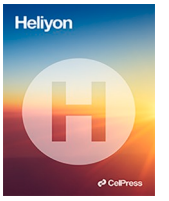
Heliyon 10 (2024) e32841

Contents lists available at ScienceDirect

Heliyon

journal homepage: www.cell.com/heliyon



Research article

# Validity of the Health Personality Assessment among rectal cancer survivors in Serbia

Nikola Grubor [a,b,*], Tatjana Gazibara [c], Pavle Gregorić [a,b], Zlatibor Lončar [a,b], Krstina Doklestić Vasiljev [a,b], Nenad Ivančević [a,b], Dušan Micić [a,b], Nemanja Pavić [a], Peter Martin [d], Boris Tadić [b,e], Katarina Erić [f], Smiljana Cvjetković [b], Miljan Ćeranić [a,b]

[a] *Clinic for Emergency Surgery, University of Clinical Center of Serbia, Pasterova 2, 11000, Belgrade, Serbia*
[b] *Faculty of Medicine University of Belgrade, Dr Subotića 8, 11000, Belgrade, Serbia*
[c] *Institute of Epidemiology, Faculty of Medicine University of Belgrade, Višegradska 26a, 11000, Belgrade, Serbia*
[d] *Department of Human Development and Family Studies, Iowa State University, 1096 LeBaron Hall, Ames, IA, 50011-1120, USA*
[e] *Department for Hepato-pancreato-biliary Surgery, Clinic for Digestive Surgery, University Clinical Center of Serbia, Koste Todorovica 6, 11000 Belgrade, Serbia*
[f] *Department of Pathology, Clinic for Digestive Surgery, University Clinical Center of Serbia, Koste Todorovića 2, Belgrade, Serbia*

ARTICLE INFO

*Keywords:*
Health personality assessment
Rectal cancer
Validity
Reliability

ABSTRACT

Understanding health personality traits in rectal cancer survivors could help to optimize recovery and coping mechanisms. The objective of this study was to evaluate psychometric properties of the Health Personality Assessment in Serbian language among rectal cancer survivors. A cross-sectional study was carried out from June to December 2022. The study sample consisted of 76 people who underwent the open lower anterior resection for rectal carcinoma at the Clinic for Digestive Surgery and the Clinic for Emergency Surgery, University of Clinical Center of Serbia (Belgrade, Serbia) and whose ileostomy was closed. Study participants were interviewed over the telephone using the Serbian version of the HPA which was translated according to the internationally accepted methodology for translation and adaptation of questionnaires. The confirmatory factor analysis suggested that the fit indices for 5-factor structure of the HPA were acceptable-to-good: Goodness of fit index = 0.939; Tucker Lewis fit index = 0.989; Comparative fit index = 0.992; Root Mean Square Error of Approximation = 0.019. Cronbach's alpha coefficients for Health Neuroticism, Health Extraversion and Health Agreeableness were>0.7 and for Health Openness and Health Conscientiousness were >0.4. Predictive validity testing suggested that not having complications with the ileostomy and a longer time since ileostomy closure were associated with stronger Health Agreeableness. Also, a longer time since ileostomy closure was associated with stronger Health Conscientiousness. The Serbian version of the HPA showed good construct validity and acceptable internal consistency. This is an important tool in further research of personality and health outcomes among rectal cancer survivors.

* Corresponding author. Clinic of Emergency Surgery, University Clinical Center of Serbia, Faculty of Medicine University of Belgrade, Pasterova 2, Belgrade, 11000, Serbia.
*E-mail addresses:* n.grubor@yahoo.com, nikola.grubor@med.bg.ac.rs (N. Grubor).

https://doi.org/10.1016/j.heliyon.2024.e32841
Received 30 November 2023; Received in revised form 25 May 2024; Accepted 10 June 2024
Available online 13 June 2024

## 1. Introduction

Colorectal cancer (CRC) is one of the most common malignancies in adults as well as one of the highest contributors to cancer-related mortality [1]. In terms of CRC risk, there appears to be a distinctive pattern of CRC incidence rates. Specifically, the highest risk of CRC occurrence was observed in the industrialized countries [1,2]. However, even in countries where the CRC incidence rates are low, over the past decades an upward trend in CRC occurrence has been reported [1,2].

Timely diagnosis and surgical treatment are essential for long term CRC survival [3]. The most challenging surgical procedure is undertaken in people with rectal cancer, because of its anatomical site deep within the pelvis and in close proximity to other organs, such as urinary bladder, ureters, prostate or uterus. Another difficulty in surgical management of rectal cancer represents the risk of injury of anal sphincter and fecal incontinence. As a result, following the lower rectal cancer removal, it is necessary to create a temporary ileostomy [4]. After several months, the ileostomy is closed, which marks the completion of the surgical treatment. Over the following years, rectal cancer survivors are periodically checked for their health status.

Learning about cancer diagnosis is a challenge in and of itself and while treatment is dependent on the surgical excellence, it is by no means the only factor contributing to optimum health outcomes. One of the factors that has been recently explored is related to personality traits of cancer survivors [5,6]. Specifically, it has been observed that extraversion and neuroticism were strong contributors of coping strategies in breast cancer survivors [5]. Neuroticism was also found to play a mediating role in the association between poorer health status and the onset of depression [6]. A recent systematic review of personality traits relevant for coping in cancer survivors focused on the Big Five Inventory (neuroticism, extraversion, openness to experience, agreeableness and conscientiousness) [7], which examines general personality traits. This could be a limiting factor, because for cancer survivors it may be more appropriate to examine personality traits relative to their health challenge which includes their perspective on their health condition and their health behaviors.

