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ARTICLE

Personality and educational level determine self-reported health-related quality-of-life and distress in patients with renal tumors awaiting radical surgery

Elisabeth Beisland[a], Elen M. Hauge[b], Anne K. H. Aarstad[d], Marianne J. Hjermstad[e,f], Hans J. Aarstad[b,g] and Christian Beisland[b,c]

[a]Department of Health and Social Sciences, Western Norway University of Applied Sciences, Bergen, Norway; [b]Department of Urology, Haukeland University Hospital, Bergen, Norway; [c]Department of Clinical Medicine, University of Bergen, Bergen, Norway; [d]Faculty of Health, VID Specialized University, Bergen, Norway; [e]Regional Advisory Unit in Palliative Care, Dept. of Oncology, Oslo University Hospital, Oslo, Norway; [f]European Palliative Care Research Centre (PRC), Dept. of Oncology, Oslo University Hospital, and Institute of Clinical Medicine, University of Oslo, Oslo, Norway; [g]Department of Otolaryngology/Head and Neck Surgery, Haukeland University Hospital, Bergen, Norway

ABSTRACT

Objective: Data on preoperative distress and health-related quality-of-life (HRQoL) is lacking for patients with newly diagnosed renal tumors. This study aims to compare HRQoL within this group with the general population and to study the relationship between distress, HRQoL, personality, coping, and patient/tumor-related factors.

Materials and methods: Between January 2011 and June 2014, 153 patients (100 males/53 females), scheduled for surgery were prospectively included. Distress was determined by the General Health Questionnaire (GHQ), HRQoL by EORTC-QLQ-C30 questionnaire, personality by Eysenck Personality Inventory and coping by COPE questionnaire. HRQoL-data from an age and gender matched Norwegian reference population was used for comparison.

Results: The study patients had significantly poorer HRQoL than the reference population. GHQ and HRQoL sum scores had a common variance ($CV = r^2$) of 29–35%. In regression models, the measured variables accounted for 33% of the variance for the GHQ score. Significant predictors of the measured variance were neuroticism (18%), education level (3%) and avoidant coping (2%). Similarly, the measured variables accounted for 33–44% of the variance for the HRQoL sum scores. For all HRQoL sum scores, neuroticism predicted 17–28%, while education predicted 4–11% of the measured variance. Large tumor size, comorbidity, performance status and CRP predicted 2–7% of individual sum scores.

Conclusions: For both preoperative distress and HRQoL, personality traits such as neuroticism and education level were the most important predictors. Tumor-related factors and other preexisting conditions seemed to be of lesser importance. Thus, preoperatively screening of psychological factors could be helpful to identify those at risk of poor outcomes.

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Introduction

The incidence of renal cell carcinoma (RCC) is increasing, and represents 2.5% of all new cancer cases in Norway [1]. RCC affects men 1.5-times more often than women, occurring mostly in the 6th and 7th decade [2]. Overall, tumors are incidentally detected in more than 60% of the cases. Because preoperative biopsy is only used in a minority of patients with localized disease [3], up to 30% of resected tumors turn out to be benign on final histopathology [4]. The curative treatment for kidney cancer is surgery, with a high cure rate for localized disease. Thus, over the last decades, and as with many other forms of cancer, there has been an increasing awareness about different aspects of the health-related quality-of-life (HRQoL) among kidney cancer patients. However, studies have focused on how different types of interventions have affected HRQoL outcomes after treatment [5–7]. In general, HRQoL issues with regard to kidney cancer patients are poorly explored and understood, as summarized by two review papers. In 2012, MacLennan et al. stated that HRQoL was 'inconsistently defined, measured or reported' [8], with Rossi et al. confirming this finding in their study from 2018 [9]. Moreover, few studies seem to discuss the situation under which baseline data are collected. Patients recently diagnosed with a renal mass waiting for surgery may demonstrate more acute psychological responses, often referred to as distress [10]. In regard to kidney cancer and distress, there is an acknowledged knowledge gap [11].

The first aim of the present study is to compare the HRQoL-scores in patients awaiting treatment with reference data from the general Norwegian population. The study also aims to explore to what extent preoperative HRQoL and distress are affected by patient-related factors such as personality and coping strategies, and tumor-related factors, e.g. tumor size, socio-demographic factors and comorbidities. Knowledge about interrelationships between these factors

CONTACT Christian Beisland christian.beisland@helse-bergen.no Department of Urology, Haukeland University Hospital, Bergen 5020, Norway
Supplemental data for this article can be accessed here

prior to surgical treatment may be useful as benchmarking for baseline data in future prospective studies on renal tumor patients. Lastly, the study aims to establish an improved understanding of specific needs within this group of patients waiting for treatment.

