain quality of life aspects are important independent predictors of survival (Montazeri 2009, Maisey et al. 2002, Padilla 1991, Chida et al. 2008). A number of different scales were specifically constructed to examine quality of life in affected individuals, including the perceived functional impact of the disease and patient treatment (Kaptein et al. 2005). Three aspects of the functional impact of the disease and treatment can be examined: the physiological, psychological, and social. Various instruments assessing quality of life place emphasis on these aspects of the quality of life to a greater or lesser

extent. Kaptein et al. (2006) report that in about half of the 26 studies on quality of life in individuals with stomach cancer, emphasis was placed on psychological functioning; physiological functioning is included in all studies, whereas social functioning has been hardly investigated at all. They argue that assessing quality of life in patients predominantly through physiological functioning is inacceptable, reflecting a biomedical model in approach to illness and patients in which the psychological and social functioning aspects have been neglected. Caravati-Jouvenceaux et al. (2011) compared the results of two questionnaires on quality of life which included physiological, psychological, and social dimensions in a study involving 344 participants with colon cancer, 198 participants with rectal cancer, and 1181 control participants. They concluded that although the quality of life in individuals with colorectal cancer 15 years after diagnosis is satisfactory, and comparable to the quality of life of control group participants, some complications related to physical and social functioning may last for more than ten years after diagnosis, so clinicians should pay attention to them, especially in cases of rectal cancer at an older age, and when comorbid conditions are present.

　　Most studies on quality of life in individuals with stomach cancer and colorectal cancer show that about three quarters of these individuals exhibit a medium to

high quality of life for five years after diagnosis, a smaller number of patients experienced a decline in quality of life for a period of three years after diagnosis, furthermore, one in five of all patients will have a consistently poorer quality of life (Dunn et al. 2013, Yoo et al. 2005). The variables determining the quality of life in later stages of the disease are less linked to disease symptoms and treatment than to psychosocial factors.

The definition of quality of life proposed by the World Health Organization emphasizes that it is "an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns" (Bobić 2012). Since this depends on the perception of personal experience, goals, aspirations, and values, it is clear that apart from objective external factors, quality of life is to a large extent determined by factors related to the individual's personality. Personality traits are among the most extensively studied personal factors related to quality of life in cancer patients. A five-factor model (McCrae 2009) groups personality traits into five broad dimensions: neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness. Studies using the NEO Personality Inventory have shown that quality of life in females with breast cancer who have undergone mastectomy is negatively associated with neuroticism (Van der Steeg 2010). Negative correlations between neuroticism and quality of life were found in a sample of testicular cancer survivors (Grov et al 2009) and in women suffering from stomach cancer, as well as in patients without malignant diseases and healthy control participants (Yamaoka et al 1998).

Yamaoka et al. (1998) found a positive correlation between quality of life, psychoticism and extraversion in patients with different medical conditions (malignant and nonmalignant) and healthy control participants. A possible association between quality of life and extraversion is also indicated by the fact that extraversion is negatively correlated with postoperative length of stay in 110 individuals treated for colorectal cancer (Sharma et al. 2007). Although extraversion is often associated with a better quality of life in cancer patients, this personality trait was linked in some studies to an increased risk of developing malignant diseases, probably as a result of a greater proneness to risk behavior, but results are not uniform (Nakaya et al. 2003, Wellisch & Yager 1983, Stürmer et al. 2006). Some studies clearly suggest an association between trait anxiety and lower quality of life in individuals with rectal cancer (Ristvedt & Trinkhaus 2009). Studies examining the relation between quality of life and certain personality variables, including defense mechanisms, found an association between lower quality of life and hostility and between lower quality of life and repression defense, whereas a positive correlation was found between denial defense and quality of life and between the sense of coherence and quality of life in patients with colorectal cancer (Paika et al. 2010, Hypantis et al. 2011).

The aim of this study was to examine whether quality of life in patients with colorectal cancer can be predicted on the basis of personality traits. Based on the results of previous studies, a negative correlation between neuroticism and quality of life and a positive correlation between extraversion and quality of life can be expected. Understanding the associations between personality traits and subjectively assessed quality of life can be a basis for planning possible psychosocial interventions in groups of cancer patients.