To bridge this gap, the Health Personality Assessment (HPA) has been developed to address "individual dispositions that are directly related to health" [8]. Understanding health personality traits in rectal cancer survivors could help to optimize recovery and coping mechanisms and could be used to better understand their health-related quality of life. As the HPA has been developed and psychometrically tested in the English speaking population [8], it is of paramount importance that this inventory is examined in populations who speak other world languages. The purpose of this study is to evaluate psychometric properties of the Health Personality Assessment in the Serbian language among rectal cancer survivors.

## 2. Materials & methods

### 2.1. Ethical approval

The Ethics Committee of the University of Clinical Center of Serbia approved the study (approval no. 611/2). Prior to survey, participants provided a written consent for participation.

### 2.2. Setting and participants

Study participants were recruited from the Clinic for Digestive Surgery and Clinic for Emergency Surgery, University Clinical Center of Serbia (Belgrade, Serbia). The University Clinical Center of Serbia is a tertiary health care delivery institution and the leading center for surgical procedures in the country. In Serbia, all citizens have universal access to health care, because the health care system is financed though mandatory contributions to the health insurance fund from the employers.

The inclusion criteria were: having open lower anterior resection of the rectum (LAR) via laparotomy, having histologically verified rectal cancer, having had ileostomy closed for a minimum of 2 months and providing a valid informed consent.

In the past four years (2018–2021, to account for both COVID-19 and pre-pandemic years), the average annual number of people who underwent open LAR for rectal cancer was 90. Using the Slovin's formula, the minimum sample size was calculated as follows $90/1+(90x0.05^2)$. The minimum sample size was 73 people. Potential paticipants were drawn from the electronic medical records of the two clinics and contacted via telephone.

People who underwent LAR in the period 2018–2021 were the target population for this study. A total of 182 participants were identified to have had an open LAR and a verified rectal cancer. Of 182 people, we were unable to reach 46 people (wrong number, no one answering the call) and 51 people had passed away. Of the remaining 85 people, 6 still had ileostomy and a stoma bag and 3 people refused participation.

### 2.3. Data collection

The interviews with the participants were conducted in the period June–December 2022. Cancer staging was drawn from the electronic medical records.

Demographic data included gender, age and level of education (primary, secondary and higher). Clinical data included the duration of having a stoma bag, time since ileostomy closure, having complications with stoma (irritation, leakage, retraction or prolapse, ischemia) and needing help of other people to maintain stoma, based on a previous study among rectal cancer survivors [9]. Cancer staging was based on the American Joint Committee on Cancer (AJCC), 8th edition [10].

#### 2.3.1. Health Personality Assessment

The Health Personality Assessment was applied to better understand health personality of rectal cancer survivors. This questionnaire was developed by Martin et al., in 2020 [8] on a population of older adults. To our knowledge, this validity testing is one of the few in a non-English speaking population.

This is a brief questionnaire composed of 15 items, which are grouped according to 5 major personality traits (applied to health): Health Neuroticism (related to distress and worry when visiting a doctor), Health Extraversion (related to discussing health status with other people), Health Openness (related to receptivity of new routines), Health Agreeableness (related to trust and confidence in one's doctor) and Health Conscientiousness (related to the efforts to be at optimum health). All domains consist of 3 items. Responses to items are graded on a 5-point Likert-type scale: 1-strongly disagree, 2-disagree, 3-neutral, 4-agree, 5-strongly agree. Item #5 "I do not like to talk about my health problems" (Health Extraversion domain) was re-coded in reverse. Grades for each domain are summed and divided by 3 to obtain the domain score. This questionnaire does not have a one single score, but rather 5 domain scores [8].

### 2.4. Translation to Serbian language

The Health Personality Assessment was developed in universal English language. To adequately perform the translation in accordance with the internationally accepted methodology, two people who were native speakers of Serbian and proficient in English language carried out the forward translation from English to Serbian. The two translated version were compared and discussed between the translators, after which the final version in Serbian was made. A third person who was proficient in English and a native speaker of Serbian, carried out the back translation from Serbian to English.

The back translation was discussed between the translators. There were minor adjustments in the back translation, for example the verb "strive" (item #13) was translated using a Serbian term "I make an effort". Also, the verb "I trust" (items #10 and #11) was translated using a Serbian term "I believe". The item #15 ("I do things to stay healthy") was slightly modified to match a more appropriate expression in Serbian language - "I undertake activities to stay healthy" - because the translation of the term "things" was static and not indicative of certain actions that are to be undertaken by a person in question who wants to stay healthy.

The final version of the Serbian Health Personality Assessment was pilot tested on 10 adult people who did not make any specific remarks on the clarity and comprehension of items. Therefore, no further adjustments of the translation were made.

### 2.5. Data analysis

The dataset was analyzed in the open-source software JASP, version 0.14.0.0 (http://jasp-stat.org) and SPSS 20.0 (SPSS Inc., Chicago, IL, USA). The study sample was described using percentages for categorical variables and median with corresponding interquartile range for continuous variables, as they all showed deviation from normal distribution.

Bearing in mind that the purpose of this study was to evaluate psychometric characteristics of the questionnaire in a new language (Serbian) and in a specific population (rectal cancer survivors), the recommended and widely accepted approach on such occasions is to conduct the confirmatory factor analysis (CFA). The CFA on a new dataset suggests whether the construct (i.e. the number of domains/latent factors and the items that are originally part of that domain) fits the new population [11].

