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What is the current state of anxiety and its related factors in Chinese patients undergoing colonoscopy? A cross-sectional study



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Abstract

Background Anxiety in patients undergoing colonoscopy may also result in adverse effects, including altered vital signs such as elevated heart rate and blood pressure, exacerbation of symptoms like bloating and gastrointestinal discomfort, a decline in cooperation and satisfaction, and even colonoscopy failure. However, limited studies have explored the level of anxiety, factors that influence it, and its specific causes.

Methods A cross-sectional study was conducted, recruiting 825 patients undergoing colonoscopy in Hunan Province between January and July 2023 using stratified sampling. The Spielberger State-Trait Anxiety Inventory (STAI), a self-designed demographic characteristics questionnaire, and a colonoscopy patient anxiety influencing factor questionnaire were used. The data were analyzed in SPSS (version 26) using Mann–Whitney U, Kruskal–Wallis, and multiple regression analysis tests.

Results The final study included 825 participants, of whom 19.8% exhibited mild anxiety, 37.0% exhibited moderate anxiety, and 43.2% exhibited severe anxiety. The results indicated that insomnia (β =-0.080, p = 0.013), no comorbidities (β =-0.147, p < 0.001), not smoking or drinking (β =-0.158, p < 0.001), and poor health (moderate: β =-0.183, p < 0.001; poor: β =-0.164, p < 0.001) were negatively associated with anxiety levels. In contrast, marital status (β =0.177, p < 0.001), education level (β =0.204, p < 0.001), age (β =0.114, p=0.007), medical insurance (Basic Medical Insurance for Urban Residents β =0.204, p < 0.001; Commercial medical insurance: β =0.112, p < 0.001), care provided by relatives (β =0.102, p=0.002), diarrhoea (β =0.089, p=0.005), occupation (farmers: β =0.099, p=0.009; self-employed: β =0.082, p=0.014), and paternal upbringing (β =0.067, p=0.034) were positively correlated with anxiety. Several factors had a greater impact on the anxiety level of the patients: education level (β =0.204), health status (moderate: β =-0.183; not good: β =-0.164), and marital status (β =0.177). It probably because higher education levels may increase awareness of potential risks associated with colonoscopy, contributing to greater anxiety. The five common reasons for anxiety included the presence of bloody faeces, enemas, need for further treatment, lack of timely feedback from the physician, lack of an accurate diagnosis.

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Conclusion The level of anxiety experienced by patients during the colonoscopy phase was more severe and should be alleviated with targeted interventions based on the cause of anxiety, such as pre-procedural counseling, patient education materials, and enhanced communication with healthcare providers.

Keywords Colonoscopy, Anxiety, Influencing factors, Mental health

Background

Colorectal cancer (CRC) has the third highest incidence rate and second highest mortality rate worldwide [1]. Early diagnosis of CRC and detection of pre-cancerous lesions are of great significance in reducing mortality and morbidity [2]. Colonoscopy, which allows for a complete review of the entire colorectum and biopsy of suspicious lesions to further clarify the diagnosis, is regarded as the gold standard for CRC screening. Colonoscopy screening reduces the risk of morbidity and mortality by 56% and 57%, respectively, compared to no screening [3]. However, anxiety is a significant barrier to screening [4, 5], which may reduce patient acceptance of and compliance with colonoscopy.

Some studies have found that certain factors (e.g. higher baseline anxiety) are associated with an increase in anxiety [6, 7] By utilising these factors, healthcare professionals can identify patients with higher levels of anxiety. However, some influencing factors have been inconclusive [8]. For instance, Bensusan IG [9] and Baudet J-S [10] observed that pre-colonoscopy anxiety was more severe in younger patients; Hsueh [11] found that the older the patient, the higher the level of anxiety; however, Efuni [12] and Shafer LA [6] concluded that age was not an influencing factor of pre-colonoscopy anxiety. Regarding the level of education, Sargin M [13] argued that a higher level of education was associated with lower level of anxiety, whereas Eng et al. [14] and Jones et al. [15] found no such co-relation.

To reduce the adverse effects of anxiety, non-pharmacological interventions have been used, such as music [16], aromatherapy [17], and virtual reality technology [18]. Although these interventions are diverse, they are not well targeted, and there appear to be differences in their effectiveness [19]. Additionally, some studies have provided health education to patients through interventions focusing on better understanding of colonoscopy [11, 20, 21]. Although increased messaging may reduce anxiety, none of the extant studies have described any facet of the intervention specific to anxiety [8].

In his conceptual framework of the relationship between anxiety and screening, Consedine [22] mentioned that there is an interaction between anxiety and screening, including sources and levels of anxiety. Anxiety sources can be divided into three categories: (a) screening modalities, (b) screening outcomes, and (c) undifferentiated cancer anxiety. Anxiety about the method of screening decreases the likelihood that the patient will attend screening. Reducing patient anxiety by providing clear and specific knowledge about the source of the screening modality increases the likelihood of patients participating in screening. In this study, anxiety was controlled by providing preoperative information about the colonoscopy modality, such as identifying the specific reasons for patients' anxiety about changing the modality.

