



Original Article

Character strength patterns, social support and psychological distress in adolescents and young adults with cancer: A multicenter cross-sectional study



Ning Qin^{a,b}, Yinglong Duan^a, Yi Zhou^a, Yuxuan Li^b, Juan Luo^b, Yue Kang^b, Jian Zhou^c, Jianfei Xie^{a,*}, Andy S.K. Cheng^d

^a Nursing Department, The Third Xiangya Hospital, Central South University, Changsha, China

^b Xiang Ya Nursing School, Central South University, Changsha, China

^c College of Mechanical and Vehicle Engineering, Hunan University, Changsha, China

^d School of Health Sciences, Western Sydney University, Sydney, Australia

ARTICLE INFO

Keywords:

Character
Psychological distress
Social support
Cancer
Young adult
Gender difference

ABSTRACT

Objective: Adolescents and young adults with cancer (AYAC) experience severe psychological distress worldwide. Social support was associated with reduced distress among cancer patients, but the role of character strength patterns in this association is unexplored. This study explored whether character strength patterns influence the association between social support and psychological distress in AYAC.

Methods: A multicenter cross-sectional study was conducted at four hospitals in Changsha, China. Participants completed questionnaires assessing sociodemographic, distress, social support, and character strengths. Latent profile analysis determined character strength patterns, and multiple linear regression models examined the association. Interaction terms tested moderation effects, and adjusted models examined confounding, all stratified by gender.

Results: Among 728 participants, three character strength patterns emerged: low (LCS), moderate (MCS), and high (HCS). Across all patterns, higher social support was significantly associated with lower distress in AYAC (female: $\beta = -0.124$, 95% CI = -0.051 to -0.015 ; male: $\beta = -0.180$, 95% CI = -0.080 to -0.030 ; $P < 0.001$). AYAC with MCS and HCS experienced significantly less distress than those with LCS, across both genders. However, the association between character strength patterns and lower distress was stronger in males (MCS: $\beta = -0.384$, 95% CI = -1.898 to -1.033 ; HCS: $\beta = -0.777$, 95% CI = -3.420 to -2.495 ; $P < 0.001$) compared to females (MCS: $\beta = -0.284$, 95% CI = -1.215 to -0.700 ; HCS: $\beta = -0.593$, 95% CI = -2.776 to -2.102 ; $P < 0.001$).

Conclusions: Character strength patterns didn't moderate or confound the association between social support and psychological distress, but had stronger protective effects against psychological distress than social support. Higher character strength patterns showed a stronger association with lower psychological distress, especially for males.

Introduction

Psychological distress is a significant mental health challenge for adolescents and young adults with cancer (AYAC) globally, defined by the National Comprehensive Cancer Network (NCCN) as “a multifactorial, unpleasant experience of a psychologic, physical, social, or spiritual nature.”¹ The distress encompasses emotions such as depression, anxiety, panic, sadness, sleep disturbances, and feelings of helplessness.² Systematic reviews^{3,4} have revealed a high prevalence of psychological distress among cancer patients worldwide, ranging

from 25.3% to 71.7%. AYAC aged 15–39 years are particularly vulnerable due to the developmental transitions they experience, reporting more severe distress (39.4% to 83.4%) compared to older adults and pediatric patients.^{5,6} Long-term psychological distress adversely worsens sleep quality, overall quality of life,² and mental health outcomes,⁷ leading to increased psychosocial costs as well as annual medical expenses ranging from \$993 to \$9690 per person.⁸ Furthermore, it has been associated with increased mortality rates for specific cancers.⁹ Thus, it is urgent to address the burden of psychological distress among AYAC.

* Corresponding author.

E-mail address: xiejianfei@csu.edu.cn (J. Xie).

<https://doi.org/10.1016/j.apjon.2024.100609>

Received 27 August 2024; Accepted 17 October 2024

2347-5625/© 2024 The Authors. Published by Elsevier Inc. on behalf of Asian Oncology Nursing Society. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Social support is acknowledged as an important resource for promoting mental health and reducing psychological distress.¹⁰ Studies have shown that social support is negatively associated with psychological distress in AYAC.^{11,12} Character strengths, defined as positive psychological traits, contribute not only to personal growth and well-being but also enhance community cooperation, resilience, and the capacity to cope with life's challenges.¹³ Research has indicated that individuals who effectively utilize their character strengths are more likely to attract social support and derive greater benefits from it.¹⁴ However, to our knowledge, no studies have directly examined how character strengths might influence the association between social support and psychological distress in AYAC.