SUBJECTS AND METHODS

Subjects

This study included 56 patients with colorectal cancer (40 men and 16 women). Participants were recruited from the Department of Abdominal Surgery at the General County Hospital in Požega. Participant age ranged from 48 to 87 years (M=68.40, sd=8.98). A large number of participants had secondary school education (n=28), 21 participants primary school education, 3 had college degrees and 4 university degrees. Most participants were retired (n=53) as expected from the common age at diagnosis of colorectal cancer. Most participants were married (n=51).

All participants had undergone surgery. The average interval between surgery and assessment was 3 years and 4 months (ranging from 11 months to 13 years). A stoma was present in 17 participants.

The study sample was from the group of 69 eligible patients from the list of patients treated for gastrointestinal cancer in the Požega County Hospital. They were sent a letter by post in which they were asked to participate in a study on the psychosocial aspects of malignant diseases. In the letter they were asked to come to the hospital for examination by an abdominal surgeon and to complete questionnaires concerning personality traits, stressful events, stress coping strategies, anxiety, depression, anger expression methods, quality of life and the Questionnaire on General Information and Lifestyle Habits. Out of 69 invited patients, 56 responded and came to the hospital. The only exclusion criterion was that patients were not undergoing chemotherapy or radiotherapy at the time of the study, because side-effects of these treatments can adversely affect quality of life in these patients.

The Ethics Committee of the General County Hospital approved this study. All study participants signed an informed consent for the participation in the study.

Methods

Out of the larger part of questionnaires applied for the purposes of this study, the following were used: the Questionnaire on General Information and Lifestyle Habits, the Quality of Life Scale (Krizmanić & Kolesarić 1992) and the NEO Five-Factor Inventory (Costa & McCrae 2005).

The Questionnaire on General Information and Lifestyle Habits was developed for the purposes of this study and included information on participant age, gender, education, marital and employment status, family member illnesses, previous diseases and habits (drug and alcohol use, eating habits and physical activity).

The Quality of Life Scale (Krizmanić & Kolesarić 1992) is designed to examine the experience of (dis) satisfaction with life as a result of the constant reevaluation of experiences in different areas of life. There are three different scale forms which are applied depending on participant age (scale form for individuals aged 16 to 25, scale form for adults up to the age of 60 and a scale form for elderly individuals over 60). There are separate scale forms for men and women. In this study, depending on participant age, scale forms for adults and elderly individuals were used. Scales were applied individually. Participants were asked to rate their degree of satisfaction/dissatisfaction with certain areas of their life on a scale from one to five. A higher score indicates a higher degree of satisfaction (responses expressing greatest dissatisfaction received 1 point, responses indicating mild dissatisfaction 2 points, responses where participants were indecisive 3 points, responses indicating mild satisfaction 4 points, and responses indicating great satisfaction 5 points.).

The first part of the Quality of Life Scale consists of questions which are related to factors influencing individual quality of life and which may be referred to as individual aspects of quality of life (i.e. questions related to satisfaction with family of source, children, grandchildren, sons-in-law/daughters-in-law, partner's relationship, sexual life, love, friends' relationships, education, employment, social status, social environment, leisure time, religion, material status and housing) and the number of variables differs in the scale forms with respect to age (e. g. a question about satisfaction with grandchildren is only included in the form for elderly persons). The second part of the Quality of Life Scale consists of six items related to overall satisfaction with life, satisfaction with life in the past year, satisfaction due to realization of goals, wishes and hopes, future expectations for the realization of yet unattained goals, the appraisal of persons' satisfaction if their lives were to continue the way they have been up to the point of testing and evaluation of life quality compared with one's friends, colleagues and neighbors. In the following paragraphs, these 6 items will be referred to as total satisfaction with life.

The following indicators were used in the study: the total result on the first part of the Quality of Life Scale (expressed as a sum of answers on 14 items common for the adult form and the form for elderly persons) – indicated as factors influencing quality of life (possible range: 14 to 70), the total results of 6 items in the second part of the scale (total satisfaction with life, possible range: 6 to 30) and the results of two factors derived from the second part of the scale and described by the authors. The first of these factors, satisfaction

with past life, is determined by the results of four items related to past experiences. The possible results range of this factor is 4 to 20. The second factor (future expectations and comparison with others) is determined by two items which relate to future expectations and comparison to other people (possible results range: 2 to 10).

The NEO Five-Factor Inventory (NEO-FFI, Costa & McCrae 2005) is the short form of the NEO Personality Inventory. It consists of 60 items designed to measure five personality factors: neuroticism, extraversion, openness to experience, agreeableness and conscientiousness. Participants read each item and answer on a scale of 5 points (strongly disagree, disagree, neutral, agree and strongly agree with given statements).