However, to the best of our knowledge, few studies have been conducted on the status of anxiety in patients undergoing colonoscopy in China. Therefore, there is uncertainty regarding the identification of predictors of anxiety. In addition, there is a lack of information regarding the anxiety associated with colonoscopy. A better understanding of information about anxiety associated with colonoscopy may help in the development of measures to reduce anxiety and improve acceptance of colonoscopy. Despite the growing use of colonoscopy in China, comprehensive studies addressing patient anxiety and its specific causes remain limited. Therefore, our study aimed to investigate the status of anxiety in Chinese patients undergoing colonoscopy, the influencing factors associated with anxiety, and the specific sources of anxiety during colonoscopy.

Methods

Design, participants, and settings

This cross-sectional study was conducted between January and July 2023 on adult patients (\geq 18 years old) who intended to undergo colonoscopy. Stratified sampling was adopted to select the study population from Hunan Province, which was divided into central, southern, and northern regions. Two cities and one hospital in each region were randomly selected. Therefore, six hospitals were included in this study. Confidentiality and anonymity of the survey results were ensured by not asking for names (i.e. questionnaires were numbered). Patients were able to withdraw from the survey at any time during the study.

The inclusion criteria were as follows: participants (1) aged 18 years or older, with the ability to think independently; (2) conscious, able to communicate effectively, and not under the influence of sedative drugs; and (3) signed an informed consent form and agreed to voluntary participate in this study.

The exclusion criteria were as follows: participants (1) had deficits in hearing or vision; (2) had a history of heart failure, renal failure, cirrhosis, or chronic medical

conditions; (3) had a history of anxiety or psychiatric disorders; (4) were pregnant or possibly pregnant; (5) used antidepressants, adrenergic receptor antagonists, or opioids; (6) currently or recently experienced chronic pain syndrome; and (7) had comorbidities with malignancies, immune system disorders, or infectious diseases with serious underlying conditions.

The formula for cross-sectional surveys was used to determine the final sample size required: $n = t^2p(1-p)/m^2$, where n represents the total sample size needed, t is the 95% confidence interval (standard value of 1.96), m is the precision of the prevalence estimate (0.05), and p represents the incidence rate. According to the results of McEntire J [23], we localised p to 56% [24] and considered a 40% null response rate. The final confirmed sample comprised 529 cases.

Instruments

Demographic characteristics questionnaire

The items for these questions were adapted from a literature review and included sex, age, religious relief, educational level, marital status, occupation, residence, income, type of medical insurance, first inspection, family history of colorectal cancer, health status, comorbidities, pressure state, peers, smoking or drinking, information, primary caregiver, support status, insomnia, surgical history, reasons for undergoing colonoscopy, and regular exercise.

The spielberger state-trait anxiety inventory (STAI)

The level of anxiety was measured with the State Anxiety Inventory portion of the STAI, and transient anxiety and tension were measured with the Trait Anxiety Inventory portion of the STAI. The STAI uses a Likert's 4-point scale, with one indicating "not at all;" two indicating "somewhat;" three indicating "moderately;" and four indicating "very." The reliability test results of the Chinese version of the STAI showed that the re-test reliability of the State Anxiety Inventory was 0.88, the re-test reliability of the Trait Anxiety Inventory was 0.90, and the Cronbach's α was 0.906, which indicates that the Chinese version of the STAI is reliable and valid for use with the Chinese population [25, 26].

Colonoscopy patient anxiety influencing factors questionnaire

The questionnaire was developed based on a cognitivephenomenological-transactional model [27]. This questionnaire was developed through a literature review and expert consultation. It contained four sections: (1) colonoscopy appointment, which included 11 entries, such as unknown diseases; (2) bowel cleansing, which included 8 entries, such as waking up early to perform bowel preparation; (3) colonoscopy operation, which included 20 entries, such as long waiting times and emergencies; and (4) colonoscopy follow-up, which included 7 entries, such as diagnostic inaccuracies. A Likert's 5-point scale was used, with a score of one indicating "very inconsistent," two indicating "relatively inconsistent," three indicating "uncertain," four indicating "relatively consistent," and five indicating "very consistent."

Reliability of the questionnaire was assessed by pretesting 226 patients, resulting in a Cronbach's alpha of 0.956, indicating good internal consistency. The questionnaire was expressed in terms of content and structural validity, which were measured as 0.80-1.00 for item content validity and 0.923 for item content validity, scale content validity, and item content validity, respectively. Exploratory factor analysis was used to assess the structural validity of the questionnaire, which showed a Kaiser-Meyer-Olkin measure of sampling adequacy of 0.946 and Bartlett's test of sphericity of 7279.583 (df = 1035, p < 0.001). The skewed rotation of factors using Principal Component Analysis (PCA) resulted in a cumulative variance contribution of 63.83% and factor loadings of 0.513-0.819 for each item, indicating that the questionnaire had good structural validity. The selected participants and sampling method used in the formal survey phase were consistent with those used in the pre-survey.