#### 2.5.1. Construct validity

Statistical analysis included the testing of the questionnaire structure (construct validity) using CFA. First, the maximum likelihood (ML) estimator was used. However, the model was unable to converge. For this reason, the diagonally weighted least squares (DWLS) estimator was used, and the model adequately converged. The indices on CFA that were observed were goodness of fit index (GFI) $>$ 0.90, comparative fit index (CFI) $>$ 0.90, Tucker-Lewis index (TLI) $>$ 0.90, Bentler-Bonett Non-normed Fit Index (BBNFI), McDonald fit index (MFI) and root mean square error of approximation (RMSEA). Adequate values of CFA indices were $>$0.95 and acceptable values were $>$0.90 [12]. Adequate values of RMSEA were $<$0.05 and acceptable values were $\leq$0.08 [12].

The internal consistency of the Serbian version of HPA was tested by using the Cronbach's alpha coefficient and the McDonald's omega coefficient. The values were observed in line with these cut offs: $>$0.70 adequate, 0.40–0.69 - acceptable, $<$0.40 poor [13].

Given that we observed the alpha coefficients within the acceptable range for 2 domains, we conducted the exploratory factor analysis (EFA) to better understand the questionnaire items. The EFA, however, is not routinely conducted in psychometric studies of questionnaires in a different language/population. This is because the EFA is being used to develop new questionnaires and new theories [14]. However, in the circumstances when alpha coefficients were lower than expected, the EFA might be helpful to observe relations between items and latent factors (domains).

To explore in more detail the HPA responses, the EFA with Varimax rotation was applied. The number of factors was described and the factor loadings per factor were evaluated. A factor (domain) was defined if the eigenvalues were higher than 1.0. The grouping of items based on the value of factor loading took into account the highest factor loadings per factor. Adequate communality indices were considered if $>$ 0.40 [12].

To remedy the effects of a small sample size, we have conducted an additional analysis - the Horn's parallel analysis to overcome potential sampling errors and obtain better reliability of the extracted domains [15]. The Horn's parallel analysis examines the true number of domains that should be extracted from the questionnaire when a larger parallel dataset is being analyzed. The syntax for Horn's parallel analysis for SPSS was drawn from works of Brian O'Connor [16]. The rationale behind this analysis is to generate a random larger dataset by multiplying the number of respondents (76 in this study) and the number of items (15 in the HPA). The EFA is conducted on the new larger parallel dataset and eigenvalues are retrieved.

In the study dataset the eigenvalues above 1.0 suggest the number of domains in the questionnaire. The final conclusion about the number of domains is based on the comparison of eigenvalues in the study dataset and in the parallel dataset. If the eigenvalue in the parallel dataset is lower for the corresponding eigenvalue in the same domain of the study dataset, this means that the observed domain is true. If the eigenvalue in the parallel dataset is higher than the corresponding eigenvalue of the study dataset, than the domain is not appropriate.

#### 2.5.2. Concurrent validity

The concurrent validity of the HPA was examined by correlating the domains of the HPA with demographic (age, gender) and clinical characteristics (stoma-related experience and rectal cancer staging) of the study participants. Concurrent validity was tested using the Spearman's correlation coefficient, which was also used to test the correlation between HPA domains.

#### 2.5.3. Predictive validity

The predictive validity was evaluated using linear regressions. A total of 5 multiple linear regression models were tested. In each of the models, the dependent variable was a different health personality domain (Health Neuroticism, Health Extraversion, Health Openness, Health Agreeableness and Health Conscientiousness). The set of the independent variables included participants' age, gender, education level, AJCC staging of rectal cancer, duration of having temporary ileostomy, having complications with the ileostomy, needing help to maintain the ileostomy and time since ileostomy closure. Given the size of the study sample (76 rectal cancer survivors), the number of independent variables (8 variables) satisfied the rule of thumb in the regression models where the 10-to-1 participant-to-variable ratio is recommended [17].

## 3. Results

### 3.1. Sample description

The study sample consisted of 76 people who underwent the open LAR for rectal cancer. Their demographic and clinical characteristics are presented in Table 1. The majority of study participants were male. The median age was 62 years. Most people had a secondary education. The median time of having an ileostomy was 7 months. The median time since ileostomy closure was 12 months. Most people in the study sample did not report any complications when having an ileostomy nor did they need assistance when maintaining ileostomy and stoma bag. With regards to rectal carcinoma stage, most participants were graded from I to III on the AJCC criteria (Table 1).

Table 2 displays the scores per item on the HPA. The highest scores on the HPA domains were observed on all items pertaining to Health Agreeableness. The lowest scores were observed on all items belonging to the domain of Health Extraversion (Table 2).

### 3.2. Construct validity

The baseline model Chi square = 376.191, df = 105; the factor model Chi square = 82.250, df = 80, p = 0.409. The CFA using the DWLS estimator suggested that all indices were good: CFI-0.992; TLI-0.989; BBNFI-0.989; MFI-0.985; RMSEA-0.019, while GFI was

**Table 1**
Socio-demographic characteristics of the study sample (N = 76).

| Variable | Count (n) | Percentage (%) |
|---|---|---|
| Gender | | |
| Male | 48 | 63.2 |
| Female | 28 | 36.8 |
| Age in years (median with IR) | 62.0 (53.0–67.0) | |
| Education level | | |
| Primary | 9 | 11.8 |
| Secondary | 42 | 55.3 |
| University | 25 | 32.9 |
| Duration of having temporary ileostomy in months (median with IR) | 7.0 (4.0–12.0) | |
| Time since temporary ileostomy in months (median with IR) | 12.0 (5.0–25.0) | |
| Complications with ileostomy | | |
| Yes | 19 | 25.0 |
| No | 57 | 75.0 |
| Needing help with maintenance of ileostomy | | |
| Yes | 34 | 44.7 |
| No | 42 | 55.3 |
| AJCC staging | | |
| I | 22 | 28.9 |
| II | 21 | 27.6 |
| III | 30 | 39.5 |
| IV | 3 | 3.9 |

Legend: IR-interquartile range; AJCC - American Joint Committee on Cancer.

