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Is the social withdrawal subscale a valid instrument to assess social withdrawal among colorectal cancer survivors with permanent stomas? A validation study

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Abstract

Background Although social withdrawal is common among colorectal cancer (CRC) survivors with permanent stomas, it has been poorly addressed due to a lack of valid assessment tools. The social withdrawal subscale (SWS) from the Internalized Stigma of Mental Illness (ISMI) scale shows promise for assessing social withdrawal. However, there was no available data on its validity for this purpose. This study aimed to investigate the reliability and validity of the SWS as a screening tool for identifying survivors at risk of social withdrawal.

Methods Two separate convenience samples of 127 and 245 CRC survivors with permanent stomas were selected. Item analysis and exploratory factor analysis (EFA) were conducted with the first sample of 127 survivors. Confirmatory factor analysis (CFA), reliability analysis, and tests for convergent and discriminant validity were performed with the second sample of 245 survivors. Additionally, the screening cut-off score and accuracy of the SWS scores were determined using receiver operating characteristic (ROC) curves.

Results The item-total correlation coefficients of the SWS ranged from 0.530 to 0.787. The EFA demonstrated a single-factor structure for the SWS. The CFA confirmed appropriate construct validity ($\chi^2/df = 103.115/52 = 1.983$, goodness-of-fit index (GFI) = 0.925, comparative fit index (CFI) = 0.959, and root mean square error of approximation (RMSEA) = 0.068). The test–retest reliability was 0.849. Pearson correlation analysis showed significant and moderate to large relationships between the SWS and the chosen criterion measures, supporting its good convergent validity. ROC analysis identified SWS scores of ≥ 15 as the optimal screening cut-off, with a sensitivity of 86.5%, specificity of 50.5%, and an area under the curve (AUC) of 0.748 (95% CI: 0.673–0.823, $P < 0.001$).

Conclusion The SWS demonstrates acceptable reliability and validity for measuring social withdrawal among CRC survivors with permanent stomas. Future studies should further evaluate its utility in clinical settings.

Keywords Social withdrawal, Reliability, Validity, Colorectal cancer, Permanent stomas

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Introduction

Colorectal cancer (CRC) has been the third most frequently diagnosed cancer worldwide [1] and the second leading causes of new cancer in China [2]. To eradicate the lesion and restore bowel function, a significant proportion of CRC survivors have to undergo stoma-forming colorectal surgery and live with a stoma for the rest of their lives [3, 4]. Although intestinal stoma formation is a life-saving procedure, it profoundly alters a person's relationship with their social world, affects their ability to participate and interact socially, and exacerbates their social vulnerability over time [5–7]. Consequently, social well-being or functioning has been described as one of the most compromised and challenged domain by CRC survivors with permanent stomas [8, 9], significantly impacting their process of social rehabilitation. Actively engaging in social activities, as a key component of the social rehabilitation process [10], can help survivors rebuild their social skills, regain confidence, and re-establish their social identities, which are critical for achieving holistic and sustainable rehabilitation outcomes. However, a particularly concerning aspect of living with a stoma is the development of social withdrawal behaviors, which can lead to isolation and loneliness and hinder active social participations [11].

Social withdrawal is a behavioral pattern characterized by a reduction or avoidance of social interactions and engagements with others due to experiences of social stress or disease exposure [12]. For CRC survivors with permanent stomas, social withdrawal may be attributed to limited public support resources and stoma-related issues, such as leakage, odor, and the need for frequent maintenance, body image concerns, and stoma related stigma [13, 14]. Multiple qualitative studies have shown that socializing and social participation are the most common and significant life challenges for survivors after stoma formation [5, 9, 13]. Empirical studies have also indicated that 30% to half of survivors reported a significant reduction in social activity since stoma formation [15, 16]. Although the phenomenon of social withdrawal among CRC survivors with permanent stomas is noticeable, there is a conspicuous lack of comprehensive studies that adequately address this issue due to the absence of validated assessments specifically designed to measure social withdrawal.

To date, research on social withdrawal has primarily concentrated on specific populations, including children and adolescents, the elderly, and individuals with chronic illnesses or mental health conditions. Research on social withdrawal behaviors in children and adolescents primarily focuses on the approach-avoidance motivation theory to study three subtypes of social withdrawal [17, 18] and has led to the development of the frequently used child social preference scale for investigating these behaviors [19]. In addition, there is a severe and long-term form of social withdrawal, typically observed in adolescents and young adults transitioning to adulthood, known as " hikikomori", which has also received widespread attention [20]. Corresponding assessment tools have also been developed and applied [21, 22]. However, due to the fundamental differences between behavioral characteristics during childhood development and behavioral changes following chronic disease exposure, applying the theories and assessment tools designed for children and adolescents to populations with chronic diseases is challenging. For the elderly, individuals with chronic diseases, or those with mental disorders, the decline in physical functioning due to aging or illness and the reduction in social motivation due to psychological factors are typical characteristics that lead to social withdrawal [23, 24]. Accordingly, an initial disease-specific tool was developed to primarily assess both the objective and subjective aspects of social withdrawal in patients with motor neuron disease [25]. However, the specificity of certain diseases and the overemphasis on assessing the physical disability aspects of social withdrawal have limited the application and development of this scale for other disease populations [23]. Afterward, a comprehensive literature review was conducted to identify existing instruments for assessing proxies of social withdrawal. However, these recommended tools primarily focus on areas such as social functioning, social networks, or feelings of loneliness, which reflect the outcomes or subjective experiences of social withdrawal behaviors, rather than evaluating the behavior itself [23]. Developing a specific assessment tool seems to be the most ideal and appropriate approach; however, this requires a significant investment of time and effort. Therefore, the continued identification of a viable tool for assessing social withdrawal is crucial to promote the social rehabilitation of survivors and to adequately address the specific challenges they face.