Data collection

To reduce bias, the survey was conducted by 12 trained investigators, rather than the researcher, using a standardised paper-based questionnaire. For patients who were less educated or could not complete the questionnaire independently, the investigator could request the patient's peers or nurses to assist in the completion of the questionnaires. When assistance was required, patients were given a full verbal explanation of a question. Patients were asked to complete all the questions in the questionnaire, and the questionnaires were collected immediately after completion. Questionnaires that were not filled out in a standardised way or not completed in full were marked as invalid and eliminated from the analysis. A total of 863 questionnaires were distributed, 38 were incomplete and eliminated, and 825 questionnaires were analysed, yielding a validity rate of 95.5%.

Data analysis

Data were analysed using the Statistical Package for Social Sciences (SPSS) version 26.0, with continuous variables expressed as means and standard deviations and categorical variables expressed as frequencies and percentages. Univariate analyses were performed using nonparametric tests for between-group comparisons, and multiple linear regression analyses were performed to evaluate the influencing factors. For univariate analysis, the Mann-Whitney U test was used for comparisons between two samples, and the Kruskal-Wallis test was used for comparisons between multiple samples. Both one-way analysis of variance and multiple linear regression used anxiety scores as the dependent variable. Although the dependent variable did not conform to a normal distribution, the hypothesis of normality of the residuals was confirmed, and the data still met the criteria for multiple regression [28]. Statistically significant factors in the univariate analysis were used as independent variables in the multiple linear (stepwise) regression analysis. Multicollinearity was tested using a Variance Impact Factor (VIF) of less than 10. There was no covariance between the variables in this study, and multiple linear regression was performed, with p < 0.05, defined as statistically significant.

Results

Sociodemographic characteristics of participants

Recruitment for this study was conducted between January and July 2023. A total of 825 patients were included in this study. Of them, 408 (49.5%) were males and 417 (50.5%) were females. The sociodemographic characteristics of the patients are shown in Table 1.

Presenting anxiety in patients undergoing colonoscopy

Of the 825 patients surveyed, 164 (19.8%) had no or low levels of anxiety, 305 (37.0%) had moderate anxiety, and 356 (43.2%) had severe anxiety. The median level of anxiety was 57.0 (23.5), and patients' general information was analysed by one-way analysis with the anxiety scores. The level of anxiety of the patients with different characteristics is shown in Table 1. The prevalence of anxiety is shown in Fig. 1.

Factors influencing anxiety in patients undergoing colonoscopy

The range of scores on this questionnaire was 46-230, the higher the score, the more influential the factors affecting anxiety in patients undergoing colonoscopy, and the greater the degree of their impairment. The highest mean score for the entries was 4.23 ± 0.03 , and the lowest was 2.88 ± 0.05 . According to the scores, we presented the top five entries for each dimension colonoscopy appointment, bowel cleansing, colonoscopy operation, and colonoscopy follow-up in Table 2.

The scores for each entry were summed to obtain the total score for each dimension; the specific scores and rankings are listed in Table 3.

Multiple stepwise linear regression was conducted with anxiety scores as the dependent variable and factors (p < 0.05) that were statistically different in the one-way analysis of variance as independent variables. The results showed that comorbidities, education, type of health insurance, smoking and drinking, occupation, health status, age, experience of insomnia, reason for having a colonoscopy, primary caregiver, rearing status, marital status, and searching for information were key factors for anxiety (p < 0.05). The results of the regression analyses are shown in Table 4.

Multiple stepwise linear regression with anxiety scores as the dependent variable and factors that were statistically different in a one-way ANOVA as independent variables showed that insomnia (β =-0.080, *p*=0.013), no comorbidities ($\beta = -0.147$, p < 0.001), not smoking and drinking (β =-0.158, *p*<0.001), and poor health (moderate: β =-0.183, *p*<0.001; poor: β =-0.164, *p*<0.001) were negatively associated with anxiety levels. In contrast, being married ($\beta = 0.177$, p < 0.001), education level $(\beta = 0.204, p < 0.001)$, age $(\beta = 0.114, p = 0.007)$, medical insurance (Basic Medical Insurance for Urban Residents $\beta = 0.204$, *p* < 0.001; Commercial medical insurance: $\beta = 0.112$, p < 0.001), care by relatives ($\beta = 0.102$, p = 0.002), diarrhoea ($\beta = 0.089$, p = 0.005), occupation (farmers: $\beta = 0.099$, p = 0.009; self-employed: $\beta = 0.082$, p = 0.014), and father upbringing ($\beta = 0.067$, p = 0.034) were positively correlated with anxiety. Several factors had a greater impact on the anxiety level of the patients: education level ($\beta = 0.204$), health status (moderate: $\beta = -0.183$; not good: β =-0.164), and marital status (β =0.177). The adjusted R² was 0.249, which explained 24.9% of the total variance (F = 31.83, *p* < 0.001).