**Table 2**
Scores according to items of the Health Personality Assessment.

| No. | Item | Mean (sd) | Median (IR) |
|---|---|---|---|
| | ***Health Neuroticism*** | | |
| 1 | Going to the doctor gives me a great deal of stress. | 3.2 (1.4) | 4.0 (1.0–4.0) |
| 2 | When I visit the doctor, I easily become anxious | 3.2 (1.3) | 4.0 (1.0–4.0) |
| 3 | I often worry when I am going to the doctor | 3.4 (1.3) | 4.0 (2.0–4.0) |
| | ***Health Extraversion*** | | |
| 4 | Most of the time, I enjoy talking to people about my health. | 2.9 (1.1) | 2.0 (2.0–4.0) |
| 5 | I do not like to talk about my health problems. | 2.7 (1.2) | 2.0 (2.0–3.0) |
| 6 | I talk to my family and friends about my health | 3.1 (1.1) | 4.0 (2.0–4.0) |
| | ***Health Openness*** | | |
| 7 | I prefer to keep my health behaviours just like they are | 3.6 (1.1) | 4.0 (3.0–4.0) |
| 8 | My health routine does not need change | 3.5 (1.0) | 4.0 (2.0–4.0) |
| 9 | I am interested in changing my health routine | 3.9 (0.7) | 4.0 (3.0–4.0) |
| | ***Health Agreeableness*** | | |
| 10 | I trust that I always get good care | 4.5 (1.0) | 5.0 (4.0–5.0) |
| 11 | I trust that my doctor will take my health concerns seriously | 4.6 (0.9) | 5.0 (4.0–5.0) |
| 12 | I have complete confidence in my doctor's knowledge and skills | 4.5 (0.9) | 5.0 (4.0–5.0) |
| | ***Health Conscientiousness*** | | |
| 13 | I strive to reach my health goals | 4.2 (0.8) | 4.0 (4.0–5.0) |
| 14 | I have self-discipline when it comes to my health | 4.2 (0.9) | 4.0 (4.0–5.0) |
| 15 | I do things to stay healthy | 4.2 (0.9) | 4.0 (4.0–5.0) |

Legend: sd - standard deviation, IR-interquartile range; 1-strongly disagree, 2-disagree, 3-neutral, 4-agree, 5-strongly agree.

within the acceptable range (0.930). Thus, it was confirmed that the Serbian version of the HPA supports the original questionnaire structure.

The internal consistency coefficients showed that the domains of Health Neuroticism ($\alpha = 0.848$; $\omega = 0.854$), Health Extraversion ($\alpha = 0.746$; $\omega = 0.755$) and Health Agreeableness ($\alpha = 0.750$; $\omega = 0.777$) had a desirable level of Cronbach's alpha coefficient and McDonald omega coefficient (Table 4). Domains of Health Openness ($\alpha = 0.472$; $\omega = 0.566$) and Health Consientiousness ($\alpha = 0.569$; $\omega = 0.578$) had acceptable levels of Cronbach's and McDonald's coefficients, although they were markedly lower compared to the other three domains.

Because these two domains had a lower level of internal consistency, the EFA was performed to gain a better insight into the HPA structure. However, because of a small sample size, we first conducted the parallel analysis using a larger random dataset derived from the dataset collected for this study. The purpose was to examine whether the EFA on our collected dataset would be valid. Based on the parallel analysis, it was observed that the eigenvalues of the 5 factors on the larger random dataset were lower compared to the eigenvalues of our dataset (Table 3). This confirmed that the EFA conducted on 76 observations in our dataset would provide relatively accurate results.

The EFA conducted on our own dataset showed that there are indeed 5 domains on the Serbian HPA and they explained a total of 70.3 % of variance (Table 4). Communality indices were all appropriate. The largest propotion of variance is attributed to the three domains observed to have the highest internal consistency level. However, we observed that the item #14 ("I have self-discipline when it comes to my health") from the domain of Health Conscientiousness changed places with the item #9 ("I am interested in changing my health routine") from the domain Health Openness (Table 4).

As a result, we examined the internal consistency of the Health Openness and Health Conscientiousness domains with inversion of items #9 and #14. It was observed that the Health Openness with items #7, #8 and #14 had a marginally higher Cronbach's alpha coefficient (0.552). The Health Conscientiousness domain with items #9, #13 and #15 had exactly the same Cronbach's alpha coefficient (0.568).

In the context of face validity, the items and their meaning belong to both the Health Openness and the Health Conscientiousness domain. The research team concluded that there was no evidentiary support to remove or change the distribution of items according to domains. Therefore, the items were kept in their original domains.