Patients and methods

After referral from their GP or local hospital, all patients were informed about tumor-related factors, suggested treatment and prognosis 2–4 weeks prior to surgery. In accordance with the department's standard patient trajectory, patient information was provided at each physician's discretion, but was not standardized. During the period between January 2011–June 2014, 273 patients underwent a partial or radical nephrectomy for a localized renal tumor at Haukeland University Hospital, Bergen, Norway. Immediately prior to surgery (1–3 days before), eligible patients were asked to participate in a prospective questionnaire-based study on HRQoL and renal tumors. Patients with primary metastatic RCC were not eligible for the study.

In total, 153 patients (56%) were included in the study; thus, 120 patients (44%) were not. The reasons for this are many, and include a few refusals. More common reasons for non-inclusion are another primary and more advanced malignancy, a poor understanding of the Norwegian language and administrative failure. The clinical (i.e. ASA-score, performance status, Charlson comorbidity score), demographic and tumor characteristics (i.e. tumor size and CRP) were retrieved from our general kidney tumor database for which all surgically treated patients have consented. For the HRQoL study, the included patients gave separate written informed consent. Both the general and HRQoL database were approved by the Norwegian Social Science Data Services and the Regional Committee for Medical and Health Research Ethics in Western Norway (REC-ID: 78/05 and 2010/2569).

Questionnaires

On admittance for surgery, the patients completed the baseline questionnaires. The study nurse gave paper versions of the various inventories to the patients, who independently filled them out. After the patient had completed the form, the study nurse was available for questions.

Health-related quality-of-life inventory

The HRQoL was determined by employing The validated Norwegian translation of EORTC QLQ-C30, version 3.0 [12]. The answers were given according to a four-point Likert format, with the exception of questions about general health and general quality-of-life, which were given according to a seven-point Likert format. The indexes were scored according to the EORTC guidelines [13]. The QLQ-C30 functional scales and the global scale were transformed, so that 100% indicates the best function and 0% the least function of the individual HRQoL index, whereas the QLQ-C30 symptom scales were transformed, so that 0% indicated the least- and 100% the most symptoms. Missing values were treated according to the EORTC QLQ-C30 scoring manual [13]. The QoL scales consisting of more than one response were studied by Cronbach's α, with the general health/QoL scores compiled to one sum score. Two additional sum scores were computed, compiling the functional indexes and the symptom indexes. This has previously been done in several studies by, e.g. Aarstad et al. [14–16] and Hinz et al. [17]. Computing the score as a mean of the functional scales is a potential alternative of initial scoring to the EORTC-derived indexes. All the sum scores, with the exception of nausea and vomiting, had a satisfactory Cronbach's α (see Supplementary Table 1), thereby indicating that it was psychometrically valid to calculate these indexes. The inclusion of sum scores adds unique information as to whether the question of research was to compare broader concepts to HRQoL. Nevertheless, the sum scores results must be interpreted in conjunction with the underlying indexes.

Distress (GHQ)

Distress was measured by using the General Health Questionnaire (GHQ) [18], which is used when detecting psychiatric disorders in the general population within community or non-psychiatric clinical settings. The questionnaire assesses the respondent's current state, and asks whether that differs from his or her usual state. It is therefore more sensitive to short-term psychiatric disorders, but less so to the long-standing attributes of the respondent.

Several versions of the GHQ are available, and we have chosen the GHQ-12 version. The 12-question version of the GHQ is quick to administer and score, as it only contains 12 questions. It also has comparable psychometric properties to the longer versions, including a standard 4-point response matrix. For the analyses, both an overall Likert score and case scoring were applied. In the latter, dichotomization was achieved by pooling response categories 1–2 and 3–4 into two groups. A higher score indicates more distress.

Eysenck personality inventory (EPI)

Personality may be defined as those characteristics of a person that account for consistent patterns of feeling, thinking and behavior [19]. One personality dimension denoted as neuroticism is a broad pervasive dimension of personality, whereby people vary in their tendency to experience dysphoric emotional states [20]. Individuals with neuroticism are predisposed to worry regardless of the presence or absence of threats and report more subjective health complaints than stable individuals [20].

The neuroticism (24 questions) and lie score (nine questions) dimensions of the Eysenck Personality Questionnaire (EPI) [21] were obtained. The subject responded YES or NO to the questions, and the scales were calculated as sum scores. A higher score indicates more neuroticism. The neuroticism scale consists of questions related to mental symptoms such as obsessive thoughts, anxiety, depression and low self-esteem, but also includes somatic symptoms such as muscle pain, tachycardia and sleeplessness. The scale

assesses adjustment versus emotional instability and identifies individuals prone to psychological distress, unrealistic ideas, excessive cravings or urges and maladaptive coping responses. Individuals with low scores are characterized as calm, relaxed, unemotional and self-satisfied [22]. The lie scale is based on yes or no answers to nine questions such as: 'Have you ever stolen anything?' Although originally introduced as a lie scale, it has later been suggested that the response pattern to this scale may be regarded as a measurement of a personality trait [23], with a focus on the handling of moral issues.