Discussion

Status of anxiety in patients undergoing colonoscopy

According to the survey results, the percentage of patients with a moderate degree of anxiety was 37.0% and patients with a severe degree of anxiety was 43.2%. This revealed that the patients experienced a more severe stage of anxiety prior to colonoscopy.

Factors influencing anxiety in patients undergoing colonoscopy

Personal factors

A positive correlation was observed between educational level and anxiety, which contradicts previous studies [13, 14]. This inconsistency may be attributed to the relationship between the level of education, awareness of personal health conditions, and patients' sense of social responsibility. In addition, contrary to the study by Bensusan IG [9], the results indicated that anxiety levels increased with age. This may be because physiological resilience decreases with age, especially cardiovascular and neurological functioning, which may lead to a weakening of the physiological stress response of elderly patients during colonoscopy, thereby increasing the incidence of anxiety [15, 29]. Married patients had higher levels of anxiety than unmarried patients, which is in line with Phalswal [30], possibly because married patients

Table 1 Participant characteristics and univariate analysis of anxiety (n = 825)

| Variables | N(%) | scores (Median, Interquartile range) | Z/H | p |
|---|---|---|--------|-----------|
| Sex | | | -0.698 | 0.458 |
| Male | 408(49.5) | 58.0(24.0) | | |
| Female | 417(50.5) | 56.0(23.0) | | |
| Ages(years) | | | 22.034 | 0.001* |
| 18–29 | 101(12.2) | 57.0 (19.0) | | |
| 30–39 | 154(18.7) | 58.0 (23.0) | | |
| 40–49 | 267(32.4) | 57.0(25.0) | | |
| 50–59 | 199(24.1) | 60.0(19.0) | | |
| 60–69 | 70(8.5) | 52.0(29.0) | | |
| 70–79 | 24(2.9) | 32.0(10.5) | | |
| 80-89 | 10(1.2) | 34.0(9.5) | | |
| Religious beliefs | , | | -0.646 | 0.518 |
| Yes | 66(8.0) | 50.5(32.0) | | |
| No | 759(92.0) | 57.0(22.0) | | |
| Education level | , | 57.10(22.10) | 30.526 | < 0.001 * |
| Primary school and below | 115(13.9) | 60.0(22.0) | 50.520 | 0.001 |
| | 248(30.1) | 57 0(20 7) | | |
| High school or junior college | 200(36.2) | 56.0(21.0) | | |
| | 134(16.2) | 55.0(25.7) | | |
| Graduate student and above | 20(3.5) | 46.0(28.0) | | |
| Marital status | 29(3.3) | 40.0(28.0) | 52 226 | < 0.001 * |
| Upmarried | 211/25 6) | 520(140) | 33.220 | < 0.001 |
| Married | 211(23.0) | 52.0(14.0) | | |
| Diverse | 407 (39.0) | 58.U(27.U) | | |
| | 68(8.2) 50(7.2) | 04.0(20.5) | | |
| | 59(7.2) | 48.0(32.0) | 42.050 | -0.001 * |
| Occupation | 25(4.2) | 46.0(2.4.0) | 43.050 | < 0.001 * |
| | 35(4.2) | 46.0(24.0) | | |
| | 162(19.6) | 60.0(21.0) | | |
| leachers | 65(7.9) | 49.0(13.0) | | |
| Medical staff | 36(4.4) | 55.0(17.5) | | |
| Workers | 109(13.2) | 61.0(14.5) | | |
| Farmers | 1/0(20.6) | 54.0(26.5) | | |
| Self-employed | 108(13.1) | 63.0(23.0) | | |
| Students | 61(7.4) | 54.0(25.0) | | |
| Others | 79(9.6) | 49.0(26.0) | | |
| Residence | | | 4.288 | < 0.001 * |
| Urban | 468(56.7) | 59.0(21.0) | | |
| Rural | 357(43.3) | 54.0(27.0) | | |
| Income (¥) | | | 10.956 | 0.012* |
| <2000 | 128(15.5) | 43.0(20.0) | | |
| 2000–3500 | 231(28.0) | 62.0(18.0) | | |
| 3500–6500 | 313(37.9) | 58.0(19.0) | | |
| >6500 | 153(18.5) | 55.0(29.0) | | |
| Type of medical insurance | | | 19.788 | 0.001 * |
| No medical insurance | 62(7.5) | 55.0(26.0) | | |
| New Rural Cooperative Medical Insurance | 292(35.4) | 54.0(22.0) | | |
| Basic Medical Insurance for Urban Residents | 258(31.3) | 60.0(20.2) | | |
| Basic Medical Insurance for Urban Workers | 190(23.0) | 57.0(28.0) | | |
| Commercial medical insurance | 23(2.8) | 69.0(22.0) | | |
| Whether the first inspection | | | 0.682 | 0.495 |
| Yes | 588(71.2) | 58.0(25.0) | | |
| No | 237(28.8) | 53.0(18.0) | | |