**Table 3**
The eigenvalues on the exploratory factor analysis of our dataset of rectal cancer survivors and those observed on the parallel analysis.

| Factors of the Health Personality Assessment | Eigenvalues | |
|---|---|---|
| | Exploratory factor analysis | Parallel analysis |
| 1 | 2.96 | 1.86 |
| 2 | 2.57 | 1.64 |
| 3 | 2.21 | 1.48 |
| 4 | 1.58 | 1.35 |
| 5 | 1.22 | 1.21 |

Legend: For a questionnaire domain (factor) to be true, the eigenvalues on the parallel analysis should be lower compared to eigenvalues on the exploratory factors analysis of the study dataset.

**Table 4**
Exploratory factor analysis with Varimax rotation for the Health Personality Assessment (HPA).

| HPA item | Factor 1 Neuroticism | Factor 2 Agreeableness | Factor 3 Extraversion | Factor 4 Openness | Factor 5 Conscientiousness | Communality |
|---|---|---|---|---|---|---|
| Item 1 | 0.911 | -0.032 | -0.010 | -0.003 | -0.115 | 0.845 |
| Item 4 | -0.038 | -0.233 | 0.711 | 0.129 | 0.285 | 0.660 |
| Item 7 | -0.102 | -0.087 | 0.080 | 0.565 | 0.394 | 0.498 |
| Item 10 | -0.098 | 0.781 | -0.108 | -0.149 | 0.122 | 0.668 |
| Item 13 | -0.149 | 0.390 | 0.183 | 0.435 | 0.385 | 0.545 |
| Item 2 | 0.874 | 0.130 | -0.151 | -0.117 | 0.142 | 0.838 |
| Item 5 | -0.110 | 0.182 | 0.846 | 0.156 | -0.159 | 0.810 |
| Item 8 | -0.089 | -0.374 | -0.103 | 0.624 | 0.166 | 0.575 |
| Item 11 | -0.125 | 0.687 | -0.046 | 0.465 | -0.208 | 0.750 |
| Item 14 | 0.146 | 0.092 | 0.168 | 0.830 | -0.033 | 0.747 |
| Item 3 | 0.821 | -0.196 | 0.124 | 0.069 | -0.106 | 0.743 |
| Item 6 | 0.150 | -0.173 | 0.791 | -0.106 | 0.364 | 0.821 |
| Item 9 | -0.105 | 0.014 | 0.197 | 0.026 | 0.787 | 0.670 |
| Item 12 | 0.083 | 0.869 | -0.053 | -0.126 | 0.230 | 0.833 |
| Item 15 | 0.065 | 0.254 | 0.033 | 0.212 | 0.655 | 0.544 |
| % variance | 19.76 | 17.17 | 16.79 | 10.54 | 8.06 | |

Legend: Values in shade denote items that belong to the same factor.

### 3.3. Concurrent validity

A higher level of Health Neuroticism correlated with being female (rho = 0.245; p = 0.015). A higher level of Health Extraversion correlated with being female (rho = 0.305; p = 0.017), being older (rho = 0.352; p = 0.002) and having lower socio-economic power (rho = −0.287; p = 0.022). Stronger Health Agreeableness correlated with a longer time since ileostomy closure (rho = 0.249; p = 0.028).

In terms of the HPA domains, higher levels of Health Extraversion correlated with a higher level of Health Openness (rho = 0.239; p = 0.034). A stronger level of Health Conscientiousness correlated with a higher level of Health Extraversion (rho = 0.288; p = 0.043), Health Openness (rho = 0.419, p = 0.001) and Health Agreeableness (rho = 0.344; p = 0.001) (Table 5).

### 3.4. Predictive validity

Predictive validity was evaluated using the multiple linear regression models (Table 6). Being female was associated with stronger Health Neuroticism. Being older was associated with stronger Health Extraversion. None of the examined characteristics was associated with stronger Health Openness. Not having complications with the ileostomy and longer time since ileostomy closure were associated with stronger Health Agreeableness. Finally, longer time since ileostomy closure was associated with stronger Health Conscientiousness (Table 6).

## 4. Discussion

In this study, the Health Personality Assessment was tested for the first time in a non-English speaking European population. The findings suggest that the HPA in the Serbian language among rectal cancer survivors mirrors the structure of the original inventory developed in English and validated in a population of older adults [8]. We found evidence that the Serbian version of the HPA has adequate construct, concurrent and predictive validity, while internal consistency was acceptable-to-good. Moreover, the questionnaire was acceptable to rectal cancer survivors and was not considered as intrusive or offensive. Overall, based on the observed psychometric properties, the HPA in Serbian language is a valid tool in the efforts to describe personality traits relevant for health.

**Table 5**
Domain correlations of the Health Personality Assessment (HPA).

| HPA domains | Neuroticism | Agreeableness | Extraversion | Openness | Conscientiousness |
|---|---|---|---|---|---|
| Neuroticism | 1 | | | | |
| Agreeableness | 0.063 | 1 | | | |
| Extraversion | −0.116 | 0.239* | 1 | | |
| Openness | −0.056 | −0.169 | 0.048 | 1 | |
| Conscientiousness | 0.007 | 0.288* | 0.419** | 0.344** | 1 |

Legend: The values in tables represent the Spearman's correlation coefficient; *p < 0.05; **p < 0.01.