The COPE-inventory

Coping may be defined as: 'ongoing cognitive and behavioral efforts to manage specific external and/or internal demands that are judged to tax or exceed the resources of the person' [24]. Coping contributes to enabling cancer patients to live with the demands posed by the disease, and experience a general well-being despite having been treated for cancer. The principal coping styles identified are problem-focused-, emotional-focused- and avoidance-focused coping styles [25].

Carver, Scheier and Weintraub [26] have developed the COPE questionnaire based on the conceptual framework by Lazarus [24]. The scores for each assessed coping index are calculated as the sum of the responses to four different questions, which are scored according to a four-point Likert format. A higher score indicates more use of the actual way of coping. The scales utilized assess the level of suppression of competing activity (problem-focused coping), seeking social support for emotional reasons (emotional-focused coping) and coping by behavioral disengagement (avoidance-focused coping). The subjects were also asked to relate the responses to their cancer disease.

Socio-demographic factors

Demographic variables such as age and gender were obtained by reviewing the patient records. The level of education, work and marital status as well as smoking habits and alcohol consumption were part of the questionnaires.

General Norwegian population

A sample of 3,000 persons reflecting the age and gender distribution of the adult Norwegian population was obtained with a random draw of this population. The EORTC QLQ-C30 (+3) version and a questionnaire about demographic data and health were sent by mail, yielding a response rate of 68% [27]. From this database, we matched each patient on gender (exact) and age (±5 years) with four controls yielding a control group of 612 patients. The age distributions were mean 61.8 years (median: 63 years, interquartile range: 56–71 years) in the control group and mean 62.5 years (median: 65 years, interquartile range: 56–70 years) in the study group, respectively ($p = 0.491$).

Statistics

The statistical program package IBM SPSS statistics (Ver. 24.0) was used for the analyses.

For a comparison of groups, we used a *t*-test, a Mann-Whitney U-test and a Chi-Square test for continuous, ordinal and categorical data, respectively. Unless otherwise indicated, questionnaire sum scores are treated as continuous variables. The Pearson's *r*, a partial correlation analysis, a reliability analysis and regression analyses were performed as indicated, and statistical significance was considered if $p < 0.05$. Correlation measures covariation were denoted from +1 to –1. Moreover, if indicated, r^2 was calculated and denoted as a common variance (CV).

Results

Patient characteristics are shown in Table 1. The male-to-female ratio was 1.9:1. The attrition analysis (Table 1) between included and non-included patients demonstrates a similarity concerning most demographic, tumor and comorbidity variables. Only the preoperative ASA score was statistically significantly different between the groups. Supplementary Table 2 demonstrates education level, work status, marital status and levels of alcohol and tobacco use.

Comparison of preoperative HRQoL sum scores with reference population

As demonstrated in Figure 1, the general health/QoL score was significantly lower in the preoperative tumor group ($p < 0.001$). Similarly, the functional HRQoL sum score and the symptom HRQoL sum score for the perioperative tumor group were significantly lower and higher than for the normal population, respectively ($p < 0.001$ for both).

Associations between HRQoL and GHQ scores

GHQ Likert and case scores were closely associated as measured by correlation coefficients ($r = 0.89$, $p < 0.001$). All (functional, symptom and General health) HRQoL sum scores correlated to GHQ scores, with correlation coefficients ranging between 0.51 and 0.61 (*p*-values < 0.01), thereby corresponding with a common variance of 26–37%. Similarly, the correlation coefficients between the GHQ scores and the QLQ-C30 indexes ranged between 0.22 and 0.66 (*p*-values < 0.05) (Table 2), as only the QLQ-C30 item diarrhea did not have significant correlation.

Associations between HRQoL/GHQ scores and demographic/other patient-related variables

Increasing age was inversely correlated to the GHQ ($r = -0.24/-0.30$, *p*-values < 0.01) and the QLQ-C30 symptom sum ($r = -0.16$, $p < 0.05$) scores, and correlated to the functional HRQoL sum score ($r = -0.18$, $p < 0.05$). The correlation coefficients correspond to a CV between 2.6–9% (Table 3).

Table 1. Preoperative characteristics of patients with localized renal masses and scheduled for radical surgery at Haukeland University Hospital, Bergen, Norway from January 2011 to June 2014. The 153 patients included in the prospective HRQoL study are compared to the 120 patients not included.