Table 1 (continued)

| Variables | N(%) | scores (Median, Interquartile range) | Z/H | р |
|--|------------|---|---------|-----------|
| If "No", the time since the last inspection(years) | | · · · | | |
| 0–1 | 50(6.1) | 55.0(20.0) | Ν | Ν |
| 1–2 | 82(9.9) | 58.0(16.0) | | |
| 2–3 | 69(8.4) | 50.0(14.0) | | |
| 3–5 | 36(4.4) | 53.0(29.2) | | |
| Family history of colorectal cancer | | | -2.516 | 0.012* |
| Yes | 77(9.3) | 56.0(34.0) | | |
| No | 748(90.7) | 57.0(22.0) | | |
| Health status | | | 8.784 | 0.012* |
| Good | 176(21.3) | 54.5(22.7) | | |
| Moderate | 478(57.9) | 55.0(20.0) | | |
| Not good | 171(20.7) | 67.0(22.0) | | |
| Comorbidities | | | 48.217 | < 0.001 * |
| Cardiovascular diseases | 109(13.2) | 57.0(35.0) | | |
| Diabetes | 164(19.9) | 54.0(28.0) | | |
| Hypertension | 180(21.8) | 54.0(28.0) | | |
| Not have | 372(45.1) | 49.5(17.5) | | |
| Pressure state | | | 6.619 | 0.085 |
| No pressure | 68(8,2) | 50.0(21.0) | | |
| l ow pressure | 172(20.8) | 56.0(25.0) | | |
| Medium pressure | 434(52.6) | 55.0(21.2) | | |
| High pressure | 151(18.3) | 67.0(17.0) | | |
| Peers | , | | -2.580 | 0.010* |
| Yes | 488(59.2) | 60.0(22.0) | | |
| No | 337(40.8) | 54 0(20 0) | | |
| Smoking or drinking | 557 (10.6) | 5 110(2010) | 36 91 1 | < 0.001 * |
| Smoking | 108(13.1) | 55 0(31 7) | 50.511 | (0.00) |
| Drinking | 154(18.7) | 58.0(29.2) | | |
| Neither of them | 366(44.4) | 55.0(21.0) | | |
| Both | 197(23.9) | 60.0(18.0) | | |
| Information | 197 (2019) | | 38,822 | < 0.001 * |
| Communicate with people | 165(20.0) | 55.0(27.0) | 50.022 | (0.00) |
| Search for information online | 222(26.9) | 50.5(20.0) | | |
| Neither of them | 366(44.4) | 50.0(15.0) | | |
| Both | 197(23.9) | 62.0(15.0) | | |
| Primary caregiver | 197 (20.9) | 02.0(13.0) | 22 1 58 | < 0.001 * |
| Children | 132(16.0) | 50.0(13.0) | 22.150 | (0.001 |
| Partner | 270(32.7) | 64.0(17.2) | | |
| Relatives | 97(11.8) | 54.0(21.5) | | |
| Medical provider | 28(3.4) | 63 0(25 5) | | |
| Solf | 26(3.4) | 54.0(25.0) | | |
| Other | 201(31.0) | 63 0(15 5) | | |
| Support status (by whom raised) | 57(4.5) | 03.0(13.3) | 13 73/ | 0.004* |
| Parantal Support | 647(784) | 580(210) | 15.254 | 0.004 |
| Raised by mother | 60(7.2) | 51.0(26.5) | | |
| | 26(2.2) | 51.0(20.5) | | |
| othor | 20(3.2) | AQ 5(23 Q) | | |
| Incompia | 92(11.2) | 47.3(23.0) | 2 000 | < 0 001 * |
| insomnia | | | -3.900 | < 0.001 * |

Table 1 (continued)

| Variables | N(%) | scores | Z/H | р |
|------------------------------------|-----------|-------------------------------|--------|--------|
| | | (Median, Interquartile range) | | |
| Yes | 470(57.0) | 61.0(19.0) | -0.691 | 0.490 |
| No | 355(43.0) | 50.0(22.0) | | |
| Surgical history | | | | |
| Yes | 221(26.8) | 50.0(23.5) | | |
| No | 604(73.2) | 59.0(20.0) | | |
| Reasons for undergoing colonoscopy | | | 21.629 | 0.010* |
| Asymptomatic, screening | 115(13.9) | 50.0(30.0) | | |
| Family History | 25(3.0) | 45.0(17.0) | | |
| Past colorectal cancer | 14(1.7) | 68.0(5.5) | | |
| Diagnosis of intestinal polyps | 62(7.5) | 63.0(11.5) | | |
| Positive faecal occult blood test | 58(7.0) | 59.5(24.0) | | |
| Diarrhoea | 66(8.0) | 58.5(15.5) | | |
| Constipation | 135(16.4) | 60.0(20.0) | | |
| Abdominal pain | 208(25.2) | 55.5(26.0) | | |
| Rectal bleeding | 95(11.5) | 59.0(20.0) | | |
| Others | 47(5.7) | 48.0(16.0) | | |
| Regular exercise | | | -0.255 | 0.799 |
| Yes | 233(28.2) | 59.0(23.0) | | |
| No | 592(71.8) | 56.0(23.0) | | |