Data on surgical interventions, stoma presence/absence, disease stage, age at the time of surgery were obtained from medical records.

Statistical Analyses

Data were statistically analyzed with SPSS for Windows 11 software (IBM, Armonk, New York, USA). To obtain answers to the main problem of this study and to see whether results of the NEO Five-Factor Inventory (NEO-FFI) are predictive for quality of life in colorectal cancer patients, hierarchical regression analyses were performed. To control the confounding impact of variables like gender, age, marital status, education, stoma presence and interval from surgery to examination on quality of life, these variables were entered as predictors in the first step of regression analyses. Personality traits as predictors were entered in the second step.

RESULTS

Descriptive data on the Quality of Life Scale (QOL) and NEO-FFI

Table 1 presents the results of the first part of the Quality of Life Scale (predictive variables including individual aspects of quality of life). In comparison to normative data for these results reported in manuals (Krizmanić & Kolesarić 1992) it is evident that subjective estimates of individual aspects of quality of life in this sample are comparable with responses of healthy persons. Apart from the estimates of satisfaction with former spouses expressed by participants who have experienced divorce, participants expressed the lowest satisfaction with health, but these estimates are comparable with responses of healthy persons (Krizmanić & Kolesarić 1992).

Means, standard deviations and range results for the second part of the Quality of Life Scale (total satisfaction with life), first factor (satisfaction with past life) and second factor (future expectations and comparison to others) are presented in table 2. Participants expressed great satisfaction with their past life (M=4.35, sd=0.67, range 3-5) and satisfaction with the realization of their goals, wishes and hopes (M=4.08, sd=1.03, range 1-5),

Table 1. Means, standard deviations and range results on items from QOL related to individual aspects of quality of life

Satisfaction with	No patients	Mean (range)	Standard deviation
Family of origin	56	4.58 (1-5)	0.804
Partner's relationship	56	4.41 (1-5)	1.140
Children	53	4.98 (4-5)	0.137
Son-in-law/Daughter-in-law	36	4.27 (1-5)	1.161
Grandchildren	34	4.97 (4-5)	0.171
Former spouse	6	3.16 (1-5)	1.329
Love	56	4.50 (1-5)	0.953
Sex	55	3.81 (1-5)	1.248
Friends' relationship	56	4.55 (2-5)	0.760
Education	56	4.12 (1-5)	1.096
Employment	30	4.00 (1-5)	1.339
Social status	56	4.25 (1-5)	0.899
Social environment	56	3.87 (1-5)	1.079
Religion	56	4.42 (1-5)	0.891
Health	56	3.71 (1-5)	1.390
Leisure time	56	4.28 (2-5)	0.888
Material status	56	3.83 (1-5)	1.108
Housing	56	4.57 (1-5)	0.828

Table 2. Means, standard deviations and range results on factor 1, factor 2 and total score on QOL and NEO-FFI (n=56)

Factor	Mean (range)	Standard deviation
Factor 1 (satisfaction with past life)	16.25 (6-20)	3.160
Factor 2 (future expectations and comparison to others)	7.03 (2-10)	1.700
Total results on satisfaction with life	23.28 (10-30)	4.401
Neuroticism	18.00 (1-40)	8.103
Extraversion	27.16 (12-39)	5.848
Openness	20.48 (11-35)	4.865
Agreeableness	31.33 (14-47)	5.859
Conscientiousness	36.42 (22-47)	5.055

and these results are comparable with responses of healthy individuals from the normative sample (Krizmanić & Kolesarić 1992). Participants in this study expressed slightly lower future expectations for the realization of yet unattained goals (M=3.23, sd=1.26) than individuals from the normative sample, although results of comparison to other peoples' lives (M=3.80, sd=0.96) are comparable to the normative sample (Krizmanić & Kolesarić 1992). Table 2 also shows results on five dimensions from NEO-FFI. Results on neuroticism, extraversion, conscientiousness and agreeableness are comparable to the normative sample. Openness to experience is lower in our participants (M=20.48 sd=4.86) than in normative sample (M=27.03, sd=5.84, Costa &McCrae 2005) and these results may be related to the older age in our participants.

