Associations Between Uncertainty and Self-Care Ability Among Chinese Enterostomy Patients: A Mediation Analysis

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Abstract

Purpose The relationship between uncertainty and self-care behaviors is well documented in the literature, however, there exists a paucity of information on the mediating effect of perceived stress on the relationship between uncertainty and self-care ability among enterostomy patients. This study aimed to examine the relationship between uncertainty and self-care ability among enterostomy patients, and explore the mediating role of perceived stress.

Methods 462 enterostomy patients aged (60.00 ± 12.81) years old participated in the study. Cross-sectional study was conducted among them by a set of self-administered questionnaires, which includes demographic information, perceived stress scale, illness uncertainty scale, and ostomy self-care ability scale. Multiple linear regression analyses were performed to explore the role of perceived stress between Uncertainty and self-care ability, structural equation modeling was used to verify it.

Results 450 participants finally completely finished the research, with the recycling rate of 97.4%. Uncertainty was demonstrated positively related to perceived stress ($r = 0.215$, $P < 0.01$), and negatively related to self-care ability ($r = -0.470$, $P < 0.01$), perceived stress was negatively related to self-care ability ($r = -0.640$, $P < 0.01$). Perceived stress played a partially mediating role between Uncertainty and self-care ability, which accounted 40.8 % of the total effect.

Conclusions The findings present a conceptual model containing the mediated effects of perceived stress, which facilitated our understanding of the relationship among uncertainty, perceived stress, and self-care ability. Thus, perceived stress and uncertainty should be the focus, in order to improve self-care ability of the enterostomy patients.

Introduction

According to the newly released tumor registration data, 388,000 new cases of colorectal cancer and 187,000 deaths caused by colorectal cancer were reported in China, in 2015. Colorectal cancer has become one of the major diseases threatening the lives and health of Chinese residents[1]. Surgery was traditionally used to treat it[2], but 10% of the surgery patients might suffer from the permanent ostomy. Although enterostomy extends the survival of patients, the body image change, fear of fecal leakage, bowel flatulence, frequent emptying and change of making bags, etc., had caused serious adverse effects on the patients' mental and physiological health and quality of life[3]. Related studies had found that better self-care ability was associated with a positive adjustment toward a colostomy[4], which could help to maintain and promote health, physical and mental development[5].

Illness-related uncertainty occurs when individuals are not able to recognize the illness related meanings, when they must cope with unfamiliar, complex, and potentially threatening experiences[6]. Being diagnosed with colorectal cancer provokes a variety of psychological uncertainty responses[7], e.g. ongoing face with uncertainty about treatment options, fear about cancer recurrence, symptoms from treatment side-effects[8]. A stoma can also cause worries about leakage, pain, skin problems, and limiting physical and social activities caused by ostomy bag[9], which increases the patient's uncertainty undoubtedly. Existing evidence had shown that uncertainty was negatively correlated with self-care behaviors[10], the higher level of uncertainty, the less self-care they perform, demonstrating that uncertainty management played an vital role in promoting the self-care ability of cancer patients.

The relationship between perceived uncertainty and stress has been well established[11]. Mullen[12] proposed that events with an element of uncertainty may be exceptionally stressful. The study of Byun E[13] also reported that greater uncertainty was associated with higher perceived stress among the caregivers of stroke survivors. Perceived stress the degree to which one perceives life as overwhelming, unpredictable, and out of control, defined as a global and dynamic multidimensional concept, which refers to the interaction between the individual and the environment in front of stressors[14], and was found negatively correlated with self-care ability for the enterostomy patients[10]. So there is plentiful theoretical support in the existing literature for perceived stress as a mediator of uncertainty on self-care ability.

In view of the above research, further research is needed to strengthen the evidence about the relationships between illness uncertainty, perceived stress, and self-care ability, in particular the pathways though which illness uncertainty and perceived stress affect self-care ability for enterostomy patients. This study began with the following hypotheses: Uncertainty will be negatively and directly related to self-care ability, and positively and directly related to perceived stress; Perceived stress will be negatively and directly related to self-care ability; Uncertainty will be negatively and indirectly related to self-care ability via perceived stress.