**Table 6**
Associations of demographic and clinical characteristics with stronger health personality traits.

| Variable | Health Personality Assessment domains | | | | |
|---|---|---|---|---|---|
| | Health Neuroticism | Health Extraversion | Health Openness | Health Agreeableness | Health Conscientiousness |
| | B (95%CI) | B (95%CI) | B (95%CI) | B (95%CI) | B (95%CI) |
| Gender<br>Male vs. female | 0.63 (0.02, 1.25)* | 0.42 (−0.02, 0.86) | −0.08 (−0.43, 0.27) | 0.18 (−0.18, 0.55) | 0.19 (−0.15, 0.52) |
| Age | 0.00 (−0.03, 0.03) | 0.04 (0.01, 0.06)** | −0.01 (−0.03, 0.01) | −0.01 (−0.03, 0.01) | 0.00 (−0.02, 0.02) |
| Education level | −0.10 (−0.60, 0.41) | −0.20 (−0.55, 0.16) | −0.15 (−0.43, 0.13) | −0.11 (−0.41, 0.18) | −0.01 (−0.28, 0.26) |
| AJCC stage | 0.03 (−0.31, 0.37) | 0.13 (−0.11, 0.37) | 0.08 (−0.11, 0.27) | −0.04 (−0.24, 0.15) | −0.03 (−0.22, 0.15) |
| Duration of having temporary ileostomy | −0.01 (−0.06, 0.03) | 0.00 (−0.03, 0.03) | 0.02 (−0.01, 0.41) | 0.02 (−0.01, 0.05) | 0.02 (−0.01, 0.04) |
| Complications with ileostomy<br>Yes vs. no | 0.18 (−0.49, 0.85) | 0.05 (−0.42 0.53) | 0.10 (−0.27, 0.48) | −0.40 (−0.80, −0.01)* | 0.06 (−0.30, 0.43) |
| Needing help with maintenance of ileostomy<br>Yes vs. no | 0.28 (−0.32, 0.89) | −0.06 (−0.49, 0.36) | −0.23 (−0.56, 0.11) | −0.34 (−0.70, 0.01) | −0.24 (−0.57, 0.08) |
| Time since temporary ileostomy closure | −0.01 (−0.04, 0.02) | 0.00 (−0.02, 0.02) | 0.01 (−0.00, 0.03) | 0.02 (0.00, 0.04)* | 0.02 (0–01, 0.04)* |

Legend: B - unstandardized coefficient in the linear regression model; 95 % CI - confidence interval; AJCC - American Joint Committee on Cancer; *$p < 0.05$; **$p < 0.01$.

The CFA of the 15-item HPA in Serbian language suggested that the 5-factor structure was appropriate for our population of rectal cancer survivors, which is in line with the original questionnaire structure [8]. This means that the 15 items clearly separate 5 health personality traits. The alpha and omega coefficients suggested that 3 out of 5 domains have good reliability (Health Neuroticism, Health Extraversion and Health Agreeableness). In fact, values of alpha and omega coefficients for Health Neuroticism and Health Agreeableness observed in this study were also the highest in the original study [8], suggesting that items in these domains are consistent across populations. The DWLS has been suggested as the optimum option for scales with ordinal responses, such as the HPA, because it is based on the polychoric correlation [18,19]. Some experts believe that normally distributed responses of wider range (>5) are better analyzed using the ML estimator [20]. Although the ML estimator can be useful when there are only minor deviations from normal distribution of responses, the DWLS may be better suited in those situations [21]. For example, in HPA, depending on the personality, responses on each health personality trait could have been skewed mildly or even considerably. This could be the reason as to why the DWLS estimator was more appropriate in the analysis of HPA in this study sample.

Martin et al. [8] reported the lowest alpha coefficient of 0.64 for Health Conscientiousness, however, in this study the reliability was the lowest for Health Openness. In fact, the EFA in this study showed that one item from the Health Conscientiousness domain could be exchanged with another item from the Health Openness domain. Such result could be explained by the comprehension of participants of what constitutes new health routines and having self-discipline when recovering from rectal cancer surgery. For example, given that rectal cancer is often related to specific exposure in diet, rectal cancer survivors are expected to change their diet and, therefore, adjust their lifestyle to ensure longer survival. They also need to see the treating surgeon and oncologist over the years after surgery. Thus, some people might be more motivated then others to change their routines long-term. For this reason, having self-discipline could be perceived as embracing new health behaviors later in life, which may be exceptionally difficult for some individuals [22]. On the other hand, changing routines to promote healthy lifestyle may be perceived as being conscientious and diligent about one's health status [23].

In terms of concurrent validity, it is interesting to notice that the AJCC stage of rectal cancer at surgery did not correlate with any of the examined heath personality traits. The only stoma-related characteristic that correlated with the HPA domains (Health Agreeableness) was a longer time since ileostomy closure. This finding could be explained by the notion that people who come for health checks with their treating surgeon have trust in their recommendations and follow their advice. Similarly, their concerns and needs are met when talking to health care professionals and this allows them to build self-confidence and motivation.

Further, the correlation between Health Extraversion and Health Openness is expected, because people who are preoccupied with their health conditions could be more flexible and interested in new practices to promote recovery. This goes hand in hand with Health Conscientiousness, because due to activities that individuals take on to improve their health condition they may be open to new options and daily routines. Trust in a treating physician within the domain of Health Agreeableness can also support Health Conscientiousness and enhance recovery. Health Neuroticism did not correlate with other HPA domains. This health personality trait is related to fear and being anxious when visiting a doctor. Such a result is not surprising because, relative to other personality traits in the HPA, Health Neuroticism is largely a negative construct. In fact, rectal cancer survivors may perceive a visit to their doctor as an experience that might leave them worse off. They might amplify this negative feeling and interpret it as a more difficult situation, in which they might receive bad news or otherwise unwanted pieces of information. Contrary, other domains relate to attitudes and activities that one does to improve their health and well-being. And while these other traits do not directly oppose to Health Neuroticism, they are qualitatively different, which can explain the lack of correlation.