	Included ($n = 153$)	Not included ($n = 120$)	p-value
Age at inclusion (years)	62.5 (65, 56–70)	64.5 (66, 60–73)	0.168
Gender			
Male	100 (65)	76 (63)	0.799
Female	53 (35)	44 (37)	
BMI (kg/height in m^2)	26.5 (26, 24–29)	26.0 (26, 23–29)	0.315
Symptomatic at detection			
Yes	45 (29)	39 (33)	0.599
No	108 (71)	81 (67)	
Preoperative renal mass biopsy			
Yes	14 (9)	14 (12)	0.549
No	139 (91)	106 (88)	
Lesion size (cm)	4.6 (4.0, 2.5–5.8)	4.3 (3.5, 2.2–5.4)	0.326
Lesion side			
Left	75 (49)	66 (55)	0.391
Right	76 (50)	53 (44)	
Bilateral	2 (1)	1 (1)	
Lesion type			
Solid tumor	135 (88)	103 (86)	0.588
Cystic	18 (12)	17 (14)	
eGFR (ml/min/1.73 m^2)	83 (86, 73–96)	79 (83, 65–94)	0.181
CRP	7.2 (2, 1–5)	6.6 (2, 1–5)	0.796
Preoperative ASA score			
I–II	128 (84)	83 (69)	0.006
III	25 (16)	37 (31)	
Preoperative ECOG performance status			
0	145 (95)	109 (91)	0.236
≥ 1	8 (5)	11 (9)	
Preoperative Charlson Comorbidity Index			
0	40 (26)	32 (27)	0.975
1	41 (27)	33 (28)	
≥ 2	72 (47)	55 (46)	
Previous or synchronous other primary cancer			
No	120 (78)	83 (69)	0.094
Yes	33 (22)	37 (31)	

eGFR, estimated glomerular filtration rate; BMI, Body Mass index; ECOG, Eastern Collaborative Oncology Group; CRP, C-reactive Protein. Data shown as mean (median, IQR) or n (%).

The female gender was correlated to higher GHQ scores ($r = 0.19/0.24$, $p < 0.05/0.01$). For the HRQoL sum scores, a higher symptom HRQoL sum score was significantly associated with the female gender ($r = 0.17$, $p < 0.05$). For gender, the CV was 2.9–5.9%.

A higher level of education was correlated with higher functional sum scores ($r = 0.23$, $p < 0.01$) and general health/QoL ($r = 0.30$, $p < 0.01$), and inversely correlated to the symptom sum score ($r = -0.17$, $p < 0.05$) and GHQ ($r = -0.17$, $p < 0.05$).

To live together with family was inversely correlated to the symptom HRQoL sum score ($r = -0.186$, $p < 0.05$).

Associations between HRQoL/GHQ scores and comorbidity

A high ASA score, poor PS and high CCI were inversely correlated to the functional sum score ($r = -0.27$, -0.28, and 0.16, respectively (all p-values < 0.05)) (Table 3). A higher CCI was also significantly inversely correlated to general health/QoL ($r = 0.16$, $p < 0.05$). For a high ASA score and low PS, the correlation coefficients were just above the 0.05 level. A low PS was significantly correlated to the symptom HRQoL sum score ($r = 0.17$, $p < 0.05$), while a high ASA score had a p-value $= 0.052$.

Neither smoking, level of alcohol consumption, work status, nor having another primary cancer was significantly correlated to HRQoL/GHQ scores.

Associations between HRQoL/GHQ scores and renal tumor-related factors

Higher levels of C-reactive protein (CRP) correlated significantly with HRQoL sum scores, i.e. the functional HRQoL sum score ($r = -0.23$, $p < 0.01$) and symptom HRQoL sum score ($r = 0.22$, $p < 0.01$) (Table 4), which corresponds to a CV of 4.8–5.2%. Higher levels of renal function measured by eGFR correlated with GHQ case scoring ($r = 0.16$, $p < 0.05$). A large tumor size, cystic tumor, preoperative biopsy and kidney tumor-related symptoms (hematuria, flank pain, palpable mass or general malaise) did not correlate significantly with HRQoL/GHQ.

Associations between HRQoL/GHQ scores and EPI neuroticism, EPI lie score and selected COPE scores

All EORTC QLQ-C30 HRQoL sum scores were relative closely negatively associated with the personality trait of neuroticism ($CV_{range} = 19–30\%$), and to some extent positively associated with the lie score ($CV_{max} = 5.8\%$). An avoidant choice of coping inversely accounted for EORTC HRQoL sum scores, with the CV ranging from 6.3% to 10.2%. The reported level of