Correlations between variables

The intercorrelations of all variables included in this study are presented in table 3. There were no significant correlations between results on QOL and age, gender, marital status, stoma presence/absence and interval from surgery to examination (Table 3). There are significant positive correlations between education and estimates of individual aspects of quality of life and between education and satisfaction with past life, but no correlation between education and total satisfaction with life and between education and factor 2 of QOL (future expectations and comparison with others).

As expected, correlations between different results on QOL were significant. Negative correlations between neuroticism and individual aspects of quality of life, total satisfaction with life and two factors of QOL were found. Agreeableness was not associated with any aspects of quality of life. Correlations between conscientiousness and factor 1 and between conscientiousness and total score on QOL were significant, but small. There were no significant correlations between extraversion and QOL and between QOL and openness to experience.

Regression analyses

To answer the question to which extent quality of life in colorectal cancer patients can be predicted based on personality traits, several regression analyses were performed and results are presented in tables 4 to 6.

Table 3. Intercorrelation of variables (age, gender, marital status, interval surgery/examination, stoma presence, QOL – factors contributing to quality of life, QOL – total score on satisfaction with life, future expectations and comparison with others, QOL – factor 1 and QOL – factor 2)

Variables	2	3	4	5	6	7	8	9	10	11	12	13	14	15
QOL Ind asp	0.72**	0.18	0.61**	-0.05	-0.13	-0.15	0.38**	0.07	-0.09	-0.51**	0.24	-0.06	0.21	0.20
QOL fact 1		0.57**	0.94**	0.04	-0.21	-0.08	0.30**	0.17	-0.03	-0.52**	0.26	-0.08	0.15	0.28*
QOL fact 2			0.79**	0.21	-0.14	-0.05	0.04	0.21	0.04	-0.38**	0.13	-0.07	-0.07	0.21
QOL total				0.14	-0.19	-0.09	0.23	0.20	-0.01	-0.51**	0.24	-0.08	0.11	0.28*
Age					-0.05	-0.22	0.02	0.17	-0.08	0.17	-0.02	0.10	-0.25	-0.27
Marital st						0.13	-0.11	-0.12	-0.32**	-0.08	0.01	0.20	0.15	0.04
Gender							-0.35**	-0.01	-0.01	0.13	0.05	0.09	-0.02	0.16
Education								0.09	-0.02	-0.24	-0.01	-0.01	0.07	0.06
Stoma									-0.04	-0.03	-0.01	-0.01	-0.11	0.04
Interval										0.10	-0.09	0.01	-0.10	-0.03
N											-0.42**	0.10	-0.43**	-0.49**
E												0.09	0.29*	0.38*
O													-0.01	-0.09
A														0.42**

* p<0.05; ** p<0.01

Table 4. Summary of hierarchical regression analyses with estimates of individual aspects of quality of life as a criterion and personality traits from NEO-FFI as predictors

	Predictors	Criterion: QOL - Individual aspects of quality of life	
		β	ΔR^2
Step 1	Sex	-0.023	
	Age	-0.124	
	Stoma	-0.055	
	Interval surgery-examination	-0.241	
	Marital status	-0.085	
	Education	0.379*	0.117
Step 2	Neuroticism	-0.413*	
	Extraversion	-0.026	
	Openness	-0.041	
	Agreeableness	0.064	
	Conscientiousness	-0.069	0.070
	Total R^2		0.188

* p<0.05

Table 4 shows a regression analyses summary (predictors: control variables and personality traits from NEO-FFI, criterion: estimates of individual aspects of quality of life). It is evident from table 4 that control variables entered in step 1 explain the modest (and nonsignificant) 11% variance in estimates of individual aspects of quality of life and that the only significant predictor is education. In step 2, when NEO-FFI results were entered as predictors, the explained variance percentage increased by merely 7% (nonsignificant) and the only significant predictor is neuroticism.

Table 5 presents the results of regression analyses (predictors: control variables and NEO-FFI personality traits, criterion: total satisfaction with life). Age, gender, interval from surgery to examination, stoma presence/absence, education and marital status explain merely 1% of the variance in total satisfaction with life. When, however, NEO-FFI personality traits are entered, the explained variance percentage increases significantly (25%), while the only significant predictor is neuroticism.