Regarding predictive validity, Health Neuroticism was more likely among female cancer survivors. This means that women are more likely to feel anxious when having an appointment with a physician. Our findings support this association from the general population, where it is observed that females are more likely to have higher scores on neuroticism, extraversion and agreeableness [24]. Older people were more likely to exhibit Health Extraversion in this study. This could be explained by the assumption that older people may be more preoccupied with their health and are, therefore, more likely to discuss it with family and friends. This may be a mechanism to cope with various heath conditions [25].

In addition, longer time since ileostomy closure was associated with a higher level of Health Agreeableness and Conscientiousness. As previously mentioned, after ileostomy closure, rectal cancer survivors periodically see their treating surgeon. For this reason, they establish a trustworthy relationship in which the patients are recommended specific strategies to optimize their health. In this process, rectal cancer survivors can be motivated to take on activities to stay healthy and reach their health goals. Some CRC survivors have preferences for shared decision making, while others prefer that their surgeon is entirely in charge of treatment [26]. Communication with the treating surgeon is especially relevant because colon cancer survivors articulate that they have unmet needs in terms of information about adjuvant therapy after surgery and beyond [27].

### *4.1. Clinical implications*

This questionnaire is a novel scale in which health personality is being assessed. As such, it represents a useful tool to better understand the health-related personality traits of rectal cancer survivors. Understanding these traits can pinpoint specific topics that can be addressed during and after cancer treatment. Through identification of specific health personality traits, it may be possible to adjust the treatment by including more professionals to the team in charge of treatment. Also, this approach could emphasize the dimensions which may be of concern for the treating oncologist to optimize clinical outcomes of cancer treatment.

### *4.2. Study limitations*

Some limitations of this analysis need to be addressed. While we have tested the concurrent validity of the HPA using demographic and clinical variables, we did not administer a similar or general questionnaire regarding personality traits, such as the Big Five Inventory or HEXACO. For this reason, the concurrent validity testing is limited by a lack of such a correlation. Furthermore, this study is limited by the absence of testing of the questionnaire stability. Specifically, we have not re-tested the HPA among rectal cancer survivors after several weeks. However, we believe that health personality traits are not dependent on time. In fact, we expect empirically that these traits are consistent across different time points. Finally, it should be noted that the HPA had only three items per domain. It has been observed that a domain with fewer items may have a lower internal consistency coefficient [28]. When considering time constraints in the health care setting, scales with fewer items are desirable for rapid testing, because health care providers cannot always apply lengthy assessments.

## 5. Conclusion

In conclusion, the Serbian version of the Health Personality Assessment showed good psychometric characteristics that match the original questionnaire properties when this inventory was developed i.e. it has 5 domains of which 3 have good and 2 have acceptable internal consistency. Despite this, the appropriate indices on the CFA suggest that variations exist, but the underlying original construct is reproducible in other population samples. This questionnaire could be a valuable tool in further research among rectal cancer survivors, but should also be tested in populations with other chronic health conditions.

## Funding

This study did not receive funding.

## Patient consent statement

Prior to survey, participants provided a written consent for participation.

## CRediT authorship contribution statement

**Nikola Grubor:** Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Tatjana Gazibara:** Writing – original draft, Visualization, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Pavle Gregorić:** Writing – review & editing, Supervision, Methodology, Investigation, Conceptualization. **Zlatibor Lončar:** Writing – review & editing, Methodology, Investigation, Conceptualization. **Krstina Doklestić Vasiljev:** Writing – review & editing, Supervision, Methodology, Investigation, Conceptualization. **Nenad Ivančević:** Writing – review & editing, Supervision, Methodology, Investigation, Conceptualization. **Dušan Micić:** Writing – review & editing, Supervision, Methodology, Investigation, Conceptualization. **Nemanja Pavić:** Writing – review & editing, Methodology, Investigation, Data curation, Conceptualization. **Peter Martin:** Writing – review & editing, Supervision, Methodology, Investigation, Conceptualization. **Boris Tadić:** Writing – review & editing, Supervision, Methodology, Investigation, Conceptualization. **Katarina Erić:** Writing – review & editing, Validation, Methodology,

Investigation, Data curation, Conceptualization. **Smiljana Cvjetković:** Writing – review & editing, Validation, Supervision, Methodology, Investigation, Data curation, Conceptualization. **Miljan Ćeranić:** Writing – review & editing, Supervision, Project administration, Methodology, Investigation, Data curation, Conceptualization.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2024.e32841.