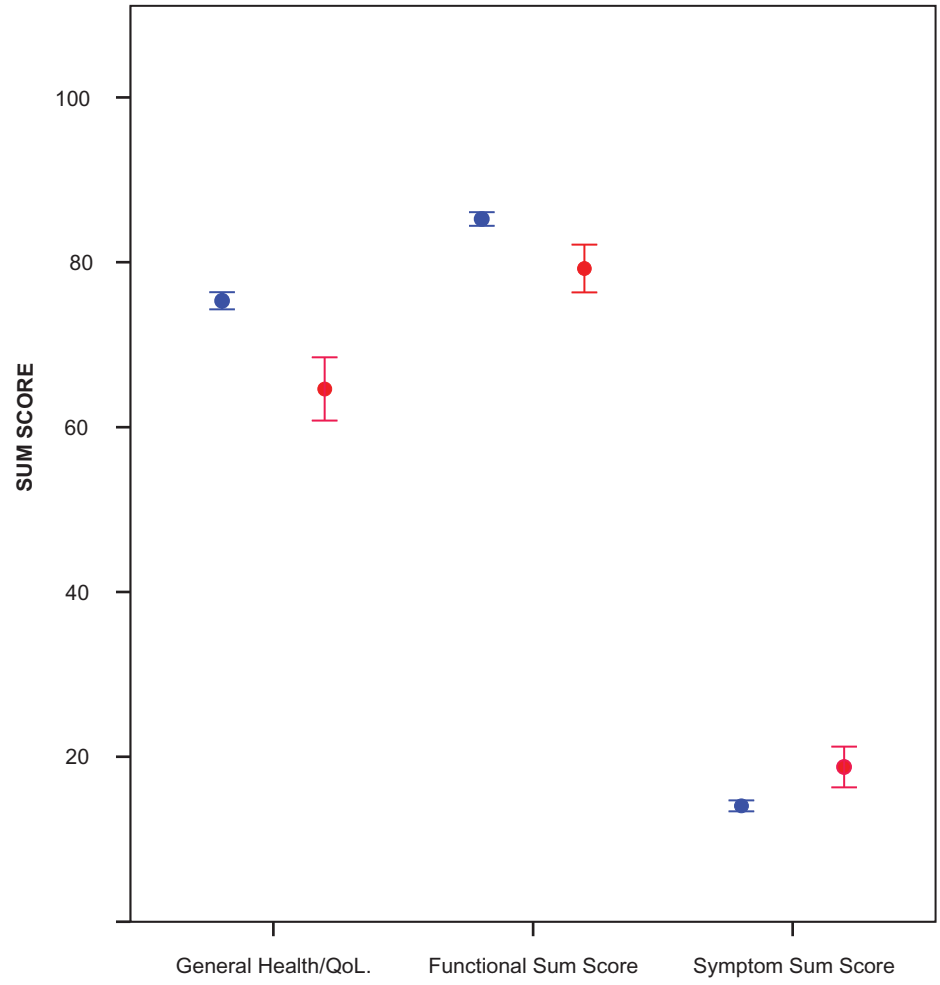

Figure 1. Sum scores with 95% confidence intervals for the study population (red) and the normal Norwegian population (blue). The differences in scores are statistically significant for all three sum scores ($p < 0.001$ for all).

Table 2. Pearson correlation matrix based on the General Health Questionnaire (GHQ-12) and European Organization for Research and Treatment of Cancer Quality-of-Life (EORTC QLQ-C30) questionnaire sum scores versus Eysenck Personality Inventory (EPI) Neuroticism, EPI Lie Score and selected COPE scores.

	GHQ −Likert	GHQ −Case	General Health/QoL	Functional HRQoL sum score	Symptom HRQoL sum score
GHQ −Case	0.89**				
C30 −General Health/QoL	−0.54**	−0.51**			
C30 −Functional HRQoL sum score	−0.60**	−0.61**	0.73**		
C30 −Symptom HRQoL sum score	0.54**	0.54**	−0.73**	−0.77**	
EPI −Neuroticism	0.54**	0.48**	−0.44**	−0.55**	0.52**
EPI −Lie	−0.16*	−0.22**	0.02	0.24**	−0.18*
COPE −Problem-focused coping	0.33**	0.24**	−0.22**	−0.20*	0.22**
COPE −Emotional coping	0.22**	0.19*	−0.02	0.04	−0.03
COPE −Avoidant coping	0.33**	0.23**	−0.32**	−0.28**	0.25**
COPE −Coping by humor	−0.02	−0.02	−0.10	−0.06	0.04

HRQoL, Health-related Quality-of-Life; QoL, Quality-of-Life. *$p < 0.05$, **$p < 0.01$.

problem-focused coping also correlated negatively with the HRQoL scores, with an approximate CV_{range} of 4–4.8% (Table 2).

All functional and symptom indices (with the exception of diarrhea) were correlated to the level of neuroticism (CV_{range} = 3.2–35.7%) (Table 5). Moreover, all the functional- and most of the symptom indices, with the exception of the gastrointestinal indexes, were significantly correlated to problem-focused coping, with a CV_{max} of 10.2%.

We also determined partial correlations between indicated choice of coping and HRQoL, adjusted by level of neuroticism (results not shown). These analyses showed that the correlations were reduced in strength as to avoidant and problem-focused coping, though in general the primary significant associations were not lost.

GHQ was closely associated to neuroticism (CV_{range} = 23–29%) for both scoring methods and somewhat less to the lie score (CV_{range} = 2.7–4.8%). Avoidant, emotional and

Table 3. Pearson correlation matrix based on the General Health Questionnaire (GHQ-12) and European Organization for Research and Treatment of Cancer Quality-of-Life (EORTC QLQ-C30) questionnaire sum scores versus demographic and comorbidity related variables.