Note: Z: Mann-Whitney U test; H: Kruskal-Wallis test; * indicates a significant correlation (p < 0.05)



Fig. 1 Frequency of different levels of anxiety (n = 825)

have more family responsibilities. Higher levels of anxiety were observed for patients with symptoms of diarrhoea, which may be related to fear of an unknown disease, but surprisingly, patients with a prior diagnosis of intestinal polyps had lower levels of anxiety. Patients with recent experiences of insomnia had lower levels of anxiety than those who did not experience insomnia, possibly because insomnia leads to physical and mental fatigue and reduces the energy needed for anxiety [31]. This might be because insomnia causes the individual to project his or her concern onto the sleep problem, converting it from fear about something else, such as a colonoscopy, to anxiety over sleeplessness. The ability to regulate anxiety may help better manage colonoscopy-related anxiety.

Family factors

Patients who were cared for by relatives had higher levels of anxiety than those cared for by their sons and daughters. This may be because patients who are cared for by relatives are concerned about placing a heavy burden on them, which may aggravate their level of anxiety. We also found that patients raised by their fathers had higher anxiety levels than those raised by both parents. Patients raised by their fathers may be more prone to a lack of emotional support, which can lead to feelings of loneliness and helplessness, exacerbating their anxiety [32].

Specific reasons for anxiety

During the appointment stage, we observed that patients were anxious about the clarity of the information provided by the medical staff. To address this issue, structured pre-colonoscopy consultation should be implemented to ensure that the patient fully understands the purpose of the examination, procedure, and preparation requirements, and that this consultation should include personalised messaging [33, 34]. An online appointment management system can be implemented to further improve communication efficiency, reduce waiting times, and increase transparency, an online appointment management system can be implemented [35, 36]. However, patients may be worried about their ability to schedule online appointments at desired times,

| Dimension | Title of entry | Min | Max | M±SD | Rank |
|-----------------|---|-----|-----|------------------|------|
| Colonoscopy | I am panicking about the possibility of an unknown disease. | 1 | 5 | 3.97 ± 0.033 | 8 |
| appointment | I am nervous about signing the informed consent form. | 1 | 5 | 3.90 ± 0.033 | 14 |
| | I am anxious about the lack of clarity of information provided by healthcare professionals. | 1 | 5 | 3.82 ± 0.040 | 16 |
| | I am bothered by the fact that the medication I use is not covered by my health insurance. | 1 | 5 | 3.75 ± 0.040 | 21 |
| | I am annoyed that I cannot get an appointment at the time point I want. | 1 | 5 | 3.65 ± 0.040 | 22 |
| Bowel cleansing | I think the enema aggravated my nervousness. | 1 | 5 | 4.03 ± 0.036 | 2 |
| | I am concerned about the preparation of the bowels. | 1 | 5 | 3.98 ± 0.037 | 6 |
| | I am overwhelmed by the adverse effects of laxatives. | 1 | 5 | 3.96 ± 0.036 | 9 |
| | I am uncomfortable with the peculiar smell of laxatives. | 1 | 5 | 3.80 ± 0.036 | 18 |
| | I feel oppressed by strict dietary requirements. | 1 | 5 | 3.78 ± 0.038 | 19 |
| | I feel oppressed by the strict process of taking laxatives. | 1 | 5 | 3.78 ± 0.037 | 20 |
| Colonoscopy | I am very concerned about the unforeseen circumstances of the operation. | 1 | 5 | 3.98 ± 0.035 | 6 |
| operation | I am embarrassed about exposing my private parts. | 1 | 5 | 3.96 ± 0.040 | 9 |
| | I am terrified of the pain that occurs during surgery. | 1 | 5 | 3.93 ± 0.037 | 11 |
| | I am concerned about the use of narcotics. | 1 | 5 | 3.93 ± 0.036 | 11 |
| | l am uncomfortable with the need to inject fluids or gases during surgery. | 1 | 5 | 3.93 ± 0.035 | 11 |
| | I am concerned about whether colonoscopes are sterile and harmful to enter the body. | 1 | 5 | 3.91 ± 0.036 | 14 |
| | I am burdened by the fact that doctors see faeces in the intestines. | 1 | 5 | 3.81 ± 0.040 | 17 |
| Colonoscopy | I am afraid of the blood in my stool after the operation. | 1 | 5 | 4.23 ± 0.035 | 1 |
| follow-up | I am terrified of needing further treatment. | 1 | 5 | 4.02 ± 0.034 | 3 |
| | I am concerned about the lack of timely feedback from my doctor. | 1 | 5 | 4.01 ± 0.035 | 4 |
| | I am disturbed by the fact that no clear diagnosis emerged from the tests. | 1 | 5 | 3.99 ± 0.033 | 5 |
| | I was concerned about the length of recovery after surgery. | 1 | 5 | 3.38 ± 0.037 | 23 |