## References

[1] T. Sawicki, M. Ruszkowska, A. Danielewicz, E. Niedźwiedzka, T. Arłukowicz, K.E. Przybyłowicz, A review of colorectal cancer in terms of Epidemiology, risk factors, development, symptoms and diagnosis, Cancers 13 (9) (2021) 1–10.
[2] V. Aran, A.P. Victorino, L.C. Thuler, C.G. Ferreira, Colorectal cancer: epidemiology, disease mechanisms and interventions to reduce onset and mortality, Clin. Colorectal Cancer 15 (3) (2016) 195–203.
[3] T. Matsuda, K. Yamashita, H. Hasegawa, T. Oshikiri, M. Hosono, N. Higashino, et al., Recent updates in the surgical treatment of colorectal cancer, Ann Gastroenterol Surg 2 (2) (2018) 129–136.
[4] K.L. Sherman, S.D. Wexner, Considerations in stoma reversal, Clin. Colon Rectal Surg. 30 (3) (2017) 172–177.
[5] J. You, C. Wang, L. Rodriguez, X. Wang, Q. Lu, Personality, coping strategies and emotional adjustment among Chinese cancer patients of different ages, Eur. J. Cancer Care 27 (1) (2018) 1–9.
[6] P.I. Chow, K.M. Shaffer, M.C. Lohman, V.T. LeBaron, K.L. Fortuna, L.M. Ritterband, Examining the relationship between changes in personality and depression in older adult cancer survivors, Aging Ment. Health 24 (8) (2020) 1237–1245.
[7] K. Knauer, A. Bach, N. Schäffeler, A. Stengel, J. Graf, Personality traits and coping strategies relevant to posttraumatic growth in patients with cancer and survivors: a systematic literature review, Curr. Oncol. 29 (12) (2022) 9593–9612.
[8] P. Martin, J. Kim, A. Jasper, Y. Baek, D. Russell, The development of a brief measure of health personality, J. Health Psychol. 26 (14) (2021) 2768–2780.
[9] H. Liu, X. Zhu, J. Yu, P. He, B. Shen, X. Tang, et al., The quality of life of patients with colorectal cancer and a stoma in China: a quantitative cross-sectional study, Adv. Skin Wound Care 34 (6) (2021) 302–307.
[10] M.R. Weiser, AJCC 8th edition, Colorectal Cancer. Ann Surg Oncol. 25 (6) (2018) 1454–1455.
[11] M.W. Gallagher, T.A. Brown, Introduction to confirmatory factor analysis and structural equation modeling, in: T. Teo (Ed.), Handbook of Quantitative Methods for Educational Research, SensePublishers, Rotterdam, 2013, pp. 289–314.
[12] J.F. Hair, W.C. Black, B.J. Babin, R.E. Anderson, Multivariate Data Analysis: A Global Perspective, seventh ed., Pearson Prentice Hall, New Jersey, 2010.
[13] T.J. Dunn, T. Baguley, V. Brunsden, From alpha to omega: a practical solution to the pervasive problem of internal consistency estimation, Br. J. Psychol. 105 (2014) 399–412.
[14] E. Knekta, C. Runyon, S. Eddy, One size doesn't fit all: using factor analysis to gather validity evidence when using surveys in your research, CBE-Life Sci. Educ. 18 (1) (2019) rm1.
[15] N.D. Wood, D.C. Akloubou Gnonhosou, J. Bowling, Combining parallel and exploratory factor analysis in identifying relationship scales in secondary data, Marriage Fam. Rev. 51 (2015) 385–395.
[16] B.P. O'Connor, SPSS and SAS programs for determining the number of components using parallel analysis and Velicer's MAP test, Behav. Res. Methods Instrum. Comput. 32 (2000) 396–402.
[17] C.R. Wilson Van Voorhis, B.L. Morgan, Understanding power and rules of thumb for determining sample size, Tutor Quant Methods Psychol. 3 (2) (2007) 43–50.
[18] C. DiStefano, G.B. Morgan, A comparison of diagonal weighted least squares robust estimation techniques for ordinal data, Struct. Equ. Model. 21 (2014) 425–438.
[19] F.P. Holgado–Tello, S. Chacón–Moscoso, I. Barbero–García, E. Vila-Abad, Polychoric versus Pearson correlations in exploratory and confirmatory factor analysis of ordinal variables, Qual. Quantity 44 (2010) 153–166.
[20] C.-H. Li, The performance of ML, DWLS, and ULS estimation with robust corrections in structural equation models with ordinal variables, Psychol. Methods 21 (2016) 369–387.
[21] D. Mindrila, Maximum likelihood (ML) and diagonally weighted least squares (DWLS) estimation procedures: a comparison of estimation bias with ordinal and multivariate non-normal data, Int J Digital Soc. 1 (2010) 60–66.
[22] S.J. Kiew, H.A. Majid, N.A. Mohd Taib, A qualitative exploration: dietary behaviour of Malaysian breast cancer survivors, Eur. J. Cancer Care 31 (1) (2022) 1–13.
[23] S.J. Hardcastle, M. Galliott, B.M. Lynch, N.H. Nguyen, P.A. Cohen, G.R. Mohan, et al., Acceptability and utility of, and preference for wearable activity trackers amongst non-metropolitan cancer survivors, PLoS One 13 (12) (2018) e0210039.
[24] Y.J. Weisberg, C.G. Deyoung, J.B. Hirsh, Gender differences in personality across the ten aspects of the Big five, Front. Psychol. 2 (2011) 1–8.
[25] S. Abdi, A. Spann, J. Borilovic, L. de Witte, M. Hawley, Understanding the care and support needs of older people: a scoping review and categorisation using the WHO international classification of functioning, disability and health framework (ICF), BMC Geriatr. 19 (1) (2019) 1–9.
[26] G. Salkeld, M. Solomon, L. Short, P.N. Butow, A matter of trust–patient's views on decision-making in colorectal cancer, Health Expect. 7 (2) (2004) 104–114.
[27] C.M. den Bakker, F.G. Schaafsma, J.A.F. Huirne, E.C.J. Consten, H.B.A.C. Stockmann, C.J. Rodenburg, et al., Cancer survivors' needs during various treatment phases after multimodal treatment for colon cancer - is there a role for eHealth? BMC Cancer 18 (1) (2018) 1–12.
[28] K.S. Taber, The use of Cronbach's alpha when developing and reporting research instruments in science education, Res. Sci. Educ. 48 (2018) 1273–1296.