Qualitative studies focusing on social withdrawal among CRC survivors with permanent stomas have shown that the primary reason for social withdrawal is concerns about negative judgments or social rejection due to the stoma [5, 9, 13]. Therefore, considering both the social triggers of withdrawal behavior and the behavior itself may be an important component of a tool for assessing social withdrawal. Based on this, the social withdrawal subscale (SWS) from the Internalized Stigma of Mental Illness (ISMI) scale appears to be a promising tool for assessing social withdrawal [26]. The ISMI scale is a reliable and valid tool originally designed to measure the internalized stigma experienced by individuals with mental illnesses [27]. Five subscales are produced from the instrument: alienation, stereotype endorsement, discrimination experience, social withdrawal, and stigma resistance. By replacing the term "mental illness" in the

items with another "focus disease", the ISMI scale can be modified and used for other conditions beyond the scope of its original focus [27], such as substance abuse [28], breast cancer [29] and irritable bowel syndrome [30]. The six items from SWS (e.g. I don't socialize as much as I used to because of my…) align well with the key constructs of social withdrawal, including avoidance of social interactions, reduced participation in social activities, isolation, and emotional distress. The SWS specifically addresses aspects of social withdrawal related to stigma and self-perception, capturing how individuals with illness might retreat from social interactions due to feelings of shame and fear of negative evaluation. This aligns well with the experiences of CRC survivors with permanent stomas. Moreover, the short length of the SWS with six items enhances its robustness and feasibility for implementation in various settings, such as clinical environments, research studies, and routine screenings. Nevertheless, its reliability and validity specifically for assessing social withdrawal among CRC survivors with permanent stomas have not been thoroughly evaluated. Therefore, further validation studies are warranted.

Taken together, the present study aims to examine the reliability and validity of the SWS as a screening tool to assess social withdrawal among CRC survivors with permanent stomas, especially focusing on its convergent validity, discriminant validity, and the ability to identify survivors who disengage from social interactions. To achieve these goals, other reliable and valid criterion measures were chosen and administered. These measures were chosen by an understanding of the main causes, characteristics, and impacts of social withdrawal in survivors with stomas [5, 11, 13], as well as social motivation theory [31], including constructs about social participation, social connection motivation, social functioning, and stigma. To further determine the accuracy of the SWS in detecting survivors who have disengaged from social interaction, survivors' self-reported frequency of participation in socializing during the past month was used as the outcome. The main hypotheses underlying the present study are that (1) the SWS scores will strongly correlate with the chosen criterion measures and (2) have acceptable accuracy in detecting disengaged survivors once good reliability and validity are verified.

Methods

Participants and procedure

Two separate and convenience samples were recruited from the stoma outpatient clinic of Shandong Cancer Hospital & Institute located in Jinan from September 2022 to May 2024. The inclusion criteria were as follows: (1) age 18 or older; (2) diagnosed with CRC and treated with permanent ostomy; (3) received surgery at least one month before the study; and (4) able to understand and answer the questionnaires. The exclusion criteria were as follows: (1) CRC patients who had a reversed temporary ostomy; (2) previously diagnosed with autism or motor neuron diseases; and (3) severe mental illness or cognitive impairment that would impede their ability to complete the survey. The minimum sample size was determined based on the recommended requirement of 5 to 10 participants per item for a psychometric assessment of an instrument [32, 33]. This study was approved by the Human Research Ethics Committee of the School of Nursing and Rehabilitation, Shandong University (Approval No. 2022-R-022).

All CRC survivors with permanent stomas who provided oral informed consent were enrolled in the study. The procedures were conducted per the ethical standards of the 1964 Declaration of Helsinki. Sample 1 included 127 participants and was primarily used for item analysis and EFA. Specifically, 130 participants were invited from September 2022 to March 2023, of which 127 completed the questionnaire assessment, mainly including the socio-demographic variables, clinically relevant variables, and SWS. Sample 2 included 245 participants and was primarily used for CFA, reliability and validity testing. Specifically, 250 participants were invited from May 2023 to May 2024, of which 245 completed the questionnaire assessment, including the newly added criterion measures. Among the participants who were continuously enrolled and completed the assessment in Sample 2, 20 participants were invited and agreed to be re-evaluated two weeks later. The assessments were conducted via online questionnaire or outpatients' follow-ups, scheduled by telephone appointment.

Measures

A self-administered, structured questionnaire, including a study-specific questionnaire on socio-demographic and clinically relevant variables, social withdrawal, and criterion measures, was used to collect data.