 Table 2
 Top five influencing factors for each dimension of colonoscopy patient anxiety

Note: Min: minimum value; Max: maximum value; M: mean; SD: standard deviation

| Table 3 | Dimensions | scores on the | questionnai | re on factors |
|------------|------------|---------------|-------------|---------------|
| influence. | | | | 025) |

| Dimension | Num- | Scores | Average scores | Rank- |
|----------------------------|----------------|----------------------------------|---|-------|
| | entries (n) | (Mean, Standard deviation) | of entries (Mean, Stan- dard deviation) | ing |
| Colonoscopy appointment | 11 | 39.30±9.23 | 3.57±0.84 | 4 |
| Bowel cleansing | 8 | 29.97 ± 6.51 | 3.75 ± 0.81 | 2 |
| Colonoscopy operation | 20 | 74.69±15.08 | 3.73±0.75 | 3 |
| Colonoscopy follow-up | 7 | 27.11±5.51 | 3.87±0.79 | 1 |
| Overall score | 46 | 171.08±33.70 | 3.72 ± 0.73 | |

partly because some patients live in rural areas with limited support for bowel preparation prior to colonoscopy examination. A related concern is that a significant number of patients may not be able to schedule a time for their colonoscopy that does not conflict with work constraints. To reduce patient stress due to scheduling, healthcare providers should offer flexible appointment times that accommodate patients' personal and work schedules. In support of flexible scheduling, confirmation of appointments should be made with patients, with reconfirmation through multiple communication channels, to minimise appointment failures owing to misunderstanding or forgetfulness [35, 36]. Simultaneously, an emergency handling mechanism should be established to reschedule appointments in a timely manner if patients are unable to prepare their bowels.

Studies have shown that final bowel preparation may contribute to feelings of anxiety when patients perform cleansing enemas [37]. Therefore, further discussion is needed to determine whether every patient should undergo cleansing. Health promotion should emphasise the benefits of bowel preparation. As patients cannot eat regularly during bowel preparation, those with diabetes are more worried about their blood glucose levels. Therefore, a bowel preparation programme for patients with diabetes should be specially designed to reduce adverse reactions and alleviate patient anxiety [38–40].

During the intraoperative phase, the patient's greatest concern is that accidents may occur during surgery. We observed that the patients were worried about the sterility of the colonoscope, which may be harmful when inserted into the patient. Therefore, sterility of colonoscopy equipment and procedures should be emphasised before the operation. Not only is the colonoscopy procedure harmless to the body, but it is also important in the early detection and diagnosis of disease [41–43]. In addition, according to the survey results, patients were worried about the use of sedative drugs during the procedure. Studies have shown that because the advancement of techniques has made the examination less irritating, most patients do not need sedative drugs during the

Table 4 STAI-S score multiple linear regression results (n = 825)

| Variable | В | SD | β | t | р | Tolerance | VIF |
|---|--------|-------|--------|--------|---------|-----------|--------|
| Constant | 43.096 | 1.764 | | 24.433 | < 0.001 | | 43.096 |
| Comorbidities | | | | | | | |
| Cardiovascular diseases (Reference) | | | | | | | |
| Not have | -2.270 | 0.571 | -0.147 | -3.971 | < 0.001 | 0.660 | 1.514 |
| Marital status | | | | | | | |
| Unmarried (Reference) | | | | | | | |
| Married | 2.757 | 0.511 | 0.177 | 5.390 | < 0.001 | 0.844 | 1.184 |
| Education level | 1.534 | 0.280 | 0.204 | 5.481 | < 0.001 | 0.655 | 1.526 |
| Type of medical insurance | | | | | | | |
| Without medical insurance (Reference) | | | | | | | |
| Basic Medical Insurance for Urban Residents | 1.559 | 0.566 | 0.097 | 2.753 | 0.006 | 0.728 | 1.373 |
| Commercial medical insurance | 5.224 | 1.445 | 0.112 | 3.615 | < 0.001 | 0.944 | 1.060 |
| Smoking or drinking | | | | | | | |
| Both (Reference) | | | | | | | |
| Neither of them | -2.431 | 0.516 | -0.158 | -4.715 | < 0.001 | 0.814 | 1.229 |
| Primary caregiver | | | | | | | |
| Children (Reference) | | | | | | | |
| Relatives | 2.417 | 0.784 | 0.102 | 3.084 | 0.002 | 0.838 | 1.193 |
| Reasons for undergoing colonoscopy | | | | | | | |
| Asymptomatic, screening (Reference) | | | | | | | |
| Diarrhoea | 2.513 | 0.888 | 0.089 | 2.829 | 0.005 | 0.920 | 1.087 |
| Diagnosis of intestinal polyps | -2.092 | 0.919 | -0.072 | -2.278 | 0.023 | 0.911 | 1.098 |
| Occupation | | | | | | | |
| Workers (Reference) | | | | | | | |
| Farmers | 1.867 | 0.714 | 0.099 | 2.614 | 0.009 | 0.640 | 1.562 |
| Self-employed | 1.857 | 0.752 | 0.082 | 2.469 | 0.014 | 0.830 | 1.205 |
| Others | -1.895 | 0.880 | -0.073 | -2.155 | 0.031 | 0.797 | 1.255 |
| Health status | | | | | | | |
| Good (Reference) | | | | | | | |
| Moderate | -2.836 | 0.631 | -0.183 | -4.496 | < 0.001 | 0.551 | 1.816 |
| Not good | -3.091 | 0.783 | -0.164 | -3.949 | < 0.001 | 0.531 | 1.885 |
| Information | | | | | | | |
| Communicate with people (Reference) | | | | | | | |
| Neither of them | -2.029 | 0.554 | -0.126 | -3.663 | < 0.001 | 0.772 | 1.295 |
| Both | -1.946 | 0.662 | -0.099 | -2.938 | 0.003 | 0.798 | 1.253 |
| Support status | | | | | | | |
| Parental Support (Reference) | | | | | | | |
| Raised by father | 2.926 | 1.375 | 0.067 | 2.128 | 0.034 | 0.925 | 1.081 |
| Ages(years) | 0.668 | 0.248 | 0.114 | 2.697 | 0.007 | 0.512 | 1.955 |
| Insomnia | -1.234 | 0.496 | -0.080 | -2.490 | 0.013 | 0.887 | 1.127 |