According to stress-coping theory, individual responses to and evaluations of stressors can significantly shape their mental health outcomes.¹⁵ Character strengths, particularly those that enhance an individual's ability to cope with adversity, may act as a moderator in the association between social support and psychological distress.¹⁶ Specifically, individuals with high levels of character strengths may be better positioned to leverage social support, thereby reducing psychological distress more effectively. Conversely, those with lower levels of character strengths may struggle to utilize social support resources fully, limiting the potential benefits of social support in mitigating psychological distress. This suggests that character strengths might serve as a moderator, altering the strength or direction of the associations between social support and psychological distress. Additionally, conservation of resources theory provides a complementary theoretical rationale for the moderating role of character strengths. This theory posits that individuals strive to protect and build resources to combat stress.¹⁷ Character strengths, as an internal resource, enhance an individual's capacity to utilize external resources such as social support.¹⁸ This supports the hypothesis that character strengths may moderate the extent to which social support influences mental health outcomes. Alternatively, character strengths could serve as a confounder, where it simultaneously influences both social support and psychological distress resulting in a spurious association between the two. In this scenario, individuals with higher character strengths may report both greater social support¹⁹ and lower psychological distress,⁵ but the relationship between social support and distress may be explained largely by their character strengths rather than a direct causal link between social support and distress.

Several studies have identified patterns of character strengths within populations, offering additional insights into their potential role in moderating the relationship between social support and psychological distress. For example, Duan and Wang²⁰ employed latent profile analysis (LPA) to identify two distinct character strength patterns among community participants: the at-strengths group and the at-risk group. The at-strengths group exhibited fewer negative emotional symptoms and reported better psychological well-being. Similarly, Ford et al.²¹ identified four distinct character strength patterns among individuals aged from 18 to 68 years, revealing significant associations between these patterns and overall well-being across various domains. These findings^{20,21} suggest that character strengths tend to cluster within individuals and that different patterns of strengths are associated with varying levels of mental health. However, there remains a dearth of specifically addressing character strength patterns among AYAC. Identifying unique patterns of character strengths within this population may provide valuable insights into the differential effects of social support and guide the development of more personalized psychological interventions.

These above findings underscore the importance of examining the potential influence that character strength patterns may have on the association between social support and psychological distress. Neglecting character strengths may misidentify social support as a factor directly associated with psychological distress, when this association might only apply to certain AYAC (i.e., those with high character strengths) or be influenced by a third variable (i.e., character strengths). Such misidentification could result in ineffective or inefficient interventions, assuming all patients benefit equally from social support. However, those with

lower levels of character strengths may not experience the expected psychological improvements, and could even face worsening distress due to an inability to fully utilize available social support resources. Furthermore, failing to recognize the role of character strengths can also lead to the misallocation of resources, neglecting the need for individualized psychological interventions, thereby affecting the overall therapeutic outcome.

LPA is a popular person-centered approach for modeling categorical latent variables using continuous indicators. It can help identify profiles of individuals with similar variable patterns, illustrating how these variables combine into profiles and relate differently to predictors and outcomes. LPA is particularly useful for research that involve qualitatively distinct configurations of multiple variables, which are challenging to represent with other methods like moderated regression analyses with multiple interaction terms.²² Therefore, this study used LPA to determine character strength patterns. Additionally, research has identified gender differences in the associations between social support and psychological distress among young adults,²³ as well as differences in the relationship between character strengths and psychological distress based on gender.²⁴ These findings imply that gender may have an impact on these associations.

Thus, this study first determined character strength patterns using LPA to clarify the cluster features, and then examined the cross-sectional association between social support and psychological distress among AYAC, while accounting for character strength patterns, by examining whether they moderate or confound the association. To test whether the associations varied by gender, analyses were conducted for male and female, separately. The findings may provide us with a clearer understanding as to the role that social support play in improving psychological distress and if this positive association exists for all AYAC regardless of their patterns of character strengths. Such knowledge may inform the content and appropriate targets for interventions focused on improving the psychological distress among AYAC.

Methods

Study design

This study used a multicenter cross-sectional design, adhering to the Helsinki Declaration. The STROBE statement was used as a guide for reporting the study methodology and findings.²⁵

Setting and participants

The eligible participants were recruited between June and December 2019 from three university-affiliated general hospitals and one specialized oncology hospital in Changsha, China. These general hospitals encompass over 42 clinical departments, providing comprehensive care for patients with various types of cancer. The specialized oncology hospital, accredited by the Joint Commission International, comprises 58 clinical medical technology departments and serves as a national regional medical center, admitting cancer patients from all regions of China. Each hospital has a capacity of over 2000 beds. The inclusion criteria for participants were as follows: 1) individuals aged 15–39 years at the time of primary cancer diagnosis²⁶ (there is currently no officially standardized definition of AYAC in China. However, most Chinese scholars and clinicians adopt the age range of 15–39 years,^{27–29} aligning with NCCN guidelines³⁰); 2) confirmed pathological diagnosis of malignancy; 3) inclusion of eight common cancer types based on cancer sites,³¹ namely, digestive cancer, hematological cancer, gynecological cancer, lung cancer, breast cancer, head and neck cancer, skin cancer, and other malignancies due to the relatively low reported cancer incidence rates in adolescents and young adults;³² 4) current active hospital-based treatment at the aforementioned general hospitals. Participants were excluded if they had a psychiatric illness, cognitive/intellectual impairment, or drug/alcohol dependence. To ensure representation

across different cancer types, a quota of 100 participants per cancer type was established in the recruitment process.