	GHQ – Likert	GHQ – Case	General Health/QoL	Functional HRQoL sum score	Symptom HRQoL sum score
Age (cont.)	−0.24**	−0.30**	0.09	0.18*	−0.16*
Gender (male vs. female)	0.19*	0.24**	−0.14	−0.13	0.17*
BMI (cont.)	−0.03	−0.02	−0.06	0.04	0.00
Smoking (no vs. yes)	−0.01	−0.06	−0.06	−0.11	0.08
Alcohol consumption (< 1 per week vs. more)	0.10	0.03	−0.14	−0.12	0.04
Education level (less vs. univ./college)	0.16	−0.17*	0.30**	0.23**	−0.17*
Work status (working vs. not)	0.04	0.10	0.11	0.12	−0.13
Living with family (yes vs. no)	−0.06	0.01	0.08	0.10	−0.21*
ECOG Performance Status (0 vs. ≥ 1)	0.01	0.03	−0.14	−0.28**	0.17*
ASA – Score (I–II vs. III)	0.05	0.01	−0.15	−0.27**	0.16
CCI (< 2 vs. ≥ 2)	−0.01	−0.06	−0.16*	−0.16*	0.09
Previous or synchronous other cancer (no vs. yes)	−0.04	−0.06	−0.02	−0.09	−0.04

HRQoL, Health-related Quality-of-Life; QoL, Quality-of-Life; BMI, Body mass index; CCI, Charlson Comorbidity Index, ECOG, Eastern Collaborative Oncology Group. *$p < 0.05$, **$p < 0.01$.

Table 4. Pearson correlation matrix based on the General Health Questionnaire (GHQ-12) and European Organization for Research and Treatment of Cancer Quality-of-Life (EORTC QLQ-C30) questionnaire sum scores versus preoperatively known tumor related factors.

	GHQ – Likert	GHQ – Case	General Health/QoL	Functional HRQoL sum score	Symptom HRQoL sum score
Tumor size (cont.)	0.06	0.08	−0.12	−0.15	0.14
Cystic lesion (no vs. yes)	−0.07	−0.08	0.04	0.04	0.05
Preoperative biopsy (no vs. yes)	0.02	0.06	−0.02	−0.06	−0.06
Symptomatic[a] at diagnosis (no vs. yes)	−0.01	−0.01	0.11	0.05	−0.08
CRP (cont.)	0.05	−0.02	−0.14	−0.23**	0.22**
eGFR (cont.)	0.13	0.16*	−0.04	−0.11	0.02

HRQoL, Health-related Quality-of-Life; QoL, Quality-of-Life; CRP, C-reactive protein; eGFR, Estimated glomerular filtration rate; cont., Continuous. *$p < 0.05$, **$p < 0.01$.
[a]Hematuria, flank pain, gross palpable mass or general malaise.

Table 5. Pearson correlation matrix based on the General Health Questionnaire (GHQ-12), Eysenck Personality Inventory (EPI) Neuroticism, EPI Lie Score and selected COPE scores versus European Organization for Research and Treatment of Cancer Quality-of-Life (EORTC QLQ-C30) questionnaire indices.

EORTC QLQ–C30 indices	GHQ – Likert	GHQ – Case	COPE – Problem–focused coping	COPE – Emotional coping	COPE – Avoidant Coping	COPE – Coping by humor	EPI – Neuroticism	EPI – Lie
Physical function	−0.24**	−0.22**	−0.01	0.27**	−0.18*	−0.01	−0.34**	0.12
Role function	−0.46**	−0.48**	−0.13	0.09	−0.20*	−0.13	−0.37**	0.14
Emotional function	−0.66**	−0.60**	−0.35**	−0.20*	−0.32**	0.03	−0.60**	0.19*
Cognitive function	−0.45**	−0.52**	−0.08	0.06	−0.21*	−0.03	−0.47**	0.34**
Social function	−0.50**	−0.53**	−0.20*	−0.02	−0.20*	0.04	−0.38**	0.16*
Fatigue	0.47**	0.48**	0.16*	−0.00	0.24**	0.03	0.49**	−0.25**
Nausea and vomiting	0.37**	0.36**	0.14	−0.06	0.15	0.06	0.31**	−0.10
Pain	0.35**	0.36**	0.14	−0.10	0.18*	0.07	0.41**	−0.14
Dyspnea	0.45**	0.45**	0.16	−0.03	0.17*	−0.07	0.28**	−0.09
Insomnia	0.51**	0.50**	0.27**	0.13	0.19*	0.00	0.48**	−0.22**
Appetite loss	0.44**	0.44**	0.11	0.07	0.13	0.07	0.30**	−0.17*
Constipation	0.26**	0.22**	0.11	−0.07	0.06	0.06	0.18*	−0.07
Diarrhea	0.02	0.04	−0.01	−0.19*	0.06	0.06	−0.07	0.15
Financial difficulties	0.21*	0.18*	0.14	0.06	0.19*	0.11	0.25**	−0.01

HRQoL, Health-related Quality-of-Life. *$p < 0.05$, **$p < 0.01$.

problem-focused coping were all relatively closely associated with GHQ (CV_{range} = 3.6–10.9%).