The socio-demographic and clinical questionnaire was developed to elicit information including participants' age, gender, marital status, education, employment, monthly income, body mass index, time since operation, ostomy type, current adjuvant therapy status, comorbidities, and stoma self-care ability.

The social withdrawal subscale (SWS) from internalized stigma for mental illness scale (ISMI) was used to assess the extent of perceived social withdrawal among CRC patients with permanent stomas [26]. The ISMI scale was originally developed by Boyd et al. [26], and the Chinese version was translated and developed by Li et al. [34]. The ISMI scale is a 29-item questionnaire designed to measure self-stigma among persons with psychiatric disorders, producing five subscales: alienation, stereotype endorsement, discrimination experience, social

withdrawal, and stigma resistance. Of these, the SWS contains six items. In this study, the original term 'mental illness" was replaced with "stoma", such as 'I don't socialize as much as I used to because my ***stoma*** might make me look or behave weird' and 'I avoid getting close to people who don't have ***stoma*** to avoid rejection.' The items are rated on a 4-point scale that ranges from '1 = strongly disagree' to '4 = strongly agree'. The sum of all items scores is the total score, with high values indicating a higher self-perceived social withdrawal.

Criterion measures

Social participation questionnaire (SPQ) was used to assess the frequency of an individual's participation in several social activities in the past one month [35]. According to Levasseur's framework [36], the types of social activities included in the assessment mainly comprise housework, transportation, physical activity, recreational activities, leisure travel, socializing, social media use, work or study activities, donation or volunteering, religious, community, or political activities, and other supplementary activities. The frequency of participation in each activity is rated on a 4-point scale, ranging from '0 = never', "1 = rare", "2 = sometimes", to '3 = often'. The sum of all items scores is the total score, with high values indicating a higher frequency of participation. The reliability and validity of this questionnaire have been verified with college students and breast cancer groups [35]. In the present study, Cronbach's alpha for the SPQ was 0.864, and McDonald's omega for the SPQ was 0.867.

The state motivation to foster social connection scale was used to assess self-reported motivation to engage in social connections with existing and with new social targets among CRC patients with permanent stomas [37]. The 10-item scale is comprised of two 5-item subscales: state motivation to foster social connection with new (SMSC-N) (e.g., "Right now, I would like to meet new people") and state motivation to foster social connection with existing (SMSC-E) (e.g., "Right now, I'd like to be around friends"), measured from 1 (strongly disagree) to 5 (strongly agree) for each item. The sum of all item scores is the total score in each subscale, with higher values indicating a greater desire to foster social connections with others. In the present study, Cronbach's alpha for the SMSC-N and SMSC-E were 0.864 and 0.894, respectively, and McDonald's omega for the SMSC-N and SMSC-E were 0.867 and 0.895, respectively.

Social functioning subscale (SFS) from the European Organization for Research and Treatment of cancer Quality of life questionnaire core 30 were used to assess patients perceived social functioning [38]. The SFS consists of two items as follows: (1) "Has your physical condition or medical treatment interfered with your family life?"; and (2) "Has your physical condition or medical treatment interfered with your social activities?" The response categories ranged from 1 (not at all) to 4 (very much). Raw scores were standardized by linearly transforming the average of the two items according to the Quality of life questionnaire core 30 scoring manual [39], with higher scores indicating greater social functioning. In this study, Cronbach's alpha for the SFS was 0.925, and McDonald's omega for the SFS was 0.925.

The self-designed two items stigma scale was used to assess the extent of perceived stigma by asking about shame and discrimination resulting from having a permanent colostomy [11]. The items are as follows: "Because of your illness or stoma, have you ever felt: (1) shame; (2) discrimination." The items are rated on an 8-point scale that ranges from "0 = I have not felt this" to "7 = I have always felt this." The raw total scores range from 0 to 14, with higher scores indicating higher stigma experience. This two-item stigma scale has demonstrated good reliability in infertility conditions [11, 40]. In the present study, Cronbach's alpha for the two items was 0.905, and McDonald's omega for the two items was 0.905.

Statistical analysis

Data analysis was conducted by SPSS version 27.0 and Amos version 24.0. Mean ± standard deviations (SD), frequency, and percentages were used to describe the characteristics of the participants.

The item-level analysis and EFA were performed with Sample 1. The item-level analysis mainly included: distributions of item score, reliability analysis, and correlation coefficient. Specifically, distributions of item score were reported by the mean, SD, skewness, kurtosis, floor effect, and ceiling effect. Reliability analysis was examined using total Cronbach's alpha and Cronbach's alpha if item deleted. Correlation coefficient was assessed using the corrected item-total correlation. Both the Kaiser–Meyer–Olkin (KMO) and Bartlett's tests of Sphericity were used to assess sampling adequacy for EFA, with KMO more than 0.7 and the significance of Bartlett's sphericity test indicating suitable for EFA. Principal axis factoring was performed to extract the predominant factors followed by oblique rotation of factors using direct oblimin rotation. All factors with eigenvalues greater than 1.0 were retained for interpretation. An item was removed if its loading was less than ± 0.40, or if it was loaded simultaneously on two or more factors.