Data collection

The research team consisted of 1 chief nurse, 2 associate chief nurses, six nursing postgraduates, and 1 research assistant (RA). The chief nurse assumed the role of ensuring quality control and overseeing the survey process. The associate chief nurses were responsible for training the nursing postgraduates (who served as the investigators) and coordinating the survey activities. The investigators conducted face-to-face interviews with the participants following standardized training. During these interviews, the investigators first introduced themselves to build trust, explained the purpose of the study, the expected time to complete the questionnaire (approximately 15–20 minutes), and highlighted the potential benefits, such as gaining a better understanding of their psychological health, which could positively impact their overall well-being. Participants were assured that their responses would remain confidential, with anonymity maintained and no personally identifiable information collected. They were informed of their voluntary participation and the ability to withdraw at any point. The investigators expressed gratitude for their involvement. Each participant was assigned a unique identification number, and after completing the paper-based questionnaire, the investigator reviewed the responses on-site to check for any missing information or logical inconsistencies. If any issues were found, the investigator clarified them with the participant. Once the data collection was completed, the investigator was responsible for entering the data, and the RA cross-checked the digital entries against the original paper-based forms, ensuring accuracy, completeness, and consistency by verifying the data against the participant's assigned number. In terms of participant recruitment, after obtaining approval from hospital management, the research team collaborated with the nurse managers of relevant departments to secure agreement. The Hospital Information System was used to screen for potential participants who met the study criteria. The data collection will continue until the number of participants for each cancer type reaches 100 cases before it is stopped. A total of 800 questionnaires were distributed to eligible participants, and 728 (91.00%) were deemed valid and included in the analysis. No significant sociodemographic differences were found between valid and invalid questionnaires (Chi-square, $P > 0.05$).

Variables

Psychological distress

The Distress Thermometer (DT) is a validated tool developed by the NCCN for effectively assessing psychological distress.²⁵ It is a self-reported measure utilizing an 11-point numeric rating scale ranging from 0 (no distress) to 10 (extreme distress). A higher score on the DT indicates a higher level of psychological distress. In Asian cancer patients, a score of four or higher is considered indicative of psychological distress.³³ The test–retest correlation coefficient for DT in Chinese cancer patients was 0.80, showing acceptable reliability.³⁴ It has been confirmed as an effective screening tool for AYA cancer in China, with a sensitivity of approximately 0.977 at a cutoff score of 4.³⁵

Social support

The Social Support Scale (SSRS), developed by Chinese scholar Shuiyuan Xiao in 1986, is a well-established tool used to assess the type and level of social support received.³⁶ The SSRS has ten items that encompass three dimensions: objective support (items 2, 6, and 7; for example, item 7: In the past, what sources of comfort and care have you received during difficult times?), subjective support (items 1, 3, 4, and 5; for example, item 1: How many close friends do you have and how much assistance they can provide for you if needed?), and utilization of support (items 8, 9, and 10; for example, item 9: What methods do you use to seek help when you encounter difficulties?). Most items are scored on a scale

of 1–4 points. For items six and 7, a score of 0 is assigned if there is no available source of support, while each listed source receives a score of one if one is present. The total SSRS score ranges from 11 to 66, with a higher score indicating a higher level of social support. The SSRS has shown good reliability with a test–retest correlation coefficient of 0.92³⁶ and has been validated among AYAC in China.¹¹

Character strengths

The three-dimensional inventory of character strengths (TICS) was developed by Chinese scholars Weijie Duan and He Bu in 2017 as a measure of individuals' character strengths. The TICS consists of 15 items organized into three dimensions: caring, inquisitiveness, and self-control, with each dimension comprising 5 items. The self-reported measure employs a five-point Likert scale ranging from 1 (very much unlike me) to 5 (very much like me). The average score of all TICS items is used to assess one's overall level of character strengths. The TICS has demonstrated acceptable reliability, with a Cronbach's α above 0.74 for the total scale and above 0.79 for each dimension,³⁷ and has been validated among AYAC in China.⁵

Covariates

Sociodemographic characteristics were included as covariates based on evidence from previous literature,^{5,11,38} encompassing factors such as gender, age, education, marital status, residence, income, medical insurance, cancer type, time since diagnosis, treatment plan, and the presence of comorbidities.

Study size

The sample size was determined using two methods. Firstly, for multivariate linear regression analysis, a sample size of at least 15–25 times the number of independent variables is recommended.³⁹ Since there were 13 potential independent variables in this study, a minimum sample size of 195 was calculated for each multivariate linear regression model. For the LPA, past research suggests that a sample size of around 500 is reasonable.²² Considering potential invalid questionnaires, the sample size was increased by 20%. Consequently, the minimum sample size required for this study was calculated to be 675.

Data analysis

The data analysis was conducted using the statistical software Mplus Version 8.3 and IBM SPSS Statistics Version 26.0. The LPA was employed to determine the patterns of character strengths based on the mean scores of the three dimensions: caring, inquisitiveness, and self-control. To identify the optimal number of profiles, we tested five profiles ranging from 1 to five classes. The fit of each model was evaluated using several metrics: Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), adjusted BIC (aBIC), P value for Lo-Mendell-Rubin Adjusted Likelihood Ratio Test (LMR–LRT), and entropy.⁴⁰ Lower values of AIC, BIC, and aBIC indicate better model fits. A significant value of LMR–LRT indicates a significant improvement in fit. The classification accuracy of the profiles was assessed using entropy, which ranges from 0 to 1. A higher entropy value indicates a more accurate classification.