Methods

Recruitment and participants

Data collection took place from October 2019 to January 2020, a cross-sectional survey was conducted among colorectal cancer patients from four hospitals in Henan Province. This study was granted approval from the Ethical Review Board of Henan Provincial People's Hospital, Zhengzhou, China. All the participants wrote informed consents before participating in the study. Inclusion criteria included, >18 years old and willing to participate in this study; 1~6 month after permanent enterostomy (which is referring to a colostomy in this study); Exclusion criteria included: patients who were not willing to participate; Diagnosed with mental illness and cognitive impairment. According to the Kendall criterion (i.e. 5–10-fold the number of items). A total of 16 items (7 items of general information, 4 dimensions of uncertainty, 2 dimensions of perceived stress, and 3 dimensions of self-care ability) were used in this study, with regard to 20% of the sampling error, 96-192 patients were needed, and 462 [enterostomy](#) patients participate in the study. Finally, 450 participants complete the research, with the recycling rate of 97.4%.

Measures

Uncertainty

The Mishel Uncertainty in Illness Scale (MUIS) was designed by Mishel[12], and localized by Xu Shulian[15], is a valid and reliable evaluation tool, which contains 32 items and was divided into four dimensions, including unpredictability (5 items), complexity (7 items), ambiguity(13 items), and lack of information (7 items), each item ranks by Likert 5-point scoring method. The total score of the MUIS ranges from 32 to 160, and was defined as 3 levels. The range of 32 to 74.7 was defined as low level, 74.8 to 117.4 as moderate level, 117.5 to 160 as high level, and higher scores indicating a higher degree of uncertainty in illness. The Cronbach's alpha coefficient of the scale was 0.857.

Perceived stress

Perceived stress was measured by The Chinese Perceived Stress Scale (CPSS), which could assess the unpredictable, uncontrollable stress, and demonstrated to have a good reliability and validity. CPSS was 14 items and 2 subscales, each item was ranked by Likert 5-point scoring method, the total score range from 14 to 70, the higher score indicating greater awareness of stress. The Cronbach's alpha coefficient of this scale was 0.891[16].

Self-care ability

Self-care ability was measured by self-care ability scale, which involved 45 items and three dimensions: self-care intention, self-care knowledge and self-care skills. The dimension of self-care intention has 12 items, the total score ranked 12~48, and the score $\geq$ 29 indicated higher level of self-care intention. The dimension of self-care knowledge has 21 items, the total score ranked 0~21, the score $\geq$ 13 indicated higher level of self-care knowledge. The dimension of self-care skills has 12 items, the total score ranked 0~12, the score $\geq$ 7 indicated higher level of self-care skills[17]. The three dimensions (self-care intention, self-care knowledge and self-care skills) of this scale were all demonstrated to have a good reliability and validity, the Cronbach's alpha coefficient of them were 0.831, 0.869, and 0.897, respectively.

Statistical analysis

SPSS version 21.0 (IBM Corporation, Armonk, NY, USA) and AMOS22.0 (IBM Corporation, Armonk, NY, USA) were used to conduct data analysis. Sociodemographic variables were analyzed by descriptive statistics. The relationships among uncertainty, perceived stress, and self-care ability were analyzed by parson correlation. Three multiple regression equations were conducted to check out whether uncertainty and perceived stress could affect the self-care ability remarkably. The study of Dale[18] and [Goldblatt](#)[19] had found that sex, age, educational level, and household income were closely related to the level of self-care ability. Therefore, sociodemographic variables (i.e. sex, age, educational level, family residence and household monthly income) were admitted in Model I to control for their effects on self-care ability. Then, Model II was conducted with uncertainty dimensions added based on Model I, Model III was established with perceived stress dimensions added based on Model II.

In order to verify the hypothetical relationship among uncertainty, perceived stress, and self-care ability, the structural equation model was conducted with the bootstrap method (5000 replicates) . The mediation model diagram was shown in Fig.1, in which uncertainty as an exogenous latent variable illustrating by four observed variables (i.e. unpredictability, complexity, ambiguity and lack of information), perceived stress as an exogenous latent variable illustrating by two observed variables (i.e. sense of uncontrollable and sense of nervous), self-care ability as an exogenous latent variable illustrating by three observed variables (i.e. self-care intention, self-care knowledge and self-care skills). Indices as: c^2/df , the root mean square error of approximation (RMSEA), comparative fit index (CFI), goodness-of- fit index (GFI), Tacker-Lewis index (TLI) were used to determine whether the hypothesized model fit the observed data well.

Results

The participants

Twelve invalid questionnaires were removed from the 462 questionnaires. Ultimately, 450 participants completely replied questionnaires, the effective response rate was 97.4%. Participants aged between 24 and 79 years old, the average age was 60 years (SD=12.81). The distribution of demographic characteristics of the participants is shown in Table 1.

Table 1. The distribution of demographic characteristics of the sample (n =450).