The reliability and validity analysis were performed with Sample 2. The Cronbach alpha and McDonald's omega (ω) were used to assess the reliability of the SWS. Test–retest reliability was examined by calculating the intraclass correlation coefficients among 20 participants from the sample 2 who completed the survey twice within 2 weeks interval. CFA was used to validate the factor structure. Several indexes were used to evaluate whether

the hypothesized model fits the data [41], including the ratio of chi-square to degrees of freedom (χ2 / df, < 3), the goodness-of- fit index (GFI, > 0.900), comparative fit index (CFI, > 0.900), root mean square error of approximation (RMSEA, < 0.08). Convergent validity was assessed using the composite reliability (CR, a preferred value ≥ 0.70) and the average variance extracted (AVE, a preferred value ≥ 0.50) of each construct. The concurrent validity was examined by calculating Pearson correlation coefficients between SWS and several criterion measures.

Table 1 Socio-demographic and clinical characteristics of the study participants

Variables		Sample 1 (*n* = 127) *N* (%) / M ± SD	Sample 2 (*n* = 245) *N* (%) / M ± SD
Age (year)		57.98 ± 13.01	61.32 ± 11.36
Gender	Male	76 (59.8)	169 (69.0)
	Female	51 (40.2)	76 (31.0)
Marital status	Married	120 (94.5)	242 (98.8)
	Other	7 (5.5)	3 (1.2)
Education	Less than high school	81 (63.8)	139 (56.7)
	High school	23 (18.1)	56 (22.9)
	College or higher	23 (18.1)	50 (20.4)
Employment	Employed	51 (40.2)	108 (44.1)
	Unemployed	76 (59.8)	137 (55.9)
Monthly income (¥)	< 3000	24 (18.9)	49 (20.0)
	3000–6000	60 (47.2)	126 (51.4)
	> 6000	43 (33.9)	70 (28.6)
Body mass index (kg/m2)		24.33 ± 4.26	23.89 ± 3.60
	< 18.5	13 (10.2)	17 (6.9)
	18.5–24.9	57 (44.9)	139 (56.8)
	25.0–30.0	45 (35.5)	56 (30.6)
	> 30.0	12 (9.4)	14 (5.7)
Time since operation (months)		7.18 ± 8.39	7.62 ± 8.27
	≤ 3	62 (48.8)	95 (42.9)
	4–6	22 (17.3)	36 (14.7)
	7–12	17 (13.4)	63 (25.7)
	> 12	26 (20.5)	41 (16.7)
Ostomy type	Colostomy	83 (65.4)	189 (77.1)
	Ileostomy	44 (34.6)	56 (22.9)
Undergoing adjuvant therapy	Yes	74 (58.3)	124 (50.6)
	No	53 (41.7)	121 (49.4)
Comorbidities or not	Yes	40 (31.5)	107 (43.7)
	No	87 (68.5)	138 (56.3)
Stoma self-care ability	Independence	20 (15.7)	29 (11.8)
	Semi-dependence	48 (37.8)	100 (40.8)
	Fully dependence	59 (46.5)	116 (47.3)

M mean, SD Standard Deviation, ¥ China Yuan

Correlation coefficients (r) of 0.10, 0.30, and 0.50 indicate small, medium, and large effect sizes, respectively [42]. Discriminant validity was explored by comparing the inter-factors' correlation coefficients with the square root of the AVE of each individual factor [43].

Moreover, to determine the screening cut-off score and accuracy of the SWS scores in detecting survivors that disengaged social interaction, ROC curves were calculated by using the frequency of recent socializing in the SPQ as the outcome variable. Survivors who reported never participation in socializing during the past one month were classified as disengaged from social interaction; the rest were classified as engaged in social interaction. The accuracy of the ROC curve was evaluated using the AUC. An AUC of 0.9 or higher indicates high accuracy, an AUC between 0.7 and 0.9 indicates moderate accuracy, and an AUC less than 0.7 indicates low accuracy [44]. The Youden index, which is a function of sensitivity and specificity, provides a criterion for choosing the "optimal" threshold value and was used for this purpose [45]. The p-values reported were two-tailed, and the p-value < 0.05 was considered significant.

Results

Sociodemographic and clinical characteristics of the sample

The characteristics of the two samples are summarized in Table 1. Sample 1 consisted of 127 survivors, with a mean age of 57.98 years (SD = 13.01), and 59.8% of the survivors were male. The mean time since ostomy was 7.18 months (SD = 8.39), and 33.9% of patients had undergone surgery more than 6 months prior. Sample 2 consisted of 245 survivors, with a mean age of 61.32 years (SD = 11.36), and 69.0% of the survivors were male. The mean time since ostomy was 7.62 months (SD = 8.27), and 42.4% of patients had undergone surgery more than 6 months prior.

Item-level analysis and EFA

Table 2 presents the item-level analysis and EFA of the SWS based on the data from Sample 1 ($n = 127$). The floor and ceiling effect of the six items were all less than 0.20. The corrected item-total correlation values were all more than 0.40. After deleting each item individually, Cronbach's α of the scale was 0.843–0.881, which did not exceed the original Cronbach's α of 0.886. The Kaiser-Meyer-Olkin (KMO) value of 0.879, and the result of Bartlett's sphericity test was significant ($\chi2 = 392.947$, $P < 0.001$). A single factor was identified with an eigenvalue of 2.739, which accounted for 63.08% of the total variance. The factor loading ranged from 0.643 to 0.872, indicating that a strong association between all items and the factor.