Descriptive statistics were used to describe the sociodemographic characteristics of the participants. Categorical variables were presented as frequencies and percentages (%). The normality of continuous variables (psychological distress, social support, and its dimensions) was assessed using skewness and kurtosis statistics. Since the skewness and kurtosis were less than 1, it can be assumed that the continuous variables approximated a normal distribution. These variables were described using the mean \pm standard deviation ($M \pm SD$). To examine the differences in psychological distress among sociodemographic groups, independent t test and one-way analysis of variance were performed. For multiple groups, the Bonferroni test was used for pairwise comparisons. Welch analysis was used when the variance was not homogeneous. To

explore whether character strength patterns moderated the association between social support and psychological distress, we employed multiple linear regression models. These models included social support, character strength patterns and their interaction terms as independent variables, with psychological distress as the dependent variable. Character strength patterns were set as dummy variables for the analysis. This study identified three character strength patterns and used two dummy variables with low character strengths as the reference group. For the dummy variables, a match was set to "1" and a non-match was set to "0". To examine whether character strength patterns confounded the association between social support and psychological distress using multiple linear regression adjusted for character strength patterns. All models were stratified by gender and other sociodemographic variables that differ statistically between groups were included as covariates. A value of $P < 0.05$ was considered statistically significant except for interaction terms, for which $P < 0.017$ was considered significance.

Ethical considerations

This study was approved by the Institutional Review Board of the Third Xiangya Hospital, CSU (IRB No. E2021153). Prior to conducting the survey, informed consent was obtained from adult participants (≥ 18 years) and from the guardians of underage participants. The survey was conducted anonymously and did not collect any personal privacy information, such as name, identity card number, address, or telephone number.

Results

Sociodemographic characteristics

Among the 728 AYAC participants, nearly three-fifths were female. Approximately two-thirds were over 30 years, and about half had college/university education or above. Around three-quarters were married, and about seven-tenths resided in urban areas with a monthly family income exceeding 425.29 USD. The majority had medical insurance. The distribution of cancer types showed that each type accounted for more than 10% of the sample. Over half were diagnosed within the past 6 months, and more than two-fifths had received a comprehensive treatment plan. Additionally, more than half had one or more comorbidities. Univariate analyses indicated that gender, age, education, marital status, residence, income, cancer type, time since diagnosis, treatment plan, and presence of comorbidities were significantly associated with psychological distress among AYAC ($P < 0.05$). Participants who were female, aged 21–30 years, with an education level of junior high school and below, unmarried/divorced/widowed, from rural areas, with lower income, diagnosed with breast cancer less than 6 months ago, undergoing chemotherapy/radiotherapy, or having comorbidities, experienced significantly higher levels of psychological distress. More details are shown in Table 1.

Character strength patterns

The average score for character strengths was 47.34 ± 10.72 , and the average scores for caring, inquisitiveness, and self-control on each item were 3.37 ± 0.87 , 2.85 ± 0.74 and 3.24 ± 0.98 , respectively. The LPA was employed to identify patterns of character strengths, with the model fit indexes of the LPA results presented in Table 2. Although Profile 4 exhibited the highest entropy and a significant value ($P < 0.05$) for LMR–LRT, the relative frequency for the smallest class was less than 25 (10/1.37%);²² hence, the suboptimal model- Profile 3-was ultimately selected. Fig. 1 shows the means of character strengths across the three profiles among AYAC. Latent Class 1 was labeled as "low character strengths" (LCS), representing 28.57% ($n = 208$) of the participants. This group had the lowest levels of caring, inquisitiveness, and self-control. Latent Class 2 was labeled as "moderate character strengths" (MCS),

comprising 42.03% ($n = 306$) of the participants. They demonstrated moderate levels of caring, inquisitiveness, and self-control. Latent Class three was labeled as "high character strengths" (HCS), constituting 29.40% ($n = 214$) of the participants, and exhibited the highest levels of caring, inquisitiveness, and self-control.

The association between social support and psychological distress

Females

The results showed no significant moderate effect by character strength patterns on the association of social support with psychological distress among females. While the interaction term for social support and HCS was found to be statistically significant in the unadjusted model (Model 0), none of the interaction terms included in the adjusted model (Model 1) were statistically significant with all P values greater than 0.017 (Table 3). Higher social support was associated with lower psychological distress among females ($\beta = -0.154$, 95% CI = -0.063 to -0.019 , $P < 0.001$) in Model 2 adjusted for age, education, marital status, residence, income, cancer type, time since diagnosis, treatment plan, and presence of comorbidities adjustments. Attenuation of the effect was minimal among females after adjusting for character strength patterns (Model 3; Table 4). Specifically, higher social support was still associated with lower psychological distress ($\beta = -0.124$, 95% CI = -0.051 to -0.015 , $P < 0.001$) in Model 3. Additionally, higher levels of character strength patterns exhibited a stronger association with lower psychological distress (MCS: $\beta = -0.284$, 95% CI = -1.215 to -0.700 , $P < 0.001$; HCS: $\beta = -0.593$, 95% CI = -2.776 to -2.102 , $P < 0.001$).