Variables	Group	n(%)
Gender		
	Male	291(64.7)
	Female	159 (35.3)
Marital status		
	Spouses living	433(96.2)
	Widowed	17(3.8)
Educational level		
	Junior high school or below	314 (69.8)
	High School or Technical School	67 (14.9)
	Graduate or above	69 (15.3)
Family residence		
	Rural areas	332(73.8)
	Urban areas	118 (26.2)
Household monthly income		
	≤2000	240 (53.3)
	2001~4000	149 (33.1)
	4001~6000	45(10.0)
	≥6001	16 (3.6)

Preliminary correlation analyses

Table 2 showed the correlations, means, and standard deviations between these variables. The total score of uncertainty was found to be positively correlated with total score of self-care ability ($r = -0.470$, $P < 0.01$), and the dimensions of uncertainty were also negatively correlated with dimensions of self-care ability ($r = -0.463$ to -0.292 , $P < 0.01$). The total score of perceived stress was negatively correlated with total score of self-care ability ($r = -0.640$, $P < 0.01$), and the dimensions were negatively correlated with dimensions of perceived stress ($r = -0.629$ to -0.502 , $P < 0.01$). The total score of uncertainty was positively correlated with total score of perceived stress ($r = 0.215$, $P < 0.01$), and the dimensions of uncertainty were positively correlated with dimensions of perceived stress ($r = 0.179$ to 0.198 , $P < 0.01$).

Table 2. Means, standard deviations and the correlation between main variables (n = 450)

Variables	1	2	3	4	5	6	7	8	9	10	11	12
1.Uncertainty	-											
2.Unpredictability	0.491*	-										
3.Complexity	0.528*	0.304*	-									
4.Ambiguity	0.671*	0.206*	0.310*	-								
5.Lack of information	0.536*	0.048	0.209*	0.441*	-							
6.Perceived stress	0.215*	0.196*	0.320*	0.254*	0.235*	-						
7.Sense of uncontrol	0.179*	0.114*	0.202*	0.209*	0.217*	0.909*	-					
8.Sense of nervous	0.198*	0.249*	0.384*	0.236*	0.186*	0.809*	0.491*	-				
9.Self-care ability	-0.470*	-0.292*	-0.463*	-0.419*	-0.333*	-0.640*	-0.502*	-0.629*	-			
10.Self-care intention	-0.293*	-0.207*	-0.390*	-0.342*	-0.266*	-0.553*	-0.409*	-0.580*	0.861*	-		
11.Self-care knowledge	-0.478*	-0.313*	-0.476*	-0.377*	-0.332*	-0.566*	-0.450*	-0.549*	0.888*	0.654*	-	
12.Self-care skills	-0.379*	-0.175*	-0.221*	-0.299*	-0.196*	-0.428*	-0.362*	-0.386*	0.672*	0.388*	0.418*	-
Mean	95.49	17.94	26.07	29.76	18.62	40.18	19.25	20.92	51.09	33.87	12.74	4.48
Standard deviation	14.78	3.02	6.42	9.75	3.79	7.92	5.33	3.79	9.58	4.11	4.60	2.92

Abbreviations: *P<0.01.

Mediating role of Perceived stress

Self-care ability score as the dependent variable and socio-demographic variables were considered as controlled variables[19], the uncertainty and perceived stress dimensions were taken as principal predictors by a thrice repeated multiple linear regression analysis. As shown in Table 3, in Model I (F = 11.646, P < 0.001, adjusted R²=0.125), the socio-demographic variables accounted for 12.5% of the variation in self-care ability scores. Model II was conducted with dimensions of uncertainty as independent variable (F =33.441 , P < 0.001, adjusted R² =0.419) based on Model I, which explained 41.9% variance of self-care ability scores, and 29.4% of variance was explained by uncertainty. Model III (F =54.771, P < 0.001, adjusted R²=0.590) was conducted with dimensions of perceived stress as independent variable based on Model II, the variables totally accounted for 59.0% variation of self-care ability scores, and 17.1% of variance was explained by perceived stress.

Table 3. Results of the multiple regression analyses by building progressive models with the self-care ability scores as the dependent variable (n=450)