Multiple linear regression analyses with HRQoL sum scores/GHQ Likert score as dependent variable and neuroticism, selected COPE scores, education, comorbidity and tumor size as independent variables

Linear regression analyses were performed, including significantly associated factors to the HRQoL and GHQ scores. However, associated factors with *p*-values < 0.15 were also entered to avoid selection bias.

Such an analysis, including the general health/QoL scores as dependent variables, accounted for 30.2% of the total variance. Of the included factors, a high level of neuroticism (β = –0.39), a tumor size > 7 cm (β = –0.17) and an increasing CRP (β = –0.15) were uniquely negatively associated. A higher education was uniquely positively associated with the general health/QoL scores (β = 0.33) (Table 6).

A regression analysis, including the functional HRQoL sum scores, accounted for 43.8% of the total variance, also showed that a higher level of neuroticism was uniquely negatively associated with functional HRQoL sum scores (β = –0.49). In addition, a higher CRP and higher ASA score scored

Table 6. Linear regression analyses with GHQ-Likert/HRQoL sum scores as dependent variable and age, gender, neuroticism, COPE scores and present co-morbidities of the patients as independent variables.

	GHQ – Likert		Functional HRQoL sum score		Symptom HRQoL sum score		General Health/QoL	
	32.7%		43.8%		32.5%		30.3%	
Adjusted R^2_{total}	β	p	β	p	β	p	β	p
Age (cont.)	–0.16	.028						
Education (less vs. univ./college)	–0.17	.018	0.25	<.001	–0.19	.006	0.33	<.001
EPI – Neuroticism	0.42	<.001	–0.49	<.001	0.49	<.001	–0.39	<.001
EPI – Lie score			0.19	.005				
COPE – Avoidant coping	0.16	.029						
CRP (cont.)			–0.19	.004	0.23	.001	–0.15	.043
Tumor size (< 7 cm vs. ≥ 7.0 cm)							–0.17	.020
ASA score (I–II vs. III)			–0.19	.004				

GHQ, General Health Questionnaire; HRQoL, Health-related Quality-of-Life; QoL, Quality-of-Life; CRP, C-reactive protein; EPI, Eysenck Personality Inventory; cont., Continuous; Univ., University (Blank space, non-significant association). R^2_{total}, total explained variance of applied model reported in %; β, standardized beta (analog to partial (unique) correlation coefficient); p, Statistical significance level.

similarly, with a negative β indicating a unique CV of 3.6%. A higher education and a high lie score also showed a positive and unique association, with a CV of approximately 3%.

In a regression analysis, the symptom HRQoL sum scores accounted for 32.5% of the total variance. Neuroticism ($\beta = 0.49$), a lower education level ($\beta = -0.19$) and CRP ($\beta = 0.23$) were also uniquely associated factors for increased symptom HRQoL sum scores (Table 6).

For the GHQ, only the regression analysis for Likert score is shown, which accounted for 32.7% of the total variance. Neuroticism, a younger age, a lower education and the use of avoidant coping were all uniquely associated factors with an increasing GHQ ($CV_{range} = 2.6–17.6\%$).

The regression analyses generally exhibited unique relationships between the HRQoL/GHQ scores on the one hand, and personality, choice of coping, education, tumor size and present comorbidities on the other. A figure based on the correlations and regression analyses have also been constructed (Figure 2). A CV of approximately 25% was directly observed between neuroticism and HRQoL/GHQ scores. In addition, present comorbidity accounted for a maximum of 5% and tumor-related variables maximum of 2–3% of the variance.

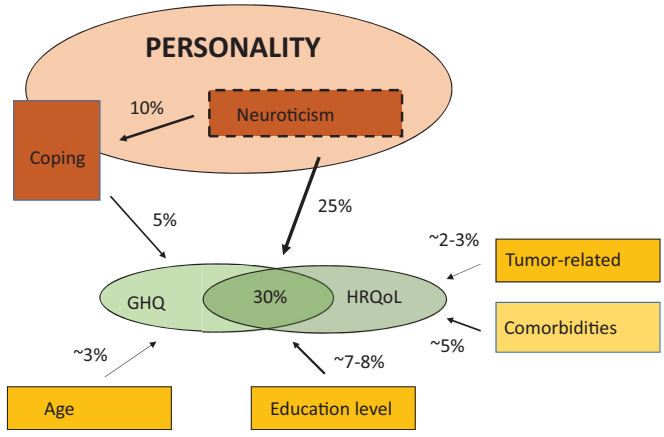

Figure 2. Proposed associations between health-related quality-of-life (HRQoL), distress (GHQ) and all other studied variables.

Discussion

The most striking finding in the current study is that personality and choice of coping is by far more important than both tumor- and patient-related factors for both distress and HRQoL prior to nephrectomy.