Males

Similar to the results among females, there was no significant moderate effect by character strength patterns on the association between social support and psychological distress among males in both unadjusted and adjusted models (Model 0 and Model 1, Table 3). Although the impact of social support on reducing psychological distress was stronger among males ($\beta = -0.250$, 95% CI = -0.107 to -0.046) compared to females, higher social support remained significantly associated with lower psychological distress in both groups ($P < 0.001$). The attenuation of the effect was minimal among males after adjusting for character strength patterns (Model 3; Table 4). Specifically, higher social support was still associated with lower psychological distress (Model 3: $\beta = -0.180$, 95% CI = -0.080 to -0.030 , $P < 0.001$). Additionally, higher levels of character strength patterns were more strongly associated with lower psychological distress in males (MCS: $\beta = -0.384$, 95% CI = -1.898 to -1.033 , $P < 0.001$; HCS: $\beta = -0.777$, 95% CI = -3.420 to -2.495 , $P < 0.001$) compared to females.

Discussion

To our knowledge, this was the first study to determine of character strengths pattern using LPA and explore the role of character strength patterns in the association between social support and psychological distress in AYAC. This study yielded three key findings. Firstly, character strengths among AYAC displayed an aggregation phenomenon, manifesting in three distinct patterns: the LCS group, the MCS group, and the HCS group. Secondly, higher social support was significantly associated with lower psychological distress among AYAC, and this effect was stronger in males than in females. Finally, character strength patterns did not moderate or confound the association in either gender, but higher levels of character strength patterns were more strongly associated with lower psychological distress, with this association being stronger in males than in females.

This study contributed to the understanding of character strengths by identifying three typical patterns among AYAC, which aligned with the findings of Xu Liu et al.⁴¹ who identified three patterns among Chinese children and adolescents, namely high, moderate, and low strength

Table 1
Sociodemographic characteristics of adolescents and young adults with cancer (N = 728).

Characteristics	Total (n = 728)	DT (M± SD)	t/F	P-value
Sex			-6.537	< 0.001
Male	298 (40.93)	4.72 ± 1.88		
Female	430 (59.07)	5.61 ± 1.67		
Age (years)			16.415	< 0.001
≤ 20	31 (4.26)	4.97 ± 1.94 ^a		
21–30	236 (32.42)	5.79 ± 1.67 ^b		
≥ 31	461 (63.32)	4.98 ± 1.82 ^a		
Education			7.250 ^a	< 0.001
Junior high school and below	209 (28.71)	5.74 ± 2.23 ^a		
High school	172 (23.63)	5.12 ± 1.55 ^b		
College/university	313 (42.99)	5.06 ± 1.58 ^b		
Master and above	34 (4.67)	4.50 ± 1.52 ^b		
Marital status			9.877	< 0.001
Unmarried	167 (22.94)	5.73 ± 1.94 ^a		
Married	537 (73.76)	5.07 ± 1.74 ^b		
Divorced/widowed	24 (3.30)	5.79 ± 1.79 ^a		
Residence			-2.550	0.011
Urban	511 (70.19)	5.12 ± 1.58		
Rural	217 (29.81)	5.54 ± 2.24		
Income (USD^a/month)			26.145 ^a	< 0.001
< 425.29	239 (32.83)	5.69 ± 2.29 ^a		
425.29–708.85	378 (51.92)	5.31 ± 1.18 ^b		
≥ 708.85	111 (15.25)	4.05 ± 1.94 ^c		
Medical insurance			1.553	0.129
Yes	690 (94.78)	5.28 ± 1.75		
No	38 (5.22)	4.61 ± 2.65		
Cancer type			20.035 ^a	< 0.001
Digestive system	88 (12.09)	5.78 ± 2.12 ^a		
Hematological	89 (12.23)	5.57 ± 0.99 ^{a,b,d}		
Gynecologic	91 (12.50)	5.97 ± 1.36 ^{a,b}		
Lung	93 (12.77)	5.33 ± 0.81 ^{a,d}		
Breast	96 (13.19)	6.21 ± 1.85 ^b		
Head and neck	95 (13.05)	4.18 ± 1.50 ^c		
Skin	90 (12.36)	4.98 ± 1.29 ^d		
Others	86 (11.81)	3.87 ± 2.53 ^c		
Time since diagnosis (months)			6.747	0.001
< 6	390 (53.57)	5.45 ± 1.91 ^a		
6–12	142 (19.51)	5.12 ± 1.77 ^{a,b}		
≥ 12	196 (26.92)	4.92 ± 1.56 ^b		
Treatment plan			87.923 ^a	< 0.001
Surgery	275 (37.77)	4.26 ± 1.99 ^a		
Chemotherapy/radiotherapy	140 (19.23)	6.35 ± 1.22 ^b		
Surgery + chemotherapy/radiotherapy	313 (42.99)	5.61 ± 1.40 ^c		
Presence of comorbidities			6.578	< 0.001
Yes	378 (51.92)	5.66 ± 1.51		
No	350 (48.08)	4.79 ± 1.99		

The letters a, b, c, d indicate pairwise comparisons: comparisons that did not differ significantly are indicated by the same letter. Bold indicates findings that are of particular importance to the study.