Table 6 presents the results of two regression analyses (in the first analysis, predictors were control variables and NEO-FFI personality traits and the criterion is QOL factor 1 - satisfaction with past life; in the second analysis, predictors were control variables and NEO-FFI personality traits and the criterion is QOL factor 2 – future expectations and comparison with others). Education was the only significant control variable, but it explains only the (nonsignificant) 2% variance in satisfaction with past life, but in step 2, the average explained variance increased by 20% (significant change), while neuroticism was only a significant predictor for satisfaction with past life.

There is no control variables contribution to the explanation of variance in future expectations and comparison with others (QOL factor 2). Again, neuroticism was the only significant predictor and explained the 19% variance in future expectations and comparison with others.

Table 5. Summary of hierarchical regression analyses in predicting total satisfaction with life based on NEO-FFI results as predictors

	Predictors	QOL – Total satisfaction	
		β	ΔR^2
Step 1	Sex	-0.036	
	Age	0.094	
	Stoma	0.150	
	Interval surgery-examination	-0.020	
	Marital status	-0.100	
	Education	0.240	0.010
Step 2	Neuroticism	-0.540**	
	Extraversion	0.070	
	Openness	-0.090	
	Agreeableness	-0.070	
	Conscientiousness	-0.010	0.256**
	Total R^2		0.265**

** p<0.05

Table 6. Summary of hierarchical regression analyses: Results on NEO-FFI as predictors, and factor 1 (satisfaction with past life) and factor 2 (future expectations and comparison with other) as criteria

	Predictors	QOL – factor 1		QOL – factor 2	
		β	ΔR^2	β	ΔR^2
Step 1	Sex	0.030		-0.03	
	Age	-0.010		0.22	
	Stoma	0.124		0.18	
	Interval surgery-examination	-0.050		0.02	
	Marital status	-0.113		-0.07	
	Education	0.306*	0.02	-0.01	0.01
Step 2	Neuroticism	-0.479**		0.51**	
	Extraversion	0.070		0.09	
	Openness	-0.080		0.06	
	Agreeableness	0.010		-0.20	
	Conscientiousness	-0.020	0.20*	-0.03	0.19**
	Total R^2		0.22*		0.20**

* p<0.05;   ** p<0.01

DISCUSSION

The results of this study clearly demonstrated that overall subjective quality of life estimates in colorectal cancer patients are comparable to those in healthy individuals. Control variables such as age, gender, marital status, education, stoma presence/absence and interval from surgery to examination were not significant predictors for quality of life in colorectal cancer patients. Education was positively correlated with estimates of individual quality of life aspects (such as satisfaction with material and social status, education, social environment, etc.) and satisfaction with past life, but the percentage of explained variance in these variables based on this predictor was not significant. Conscientiousness was correlated with satisfaction with past life and with satisfaction with life (total score), but was not a significant predictor of any quality of life aspects. Neuroticism was the only variable significantly associated with all aspects of quality of life, and neuroticism was a significant predictor for total satisfaction with life and two quality of life factors (satisfaction with past life and future expectations and comparison with others). Although correlation between neuroticism and individual aspects of quality of life was significant, neuroticism was not a significant predictor of estimates of individual aspects of quality of life. Contrary to our expectations, extraversion was not a significant quality of life predictor in our participants.

Education was not a significant predictor of any aspects of quality of life and significant correlations between education and estimates of individual aspects of quality of life and education and satisfaction with past life may be the result of particular characteristics of the Quality of Life Scale. As mentioned above, the estimates of individual aspects of quality of life including estimates of satisfaction with education, material and social status, housing, employment, leisure time and levels of satisfaction with these aspects of life were higher in individuals with higher education.

Although it was expected that neuroticism and extraversion would be significant quality of life predictors, this hypothesis was partly confirmed. Neuroticism proved to be a highly significant predictor of total life

satisfaction, satisfaction with past life, future expectations and comparison with others, but not for estimates of individual aspects of quality of life. Extraversion was not significantly correlated with any results on the Quality of Life Scale, probably as a result of differences between the instruments for assessing extraversion and quality of life used in this study and assessment instruments applied in other studies.

Although neuroticism was significantly correlated with estimates of individual aspects of quality of life, it was not a significant predictor for estimates of individual aspects of quality life. A possible explanation might lie in the above mentioned characteristics of items in this part of the Quality of Life Scale. These items include some quality of life aspects for which objective indicators are significant (e.g. education, material status, employment, etc.).