Table 2 Descriptive and exploratory factor analysis for the 6 items ($n = 127$)

Item content	M ± SD	Skewness	kurtosis	Floor effect	Ceiling effect	Corrected Item-total correlation	Cronbach's alpha if item deleted	Factors loadings
SWS1. I avoid getting close to people who don't have a stoma to avoid rejection.	2.28 ± 0.825	0.117	-0.549	0.173	0.063	0.726	0.854	0.780
SWS2. I don't socialize as much as I used to because my stoma might make me look or behave 'weird'.	2.56 ± 0.851	-0.344	-0.501	0.134	0.102	0.530	0.881	0.643
SWS3. I don't talk about myself much because I don't want to burden others with my stoma.	2.64 ± 0.897	-0.222	-0.663	0.118	0.165	0.621	0.872	0.738
SWS4. Negative stereotypes about stoma keep me isolated from the 'normal' world.	2.34 ± 0.799	0.164	-0.378	0.134	0.071	0.775	0.847	0.847
SWS5. Being around people who don't have a stoma makes me feel out of place or inadequate.	2.27 ± 0.859	0.369	-0.402	0.173	0.094	0.787	0.843	0.872
SWS6. I stay away from social situations in order to protect myself, my family or friends from embarrassment.	2.31 ± 0.870	0.072	-0.713	0.189	0.079	0.716	0.856	0.820

Reliability and test-retest reliability analysis

The Cronbach's a for the SWS based on Sample 2 ($n = 245$) was 0.853, and McDonald's omega was 0.860. The test-retest reliability analyses, based on 20 participants from Sample 2 who were assessed twice within 2-week, showed that intraclass correlation coefficient of the SWS was 0.849.

CFA

The CFA of the SWS based on Sample 2 ($n = 245$) is presented in Fig. 1. The model fit for the single-factor structure of the SWS was as follows: $\chi 2$ / df = 103.115 / 52 = 1.983, GFI = 0.925, CFI = 0.959, and RMSEA = 0.068, indicating that the model had appropriate construct validity. The standardized estimates of factor loadings ranged from 0.53 to 0.84, all exceeding 0.40.

Concurrent, convergent and discriminant validity analysis

The Pearson correlation analysis between the SWS and other criterion measures is presented in Table 3. The SWS exhibited significant and large magnitude relationships with social participation ($r = -0.606$, $P < 0.001$), social functioning ($r = -0.575$, $P < 0.001$), stigma ($r = 0.536$, $P < 0.001$), and SMSC-N ($r = -0.515$, $P < 0.001$). Additionally, it showed a medium magnitude relationship with SMSC-E ($r = -0.455$, $P < 0.001$). The AVE and CR of the SWS were 0.581 and 0.891, respectively. Moreover, the square roots of AVE for all constructs were greater than the inter-correlations of all constructs, indicating acceptable discriminant validity for all measurements in this study.

The accuracy and cut-off of the SWS for detecting disengaged survivors

The ROC curve of the SWS scores for the detection of survivors that disengaged form social interactions is presented in Fig. 2. The AUC was 0.748 (95% CI: 0.673–0.823, $P < 0.001$), indicating that the SWS scores effectively distinguish between engaged and disengaged survivors. A sum score of ≥ 15 was identified as the optimal screening cut-off based on maximized Youden index, with a sensitivity of 86.5% and specificity of 50.5%.

Discussion

The present study mainly investigated whether the SWS is a valid instrument for measuring social withdrawal among CRC survivors with permanent stomas. The results indicated that the SWS demonstrates good overall factor structure, internal consistency, test-retest reliability, and convergent and discriminant validity for assessing social withdrawal. The SWS showed significant and moderate to high relationships with social participation, social connection motivation, social functioning, and stigma, but the strength and direction of these relationships indicate that the SWS and reference constructs have different structures. In addition, the ROC results demonstrate the discriminative capacity of the SWS in differentiating between socially engaged and disengaged survivors.

The item analysis revealed strong correlation between the items and the overall scale, providing a foundational confirmation that the SWS is reasonably accurate. Moreover, the SWS demonstrated excellent internal consistency with an overall coefficient of 0.886, as well as satisfactory test-retest reliability results of 0.849, which were comparable to previous findings. This indicates that the SWS exhibits a similarly high level of internal stability