^a Welch analysis because the variance was not homogeneous. DT, Distress Thermometer; M±SD, mean ± standard deviation; USD, United States Dollars (1 USD ≈ 7.05396 CNY, October 8, 2024).

Table 2
Model fit indexes of latent profile analysis of character strengths in adolescents and young adults with cancer (N = 728).

Profile	K	AIC	BIC	aBIC	Entropy	LMR-LRT	Proportion (%)
1	6	5529.506	5557.048	5537.996	–	–	100.00
2	10	4935.360	4981.263	4949.510	0.829	0.000	61.40/38.60
3	14	4688.135	4752.399	4707.945	0.826	0.000	28.57/29.40/42.03
4	18	4659.737	4742.362	4685.207	0.868	0.0002	27.47/1.37/42.31/28.85
5	22	4621.075	4722.062	4652.205	0.797	0.5480	21.57/26.24/7.56/19.64/25.00

k, free parameters; AIC, Akaike information criterion; BIC, Bayesian information criterion; aBIC, Adjusted BIC; LMR-LRT, Lo-Mendell-Rubin Adjusted Likelihood Ratio Test.

Bold indicates the best model.

groups. However, it is worth noting that some previous studies have reported somewhat inconsistent results. Duan and Wang²⁰ identified two distinct patterns among community participants, who were recruited through social network platforms, with an average age of 23.96 ± 5.13 years, ranging from 17 to 50. These differences could be attributed to variations in the study population. In this study, the lower level of inquisitiveness may have contributed to differences in the LPA results,

which could be influenced by factors such as age and cancer diagnosis. Previous evidence suggested that inquisitiveness tends to decline with age,⁴² and the relatively young age of the participants in Duan et al.'s study may also explain the differences. Meanwhile, AYAC were at a higher risk of experiencing low well-being compared to the general population,⁴³ potentially resulting in a decrease in inquisitiveness.⁴⁴ Furthermore, cancer treatments usually cause significant physical fatigue



Fig. 1. Means of the across three profiles (n = 728).

and discomfort, which may lead to a lack of energy and motivation to explore new things, thereby diminishing inquisitiveness.⁴⁵ Another study by Ford et al.,²¹ which utilized the 24 Values In Action Inventory (VIA) combined with spirituality, identified four distinct patterns among individuals aged 18–68 years. The discrepancy in the findings could be attributed to differences in the assessment instruments used to measure character strengths. The VIA had more dimensions compared to the TIGCS, which may result in a larger number of profiles.⁴⁰ Nonetheless, it is

important to note that all the aforementioned studies, including this study, categorized the final character strength patterns based on a high-low grade system. Dimension scores within the same grade were consistently distributed within the same pattern, and no single dimension dominated a particular pattern, showing a stable structure of character strengths and the importance of comprehensive interventions. These findings provide a foundation for further exploration and categorization of character strengths. Future research should investigate the formation mechanisms and developmental trajectories of these strengths, explore the interactions between different dimensions and their combined impact on psychological health, and focus on designing interventions that encompass a broad range of character strengths.

This study provided evidence supporting a negative association between social support and psychological distress, which was in line with previous studies.^{11,12} This discovery underscored the critical role of social support in alleviating psychological distress and improving the mental health of individuals battling cancer, reaffirming its significance in intervention and treatment strategies.⁴⁶ Furthermore, this study demonstrated that males exhibited a stronger association between social support and psychological distress compared to females. This suggests that the alleviation in psychological distress might be more pronounced among males receiving social support. Gender differences in emotion regulation strategies may explain this finding.⁴⁷ Females commonly display a propensity to experience, express, and ruminate on emotions, while males frequently opt for suppression or avoidance. Consequently, males may tend to seek external support when facing psychological distress.⁴⁸ The enhanced relief effects observed after receiving social support may stem from reduced social inhibition, and males might also be more inclined than females to engage in problem-solving and cognitive reappraisal.⁴⁹

Table 3

Multivariate linear regression models examining associations of social support with psychological distress, moderated by character strength patterns.