Regarding basic determinants of neuroticism which manifest themselves as a proneness to negative affects which interfere with adaptation, proneness to irrational ideas, a reduced ability to control impulses and poor coping strategies, it was expected that individuals with higher neuroticism would have a lower satisfaction with life after the occurrence of a malignant disease. Stressful events, such as the occurrence of a malignant disease, in individuals with high neuroticism are accompanied by a high level of anxiety, fears, the perceived lack of control over the situation, all of which may lead to less successful coping strategies and poorer adaptation to the disease. In addition, these individuals may be prone to attributing greater importance and a negative attribution to various physical symptoms, which negatively affects quality of life and general satisfaction with life. Frequently experienced negative affects, on the other hand, can in turn affect a larger number of physical symptoms, which can lead to perceived reduced efficiency and reduced control over the situation. Interactions of persons with high neuroticism as a personality trait with the environment are often very complex, so the amount of social support these individuals receive from their environment, on which quality of life depends as well, may be questionable. Based on data from different studies it can be assumed that variables which can contribute to understanding the correlation between neuroticism and life satisfaction are a sense of coherence and the (perceived) capacity for self-control and controlling the world around oneself. In a study conducted by Martinović et al. (2012) based on salutogenic theory and the theory of personal control of development has shown that a sense of coherence is a predictor of life satisfaction in cancer patients, but with the control of variables of subjective health estimates and tertiary control (i.e. strategies such as reinterpretation, rationalization, avoidance, etc. individuals use in situations when primary control aimed at the outside world and secondary control aimed at one's adaptation to the outside world are ineffective). The main determinants of

a sense of coherence are individual resources an individual uses in coping, and, although sense of coherence was not directly examined in our participants, it is evident from the definition of neuroticism as a personality trait (as measured by NEO-FFI) that individuals with high neuroticism estimate their personal resources as low. With the definition of neuroticism as a personality trait, a poorer sense of control can be clearly identified and individuals' poorer ability to perceive stressful events as a challenge they can cope with in their lives. A poorer sense of coherence and a perceived lack of control over oneself and one's environment can certainly lead these individuals to estimate a lower life satisfaction than participants in which a sense of coherence and perceived control ability are clearly accentuated.

Patients with malignant or chronic diseases must make an effort to accommodate to their illness. Results of different studies emphasize the important role of response shift in this adaptation process (Sprangers & Schwartz 1999, Wilson 1999, Trentham-Dietz et al. 2003, Caravati-Jouvenceaux et al. 2011). Response shift is a change in one's self-assessment of quality of life as a consequence of changes in internal standards, values and the conceptualization of quality of life (Sprangers & Schwartz 1999). Different factors impact the manner in which response shift affects quality of life in individuals with changed health status. Among these factors it is important to emphasize the role of personality traits, expectations and spiritual identity. Optimism, self-esteem, sense of control, more positive appraisals regarding the influence of cancer on identity, relationships and the future will lead to better adaptation to illness and, consequently, to a better quality of life. Individuals with high neuroticism are not optimistic, they perceive others as happier and as more content than themselves and they are prone to negative appraisals regarding the influence of cancer (and other diseases) on their life. They are less flexible in changing their own standards, values and conceptualization, which can also negatively affect their quality of life, especially when they are faced with a life-threatening disease.

Our study had several limitations. It involved a relatively small number of participants and results should certainly be examined on larger samples. The study did not include a control group, which is an important limitation to its validity. Given that participants were of older age, information on possible comorbidity which may also affect quality of life would have been useful, particularly in participants with a long interval from surgery to examination. No measures of perceived social support and coping strategy, which might be useful in explaining the correlation between neuroticism and quality of life, were used in this study. Furthermore, the study used the Quality of Life Scale, which is limited to psychosocial quality of life aspects, so physiological variables were disregarded. However, the objective of this study was aimed at examining

subjective quality of life estimates following a malignant disease and correlations to personality traits, and not to measure symptoms related to illness and treatment.

CONCLUSIONS

Neuroticism as a personality trait explains the high variance percentage in total life satisfaction, satisfaction with past life, future expectations and comparison with others, regardless of the interval from surgery to examination, stoma presence/absence, marital status, age and gender in patients with colon carcinoma. This leads to the conclusion that improving quality of life in individuals with high neuroticism following colorectal cancer could be supported by different, primarily cognitive-behavioral interventions aimed at changing negative attributions, reducing tension and negative affects, acquiring more effective coping strategies, strengthening perceived personal control, redefining and re-conceptualizing quality of life and more adequate social support seeking/receiving.

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