Note: B = unstandardised coefficient; SD = standard deviation; VIF = variance inflation factor. $R^2 = 0.267$, adjusted $R^2 = 0.249$, F = 15.415, p < 0.001, STAI-S: Spielberger State Anxiety Inventory

procedure [44] b. In addition, the use of drugs can significantly increase costs [45].

In the postoperative stage, after obtaining their diagnosis, we observed that patients would continue to be anxious, fearing the presence of blood in their stool, the need for further treatment, and lack of timely feedback from the doctor. Therefore, in clinical practice, attention should be paid to timely discussion of the patient's condition. Patients concerned about blood in the stool should be informed that the likelihood of bleeding is low in the absence of biopsy or other procedures [46, 47]. To alleviate this anxiety, a brief postoperative counseling session is advised, during which the healthcare provider can use simple language to explain common postoperative symptoms and suitable management options. A documented postoperative care plan can also be given to the patient to help alleviate uncertainty and anxiety.

Other relevant issues

In a survey of the reasons for undergoing colonoscopy, we found that the number of patients who underwent colonoscopy as a screening test was 115 (13.9%), whereas the number of patients who presented symptoms, such as diarrhoea, constipation, abdominal pain, and rectal bleeding, was 504 (61.1%); therefore, in actual clinical practice, the patients preferred to undergo the test after the onset of symptoms rather than as a pre-screen procedure. This makes it clear that colonoscopy, as a screening procedure, has not been fully utilised.

Strengths and limitations

A strength of this study is its large sample size, which provides strong evidence that the level of anxiety experienced by patients during colonoscopy is severe and should be alleviated. However, this study had some limitations. First, the representativeness of the sample must be improved. Second, this study used a self-assessment questionnaire, which may have been affected by individual perceptions and sociocultural influences.

Conclusions

In conclusion, this study elucidated the factors that influence anxiety levels in Chinese patients undergoing colonoscopy. High levels of patient anxiety were associated with factors such as educational level, health status, and marital status. Upon further investigation of the specific reasons, it was found that patients experienced anxiety because of the lack of clarity in the information provided by the medical staff.

Abbreviations

| CRC | Colorectal cancer |
|-------|---|
| STAI | The Spielberger State-Trait Anxiety Inventory |
| SPSS | Statistical Package for Social Sciences |
| PCA | Principal Component Analysis |
| VIF | Variance Impact Factor |
| SD | Standard deviation |
| ANOVA | Analysis of Variance |
| | |

Supplementary Information

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Supplementary Material 1

Supplementary Material 2

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Author contributions

Study design: Ying Zeng, Qian-qian Yue, Ge-hui Feng and Tong Peng; Data collection: Qian-qian Yue, Tong Peng, Tian Tang, Ying-xue Sun, Xin-ru Meng, Ge-hui Feng, Ke-hao Zhao, Li-li Huang; Data analysis: Ying Zeng, Qian-qian Yue,

Tong Peng, Ge-hui Feng; Manuscript writing: Ying Zeng, Qian-qian Yue, Tong Peng, Ge-hui Feng, Tian Tang.

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Data availability

The datasets (SPSS and data collection tools) used and/or analyzed during the current study will be available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate

This study was approved by Hengyang Medical School, University of South China (NO.4502101003887). All participants will be required to provide written informed consent, for more details see the supplementary materials. Overall, the entire methods in this study were performed in accordance with international and national ethical guidelines and regulations.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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