Outcomes	Female		Male	
	β (95% CI)	P value	β (95% CI)	P value
Model 0 ^a				
Social support	-0.088 (-0.052, 0.005)	0.107	-0.179 (-0.114, 0.005)	0.071
LCS(Ref)				
MCS	-0.138 (-2.187, 1.257)	0.596	-0.530 (-4.927, 0.881)	0.171
HCS	0.143 (-1.692, 2.866)	0.613	-0.524 (-4.973, 0.986)	0.189
Social support × MCS	-0.185 (-0.056, 0.026)	0.479	0.106 (-0.061, 0.079)	0.792
Social support × HCS	-0.875 (-0.135, -0.029)	0.002	-0.383 (-0.103, 0.039)	0.372
Model 1 ^b				
Social support	-0.056 (-0.042, 0.012)	0.281	-0.181 (-0.114, 0.004)	0.065
LCS(Ref)				
MCS	-0.022 (-1.705, 1.558)	0.929	-0.617 (-5.199, 0.493)	0.105
HCS	-0.001 (-2.187, 2.176)	0.996	-0.535 (-4.986, 0.911)	0.175
Social support × MCS	-0.266 (-0.060, 0.018)	0.283	0.237 (-0.048, 0.090)	0.548
Social support × HCS	-0.610 (-0.108, -0.007)	0.027	-0.244 (-0.091, 0.050)	0.566

β, standardized coefficient; CI, confidence interval; HCS, high character strengths; LCS, low character strengths; MCS, moderate character strengths.

^a Model 0: adjusted for no covariates.

^b Model 1: adjusted for age, education, marital status, residence, income, cancer type, time since diagnosis, treatment plan, and presence of comorbidities.

Table 4

Multivariate linear regression models examining associations of social support with psychological distress, adjusting for character strength patterns.

Outcome	β (95% CI)			
	Female		Male	
	Model 2 ^a	Model 3 ^b	Model 2 ^a	Model 3 ^b
LCS(Ref)				
MCS		-0.284 (-1.215, -0.700) ^c		-0.384 (-1.898, -1.033) ^c
HCS		-0.593 (-2.776, -2.102) ^c		-0.777 (-3.420, -2.495) ^c
Social support	-0.154 (-0.063, -0.019) ^c	-0.124 (-0.051, -0.015) ^c	-0.250 (-0.107, -0.046) ^c	-0.180 (-0.080, -0.030) ^c

β, standardized coefficient; CI, confidence interval; HCS, high character strengths; LCS, low character strengths; MCS, moderate character strengths.

^a Model 2: adjusted for age, education, marital status, residence, income, cancer type, time since diagnosis, treatment plan, and presence of comorbidities.

^b Model 3: adjusted for model 2 covariates plus character strength patterns.

^c Significant results at P < 0.001.

It has been argued that positive character strengths can help individuals actively seek and effectively utilize social support to cope with stress and challenges,¹⁴ and they were associated with better mental health, such as lower psychological distress, negative emotions, and higher well-being.^{5,20,21} However, this study found no evidence that character strength patterns significantly moderated or confounded the association between social support and psychological distress in either gender. Although an interaction term (Social support \times HCS, $P < 0.017$) was significant in the unadjusted model, all interaction terms were not significant in the adjusted model. This may be attributed to the fact that the adjusted model took into account potential covariates, such as age, marital status, income, treatment plan and cancer type,⁵ which could influence psychological distress, thereby enhancing its reliability compared to the unadjusted model. The following reasons may be used to explain this nonsignificant result. Character strengths and social support are fundamentally different; the former are internal attributes that reflect an individual's values and behaviors, while the latter is an external support system. They have distinct mechanisms of action on psychological distress and may operate independently. Therefore, although character strengths and social support can influence each other to some extent,¹⁴ their interrelationships and moderating effects may not be direct or straightforward.

In this study, character strength patterns have a stronger protective effect in reducing psychological distress than social support, which corresponds with previous studies.⁵ Moreover, higher levels of character strength patterns showed a stronger association with lower psychological distress, which was in accordance with the previous literature.^{20,21} From the perspective of positive psychology, character strengths represent an individual's inner resources, which can enhance their ability to cope and make them more resilient and adaptable in the face of stress and challenges. Therefore, cultivating an individual's positive character strengths can significantly improve their happiness and mental health. A systematic review further supported this view, showing that interventions based on character strengths can effectively enhance the self-esteem of patients with chronic diseases and significantly improve self-efficacy, thereby improving mental health.⁵⁰ Individuals with higher character strengths were likely to have better problem-solving skills, higher self-efficacy, and more adaptive coping strategies, which collectively buffered against the within-person effects of specific stressor perceptions on distress.⁵¹ Additionally, males exhibited a stronger association between character strength patterns and psychological distress compared to females. This may be attributed to differences in the utilization of emotional regulation strategies. Research has suggested that character may predict the utilization of emotional regulation strategies, with individuals possessing strong character strengths more inclined to employ adaptive emotion regulation strategies.⁵² Males were more likely to suppress or avoid emotions, potentially relying more on the internal resources provided by character strengths, such as resilience, hope, and self-confidence. These strengths assist males in better identifying and handling emotions and effectively utilizing external resources, thereby alleviating psychological distress.⁴⁹ Thus, character strengths help males in using adaptive emotion regulation strategies more effectively, avoiding maladaptive strategies, and thereby managing psychological distress.