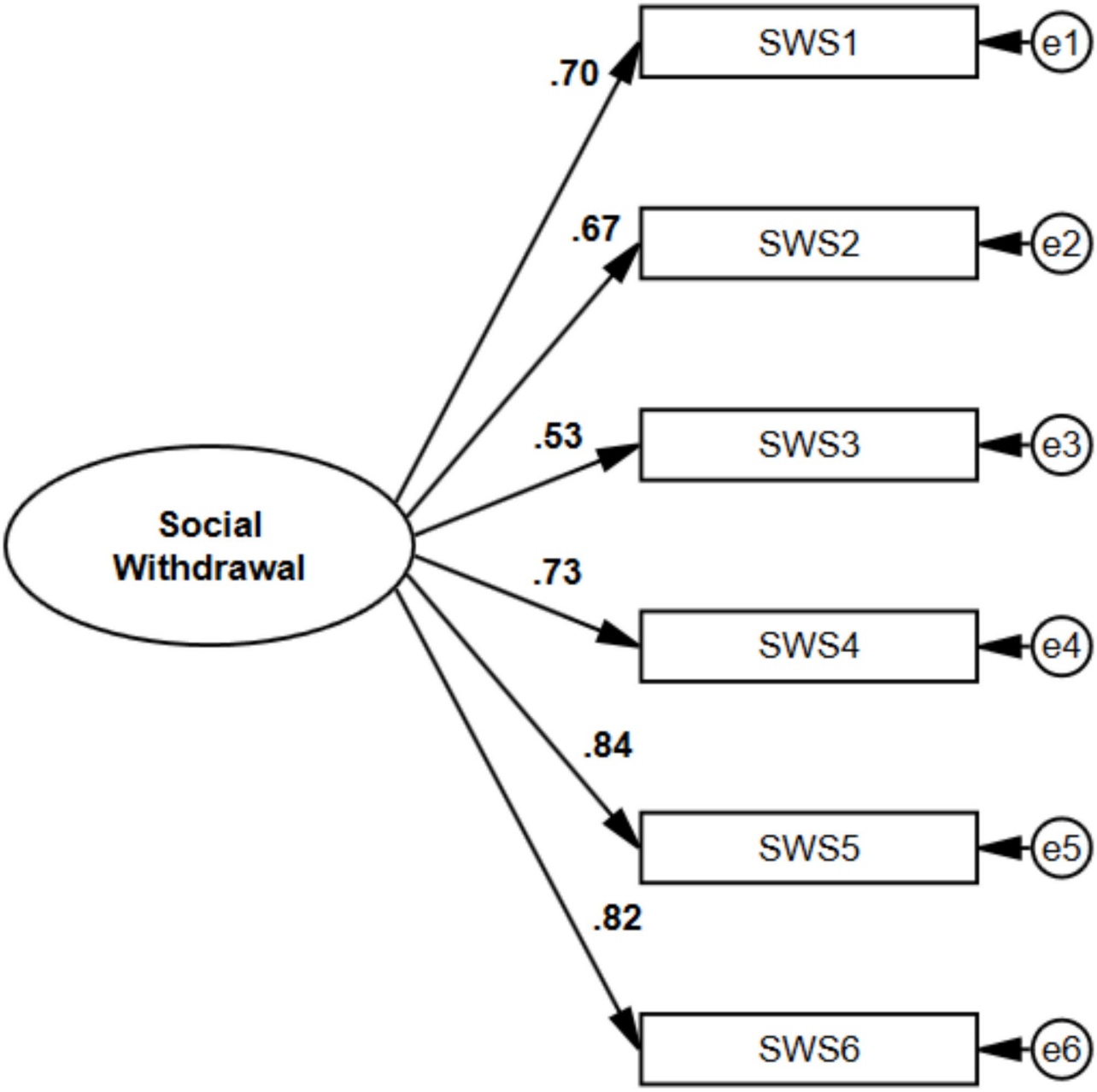

Fig. 1 Confirmatory factor analysis for the SWS ($n = 245$). SWS social withdrawal scale

as observed in the original subscale [46, 47]. In addition, EFA and CFA both showed that the structure of the SWS was consistent with the original single-factor structure, with all model fit indices falling within an acceptable range. These results suggested that the SWS exhibits good construct validity and meets psychometric criteria.

As for the relations of the SWS to criterion variables, the SWS demonstrated significant and large magnitude negative relationships with social participation and social functioning, which aligns with existing literature suggesting that individuals experiencing greater social withdrawal often exhibit diminished social engagement and reduced ability to perform social roles effectively [24, 48]. Furthermore, the significant positive correlation with stigma underscores the impact of perceived stigma on social withdrawal and supports previous viewpoints that social withdrawal can be understood as both a component and consequence of self-stigma experiences [26, 49]. In addition, the state motivation to foster social connections with both new and existing relationships were negatively associated with social withdrawal, supporting the social motivation theory that social motivation is a

Table 3 Pearson correlation between SWS and other relevant measures ($n = 245$)

Variables	M ± SD	Cronbach's α And McDonald's ω	CR	1	2	3.1	3.2	4	5
1. SWS	14.76 ± 3.64	0.853, 0.860	0.891	(0.763)					
2. SPQ	14.04 ± 5.99	0.864, 0.867	0.892	-0.606	(0.677)				
3.1 SMSC-N	15.88 ± 4.55	0.894, 0.895	0.823	-0.515	0.492	(0.840)			
3.2 SMSC-E	19.73 ± 3.75	0.855, 0.853	0.900	-0.455	0.428	0.511	(0.802)		
4. Stigma	4.98 ± 4.23	0.905, 0.905	0.955	0.536	-0.358	-0.358	-0.326	(0.955)	
5. SFS	56.46 ± 31.98	0.925, 0.925	0.963	-0.575	0.487	0.487	0.250	-0.499	(0.964)

M mean, SD standard deviation, SWS social withdrawal subscale, SPQ social participation questionnaire, SMSC-N motivation to foster social connection with new, SMSC-E Motivation to foster social connection with existing, SFS social functioning subscale