Models	Variables	<i>B</i> (<i>SE</i>)	<i>Beta</i>	<i>t</i>	<i>P</i>	<i>F</i>	<i>Adjusted R²</i>
Model I	Age	-0.073(0.035)	-0.098	-2.077	0.038	11.646 [□]	0.125
	Gender	2.193(0.941)	0.109	2.331	0.020		
	Educational level	-0.414(0.507)	-0.046	-0.815	0.415		
	Marital status	4.440(1.206)	0.175	3.647	0.000		
	Family residence	-0.872(1.341)	-0.040	-0.650	0.516		
	Household monthly income	3.218(0.677)	0.270	4.754	0.000		
Model II	Age	-0.011 [□] 0.030 [□]	-0.014	-0.367	0.714	33.441 [□]	0.419
	Gender	1.332 [□] 0.769 [□]	0.066	1.731	0.084		
	Educational level	-0.378 [□] 0.431 [□]	-0.042	-0.877	0.381		
	Marital status	5.334(1.042)	0.213	5.130	0.000		
	Family residence	2.659 [□] 1.146 [□]	0.122	2.320	0.021		
	Household monthly income	1.557 [□] 0.572 [□]	0.131	2.722	0.007		
	Unpredictability	-0.923(0.139)	-0.291	-6.655	0.000		
	Complexity	-0.304(0.063)	-0.204	-4.816	0.000		
	Ambiguity	-0.155(0.043)	-0.158	-3.586	0.000		
	Lack of information	-0.526(0.104)	-0.208	-5.063	0.000		
Model III	Age	0.058 [□] 0.025 [□]	0.078	2.284	0.023	54.771 [□]	0.590
	Gender	2.713 [□] 0.659 [□]	0.108	3.295	0.001		
	Educational level	-0.478 [□] 0.362 [□]	-0.053	-1.321	0.187		
	Marital status	3.499(0.901)	0.139	3.886	0.000		
	Family residence	1.185 [□] 0.971 [□]	0.054	1.220	0.223		
	Household monthly income	0.324 [□] 0.489 [□]	0.027	0.661	0.509		
	Unpredictability	-0.591(0.119)	-0.186	-4.960	0.000		
	Complexity	-0.191(0.054)	-0.128	-3.514	0.000		
	Ambiguity	-0.115(0.036)	-0.117	-3.156	0.002		
	Lack of information	-0.320(0.089)	-0.126	-3.578	0.000		
	Sense of uncontrol	-0.337(0.067)	-0.188	-5.013	0.000		
	Sense of nervous	-0.958(0.098)	-0.379	-9.752	0.000		

Abbreviations: Demographic variables were entered as categorical variables, except for age which was entered as a continuous variable. Gender (1: Male, 2: Female); Educational level (1: Junior high school or below; 2: High School or Technical School; 3: Graduate or above). Marital status(1: Spouses living; 2: Widowed). Family residence (1: Rural areas , 2: Urban areas); Household monthly income (1: ≤2000 Yuan; 2: 2001~4000 Yuan; 3: 4001~6000 Yuan; 4: ≥6001Yuan). **P*<0.01.

Structural equation model confirmed analysis

Results of the thrice repeated multiple linear regression analysis indicated that there might exist mediating effect of perceived stress between uncertainty and self-care ability. Then the structural equation modeling covering three latent variables was conducted to confirm the hypothesis, as presented in Fig.1. The four factor-loading parameters (0.38–0.62) in the uncertainty matrix, the two factor-loading parameters (0.62–0.79) in the perceived stress matrix and the three factor-loading parameters (0.52–0.83) in the self-care ability matrix all exhibited significance (*P*<0.01). Indices as: $c^2/df=2.653$, the RMSEA=0.061, CFI=0.968, GFI=0.972, TLI=0.947, indicated the mediation model fitted the data well[20]. The structural equation modeling accounted for 93.0% of the variation in self-care ability scores, and 48.0% of the variation in

perceived stress scores. And results showed that uncertainty significantly affected self-care ability and perceived stress. Perceived stress significantly affected self-care ability. Bootstrapped 95% confidence interval (CI) showed that indirect effect of perceived stress index in the relationship between uncertainty and the self-care ability was significant, the mediation effect was 40.8% (0.358/0.887) (See Table 4).

Table 4. Results for the total, indirect, and direct effects of uncertainty on self-care ability with perceived stress as a mediator

Model pathways	Point estimate	SE	Bias-corrected 95% Confidence interval		Percentile 95% Confidence interval	
			Lower	Upper	Lower	Upper
Total effect						
Uncertainty→Self-care ability	-0.887	0.059	-1.010	-0.778	-1.010	-0.778
Indirect effect						
Uncertainty→Self-care ability	-0.358	0.109	-0.536	-0.183	-0.514	-0.140
Direct effect						
Uncertainty→Self-care ability	-0.529	0.152	-0.876	-0.306	-0.857	-0.304
Uncertainty→Perceived stress	0.690	0.073	0.542	0.831	0.551	0.837
Perceived stress→Self-care ability	-0.519	0.149	-0.708	-0.151	-0.722	-0.177