For kidney cancer patients, we have previously demonstrated a similar personality-dependent pattern for HRQoL in a cross-sectional post-treatment study [28]. Thus, the HRQoL results validate the importance of personality traits on patient-reported HRQoL in kidney tumor patients. Moreover, the significant impact of neuroticism on self-assessed HRQoL is well acknowledged for many different cancer types, i.e. head and neck cancer [29] and prostate cancer [30]. Based on this knowledge, preoperatively screening psychological factors like personality and choice of coping in renal tumor patients could be helpful to identify patients at risk of poor outcomes regarding HRQoL. Rossi et al. [9] state 'further education is required amongst renal cancer surgeons to increase awareness regarding determinants of poor HRQoL following management of RCC. This will enable patients at high risk of worse HRQoL to be identified and offered tailored support, including psychological interventions and increased education. In our opinion, this should include a preoperative assessment of personality and choice of coping, as real intervention studies in this field, including studies on individualized psychosocial support and information, are lacking. This study, being the first of several planned data collection timepoints, with a potential predictive ability, may help establish an in-depth understanding of specific needs for intervention in this group of patients.

The significantly poorer HRQoL sum scores within the study population compared to the normal population (Figure 1) demonstrate that newly diagnosed kidney tumor patients indeed have health issues. Our study population is representative of the contemporary cohort of patients referred for radical surgical treatment in Norway (Table 1), with 70% incidentally detected. Yet, two-thirds of the latter have been submitted to imaging that includes the kidneys due to established diseases or definite medical conditions [2], hence confirming the health challenges within the patient group. The impact of comorbidities is further underscored by the significant associations between HRQoL sum scores and ASA scores, performance status and the Charlson Comorbidity Index. Furthermore, with the high fraction of incidentally detected asymptomatic tumors, and the parallel small

average tumor size (median 4.0 cm), the modest impact of tumor-related factors on HRQoL sum scores seems reasonable. However, the exception was that patients with the largest tumors (> 7.0 cm) reported a significantly reduced general health/QoL (questions 29 and 30 in QLQ-C30 questionnaire). Nevertheless, these results are in line with the paper from Vissers et al. [31], showing that regardless of cancer type, comorbidity explains more of the variance in HRQoL, compared with tumor characteristics.

Levels of distress and HRQoL in this study are overlapping, with a common variance of 25–30%. This is in accordance with earlier publications from our group [29,32]. Patient distress is perceived as something that increases in more acute settings. Therefore, being newly diagnosed with- and waiting for kidney tumor surgery could certainly be expected to cause increased distress levels. There is little knowledge concerning distress in the preoperative setting and, to the best of our knowledge, this is the first study to address newly diagnosed non-treated patients with localized kidney tumors. A study on more advanced kidney cancer patients has demonstrated higher levels of distress than for other cancer types [11]. Our study showed significant associations between higher levels of distress and younger age/female gender. This is in line with both the abovementioned study on more advanced kidney cancer [11], as well as other types of cancer [33,34]. The strong associations shown between neuroticism/avoidant coping and distress is in agreement with previous report publications on other cancer types [29,32]. For the planned follow-up studies, one goal is to determine whether the level of distress remains stable or changes with time and/or treatment or not.

Together with neuroticism, a high level of education was the most consistent factor associated with high HRQoL scores and low levels of distress. One interpretation of the results, which is in line with the works of Antonovski [35], could be that if the world is comprehensible, manageable and meaningful, health is facilitated. This can be accomplished by following the idea that patients need individualized information and care, including taking patients' educational level and present co-morbidities into consideration when healthcare professionals are attempting to help cancer patients cope in the cancer trajectory. Because 70% of the patients were asymptomatic at diagnosis, the understanding of having a cancer disease may be difficult to grasp. It is probably easier to receive and understand information about the risk and prognosis of a cancer treatment if the patient is used to mentally processing abstract information. Education level is not commonly referred to as predictive for HRQoL and distress in cancer patients, but for this specific group it might be of interest to know so that tailored information could be conveyed to each individual patient.

This study has some obvious limitations regarding design and methods. The numbers are relatively small, and the study is a single-center study. The inclusion rate was also only 56%. However, there was no active selection bias and our baseline characteristics demonstrate similarity in regard to most demographic, tumor and comorbidity variables. Lack of standardization of information given to the patients, by several doctors at a teaching hospital might be seen as a limitation of the study. However, the study reflects real life data which might be viewed as a strength for the study.

Moreover, another limitation is that we have not investigated the personalities of the physicians, which could have impacted the outcome of the study.

A strength of our study is the fact that we have compared our data to an age- and gender-matched general adult population [27]. The fact that the data from the reference population was collected two decades ago may be regarded as a potential limitation. However, the stability of the QLQ-C30 questionnaire in the Norwegian general population over time was documented as satisfactory when comparing two QLQ-C30 surveys collected 8 years apart [36], supported by similar findings for the SF-36 [37].

Conclusion

For both preoperative distress and HRQoL, personality traits such as neuroticism and education level were the most important predictors. Psychological factors outperformed tumor-related factors and other preexisting conditions by 4–6-fold. Thus, preoperatively screening of psychological factors could be helpful to identify patients in need of tailored support during their hospital stay.

Disclosure statement

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ORCID

Christian Beisland http://orcid.org/0000-0002-3216-4937

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