The values in the parentheses are the square root of the average variance extracted (AVE) of each construct

The P values for all correlation coefficient were less than 0.001

powerful force guiding human behavior and that disruption of social motivational mechanisms may constitute a primary deficit in severe social withdrawal [31]. These relationships highlight the significant barriers CRC survivors face in establishing new and maintaining existing social networks. Moreover, there was a difference in the magnitude of the relationship between social withdrawal and maintenance motivation and between social withdrawal and novelty-seeking motivation, which may partially support recent ideas that social withdrawal behavior in the context of disease is primarily manifested by the avoidance of unfamiliar targets and proximity to significant others [12]. It is worth mentioning that although the relationships between the SWS and criterion variables all showed relatively strong correlations, the strongest was between the SWS and social participation. This suggests that the constructs assessed by the SWS best reflect the degree of reduced social interaction or participation, which closely aligns with the core definition of social withdrawal. Overall, the results further confirmed that the SWS has satisfactory convergent and discriminant validity for assessing social withdrawal among CRC survivors with permanent stomas.

As for the predictive validity of the SWS, the findings from the ROC analysis further substantiate the discriminant validity and clinical utility of the SWS in identifying CRC survivors with permanent stomas who are disengaged from social interactions. Specifically, the AUC value of 0.748 indicates a good level of discriminant validity, suggesting that the SWS scores could effectively distinguish between socially engaged and disengaged survivors. Furthermore, the identification of a sum score of ≥ 15 as the optimal screening cut-off, with a sensitivity of 86.5% and specificity of 50.5%, highlights the SWS's efficacy in identifying those at risk of social withdrawal while maintaining a moderate rate of false positives. Although the specificity rate of 50.5% suggests a moderate rate of false positives, increasing the cut-off value could improve specificity but would likely decrease sensitivity. Nonetheless, this high sensitivity ensures early detection and timely intervention, which is crucial for addressing the unique challenges faced by survivors at high risk of social withdrawal. Therefore, future research should continue to explore the application of the SWS in diverse clinical settings to further validate its utility and effectiveness.

To our knowledge, this study is the first to examine the applicability of the SWS in assessing social withdrawal among CRC survivors with permanent stomas. The results of this study give to the SWS evidence of its reliabity and validity to measure social withdrawal. In addition, the ROC analysis provides robust evidence of its discriminant validity and clinical screening value. The identification of a sum score of ≥ 15 as the optimal screening cut-off is consistent with the item average score cut-off of 2.5 used for the ISMI scale and its subscales in previous studies [26, 50]. With a high sensitivity rate, a reasonable specificity rate, and low completion burden, the SWS could serve as an effective tool for identifying social withdrawal among CRC survivors with permanent stomas. These findings support the integration of the SWS into routine clinical practice, facilitating early detection and intervention to enhance social and psychological outcomes for this vulnerable population. Despite these strengths, this study still had some limitations. First, the use of a convenience sampling method and a relatively small sample size may constrain the generalizability of the findings. Future research should aim to include larger, more diverse survivors to enhance the generalizability of the results and provide a more comprehensive understanding of social withdrawal across different populations. Second, the absence of a gold-standard assessment tool for social withdrawal complicates the validation process for the SWS. Future studies should explore the development or identification of a standardized measure for social withdrawal that can serve as a reliable reference point for validation purposes. Third, although the ISMI scale can be adapted for other chronic conditions by replacing the term 'mental illness' with another 'focus disease,' the content of the SWS predominantly focuses