Discussion

Enterostomy patients might experience severe bowel function problems and impaired body image. Study of Reinwalds [21]revealed that patients with stoma caused by rectal cancer would suffer from the uncertainty regarding bowel function. In this study the total score of uncertainty was at a moderate level (95.49 ± 14.78), which was higher than that reported in previous studies using the MUIS-A 33-item scale which reported scores (70.20 ± 19.65) in a sample of Northeastern United States adults living with incontinent ostomies[22]. The data showed that the dimensions of unpredictability and lack of information had the lower score. Related study reported that knowledge and information about this disease was essential to help them regain control over the bowel[22]. In this study, the low educational level of the sample may have contributed to greater uncertainty, 69.8% of them had junior high school or below, and this was in line with the study of Adarve[23]. According to the theory of uncertainty, educational level as an ability could help to find, interpret, process, and assimilate information related to the experience of illness. And in the study of Moser[24], education was supposed as a "surrogate" variable for socioeconomic status, patients with higher education levels might acquire better health care, material and emotional assistance, which could help alleviate the uncertainty. So the clinical staff should be more patient with the patients with low education level, and support them more understandable health care information and emotional assistance, to help them have a better understanding and control of their own diseases.

The present study was conducted to identify the uncertainty, perceived stress, and self-care ability levels of enterostomy patients. We examined correlations between these variables, and the factors that influenced self-care ability. Uncertainty could affect self-care ability negatively ($r = -0.470$, $P < 0.01$), suggesting that the higher the level of uncertainty that patients feel, the less self-care behavior they possess to cope with effects of the disease[10]. Uncertainty positively affected perceived stress ($r = 0.215$, $P < 0.01$), was in line with the study of Bardeen[25], uncertainty representing beliefs that an uncertain future is unfair and distressing, and reduces the ability to modulate distress, resulting in an increase in uncertainty-related perceived stress. And perceived stress was negatively correlated with self-care ability ($r = -0.640$, $P < 0.01$), which was corresponding to our previous study[26]. In view of the above research, we try to explore the role of perceived stress between uncertainty and self-care ability. Then, a thrice repeated multiple linear regression analysis were conducted with demographic data (age, gender, educational level, marital status, family residence and household monthly income) as control variables. Results revealed that after adding the uncertainty, perceived stress in the regression model step by step, the explanations for self-care ability increased by 29.4% and 17.1%. That perceived stress could augment the effect of uncertainty on self-care ability, which tentatively confirmed our hypothesis.

Then, a structural equation modeling was conducted to verify the assumption further, see Fig. 1 and Table 4. Results of structural equation model, the data had well fitted the theoretical model. Uncertainty exerted indirect effects on self-care ability through perceived stress, which confirmed the hypothesis of the study again. Uncertainty as a stressor could enhance the perceived stress, then decrease the level of self-care ability. Understanding the mediating effect of the perceived stress appeared essential to identify appropriate targets for novel treatment approaches that could be offered to enterostomy patients. Some appropriate measures could be taken to reduce the perceived stress, since

the affective and bodily consequences could vary depending on how the same life event is interpreted psychologically according to the appraisal theory[11].

The present study improves our understanding of the relationship among uncertainty, perceived stress, and self-care ability, study limitations must be acknowledged. First, this is a cross-sectional study at a single time point, the generalizability of our results needs to be tested in future longitudinal studies. Second, the sample did not represent all the enterostomy patients in China, due to possible selection bias during recruitment, the multicenter investigation was also needed to ascertain the current research result. Last, This study collected information from self-reports of participants, which may biased the results. Despite the above limitations, this paper provided a new perspective to relieve the effect of uncertainty on self-care ability.

Conclusion

To date, this was the first time to test the relationship among three variables (uncertainty, perceived stress, and self-care ability), and uncertainty exerted a partial mediation effect through perceived stress on self-care ability. The results of this study suggest that lower level of perceived stress play a key role in reducing the effect of uncertainty on self-care ability, which contributes to an improved understanding of the complexity of the underlying mechanisms.

Declarations

Funding

There is no funding supports this study.

Conflicts of interest

The authors declare that they have no conflict of interest.

Availability of data and material

Not applicable.

Code availability

Not applicable.

Authors' contributions

All authors have made substantial contributions to the concept and drafting of the manuscript and have seen and approved the final version of the manuscript.

Ethics approval

This study was granted approval from the Ethical Review Board of Henan Provincial People's Hospital, Zhengzhou, China.

Consent to participate

Prior to participation, written and verbal informed consents were obtained from all individual participants in the study.

Consent for publication

All authors consent to the publication of the manuscript.

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Figures

Figure 1

The structural equation model on the relationship among uncertainty, perceived stress and self-care ability