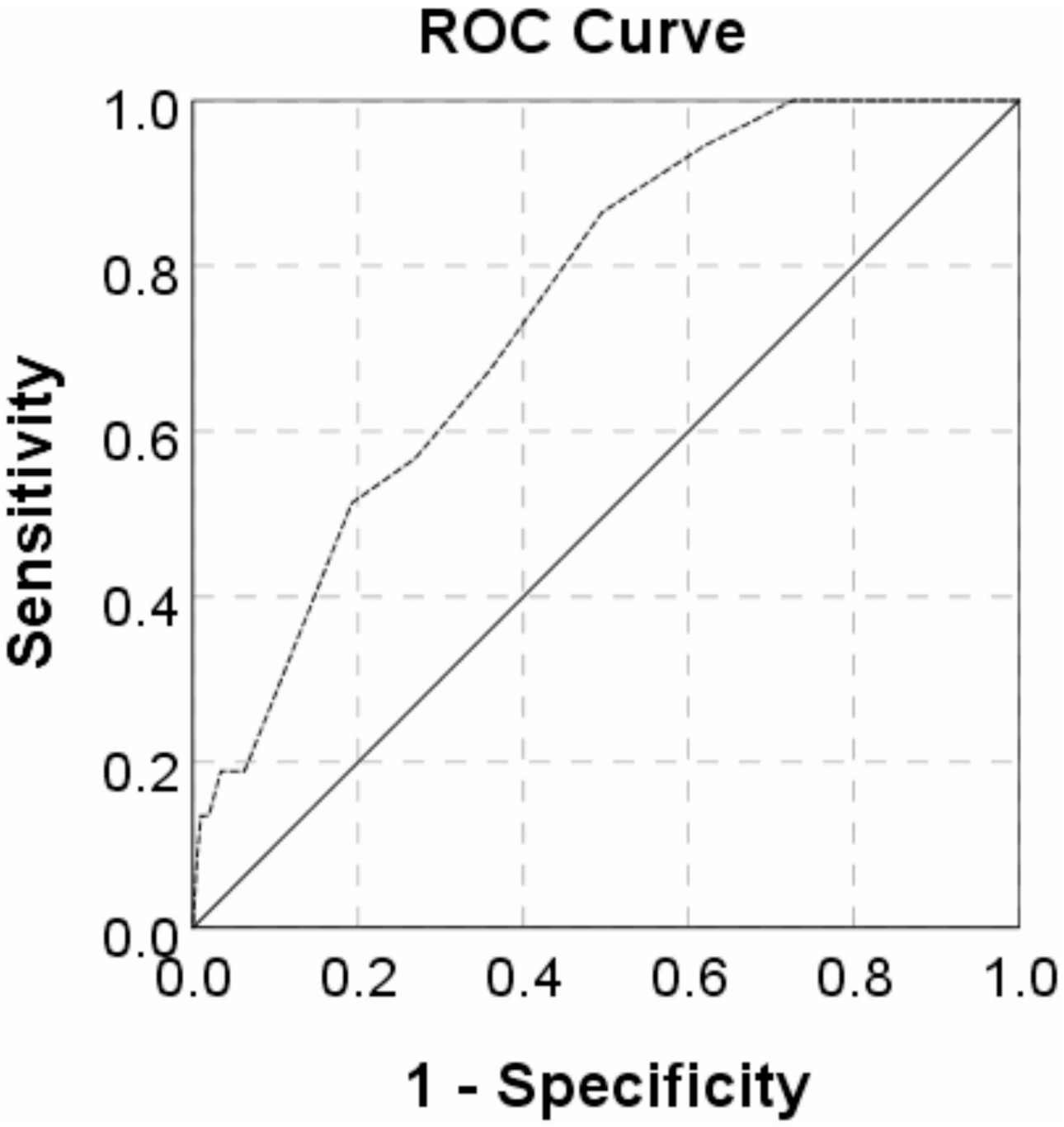

Fig. 2 The ROC curve of the SWS scores for disengaged survivors ($n = 245$). SWS social withdrawal scale

on social withdrawal stemming from social prejudice due to illness. This approach potentially neglects other important factors, such as social withdrawal related to energy regulation, which can be influenced by inflammation cascades associated with the disease's pathology [51]. This limitation is particularly relevant for chronic disease populations, such as those with multiple sclerosis or severe anemia, where weakness and fatigue are more prominent, and social prejudice is less common. Future research should consider expanding the content of the SWS to include items that capture a broader range of social withdrawal factors, including those related to physical and psychological symptoms like fatigue, which would provide a more holistic assessment and applicability of social withdrawal across diverse chronic disease groups. Finally, as a self-reported tool, the SWS is subject to certain biases. Future research should consider incorporating objective measures of social behavior,

such as behavioral paradigms under experimental conditions [23], to obtain a more comprehensive and accurate assessment of social withdrawal.

Conclusion

In summary, this research suggests that the SWS has acceptable reliability and validity for measuring social withdrawal among CRC survivors with permanent stomas. The strong correlations between the SWS and related constructs, such as social participation, social functioning, stigma, and social connection motivation, underscore its relevance in capturing key aspects of social withdrawal. Better discriminative validity and a lower completion burden ensure that the SWS is an effective tool for identifying survivors at risk of social withdrawal. Future studies should continue to explore the application of SWS in different clinical settings to further validate its reliability and validity. Additionally, longitudinal studies are needed to assess the stability and sensitivity of the SWS over time, particularly in response to the tailored clinical intervention and changes in survivors' health status and social environments.

Abbreviations

CRC	Colorectal cancer
SWS	Social withdrawal subscale
ISMI	Internalized Stigma of Mental Illness
EFA	Exploratory factor analysis
CFA	Confirmatory factor analysis
ROC	Receiver operating characteristic
AUC	Area under the curve
GFI	Goodness-of- fit index
CFI	Comparative fit index
RMSEA	Root mean square error of approximation
SPQ	Social participation questionnaire
SMSC-N	State motivation to foster social connection with new
SMSC-E	State motivation to foster social connection with existing
SFS	Social functioning subscale
SD	Standard deviations
CR	Composite reliability
AVE	Average variance extracted

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Author contributions

Study design: G.L., X.D. Data collection: X.H., Q.Y. Data analysis: G.L., X.H. Manuscript writing: G.L. Review and editing: Q.Y., X.D. Conceptualization and supervision: X.D. All authors read and approved the final manuscript.

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Data availability

The datasets analyzed during the current study are not publicly available due to them containing information that could compromise research participant consent but are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

This study was approved by the Human Research Ethics Committee of the School of Nursing and Rehabilitation, Shandong University (Approval No. 2022-R-022). All CRC survivors with permanent stomas who provided oral informed consent were enrolled in the study. The procedures were conducted per the ethical standards of the 1964 Declaration of Helsinki.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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