Implications for nursing practice and research

Firstly, this study determined three distinct character strength patterns among AYAC. By recognizing the characteristics of these different patterns, psychological rehabilitation resources can be allocated more effectively. For AYAC exhibiting lower patterns of character strengths, providing character strength-based psychotherapies,³⁵ can assist in enhancing their psychological resilience and coping abilities. Secondly, higher social support was significantly associated with lower psychological distress among AYAC, particularly among males. This highlights the need for gender-sensitive approaches in psychological interventions. Tailored strategies, such as establishing male-specific support groups or

offering personalized counseling, could address the unique psychological needs of males. For example, group therapy sessions that encourage open discussions among male peers may foster stronger support networks, thereby reducing psychological distress. Thirdly, the findings challenged the assumption of character strength pattern as a moderating variable, prompting researchers to rethink and revise existing theories. This can lead to a more accurate understanding of the complex associations between social support, character strengths and psychological distress, thus fostering the development and enhancement of theoretical frameworks. Then, character strength patterns were more influential in alleviating psychological distress than social support. Therefore, intervention strategies should prioritize enhancing character strengths while also providing appropriate social support. For example, a combined intervention program might include character strength-building exercises alongside peer support activities,²⁷ creating a holistic approach to psychological rehabilitation for AYAC. Lastly, the more pronounced impact of character strength patterns on psychological distress among males suggests that males might benefit more from strength-based interventions. Psychosocial workers could design gender-sensitive strategies, emphasizing the development of character strengths for males while considering alternative approaches for females. For females, supplementary measures such as mindfulness-based stress reduction or emotional regulation training could enhance the effectiveness of interventions.⁵³ This tailored approach ensures that both genders receive the most appropriate support for their unique psychological profiles.

Limitations

This study has several limitations that warrant consideration. Firstly, the sample was drawn exclusively from a single region in China, which may limit the generalizability of the results to broader populations or different cultural contexts. This geographic focus may also introduce selection bias. Secondly, the use of self-reported measures raises concerns about the potential for recall bias and social desirability bias, which could influence the accuracy of the data reported by participants. Thirdly, the cross-sectional design restricts the ability to infer causal associations between variables, as it captures data at only one point in time. Future studies employing longitudinal designs would be better suited to uncovering the causal mechanisms driving the associations observed in this study.

Conclusions

This study revealed that character strengths among AYAC exhibited an aggregation phenomenon, categorizing participants into three typical patterns: LCS, MCS and HCS. Higher social support was significantly associated with lower psychological distress, with this effect being notably stronger in males compared to females. Importantly, while character strength patterns did not moderate or confound the association in either gender, higher levels of character strength patterns showed a stronger association with lower psychological distress, particularly among males. These findings emphasized that the critical role of both social support and character strengths in influencing psychological distress among AYAC. In light of the distinct character strength patterns identified, personalized intervention strategies should be developed that specifically target the unique needs and strengths of each group. Tailoring interventions to enhance character strengths while leveraging social support could effectively reduce psychological distress, particularly considering the observed gender differences. Future research should focus on implementing and evaluating such personalized interventions to further enhance psychological well-being in AYAC.

CRedit authorship contribution statement

Ning Qin: Conceptualization, Statistical programming, Writing – Original draft. **Yinglong Duan:** Data curation, Statistical programming,

Writing – review. **Yi Zhou, Yuxuan Li, Juan Luo, Yue Kang, Jian Zhou:** Data curation, Writing – review and Editing. **Jianfei Xie:** Conceptualization, Methodology, Resources, Supervision, Project administration, Management, Funding acquisition, Writing – review and Editing. **Andy SK Cheng:** Methodology, Supervision, Writing – review and Editing. All authors had full access to all the data in the study, and the corresponding author had final responsibility for the decision to submit for publication. The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted.

Ethics statement

This study was conducted after obtaining approval from the Institutional Review Board of the Third Xiangya Hospital, CSU (IRB No. E2021153). All participants provided written informed consent.

Funding

This research was supported by the National Natural Science Foundation of China (Grant No. 82073409). The funders had no role in considering the study design or in the collection, analysis, interpretation of data, writing of the report, or decision to submit the article for publication.

Data availability statement

The data that support the findings of this study are available from the corresponding author, Jianfei Xie, upon reasonable request.

Declaration of generative AI and AI-assisted technologies in the writing process

No AI tools/services were used during the preparation of this work.

Declaration of competing interest

The authors declare no conflict of interest.

Acknowledgments

We express our gratitude to all the participants who voluntarily took part in this study, as well as to the dedicated members of the research team who contributed their efforts and expertise.

References

- Holland JC, Bultz BD, National comprehensive Cancer Network (NCCN). The NCCN guideline for distress management: a case for making distress the sixth vital sign. *J Natl Compr Cancer Netw*. 2007;5(1):3–7. <https://pubmed.ncbi.nlm.nih.gov/17323529/>.
- Riba MB, Donovan KA, Andersen B, et al. Distress management, version 3.2019, NCCN clinical practice guidelines in oncology. *J Natl Compr Cancer Netw*. 2019; 17(10):1229–1249. <https://doi.org/10.6004/jnccn.2019.0048>.
- Liu F, Huang J, Zhang L, et al. Screening for distress in patients with primary brain tumor using distress thermometer: a systematic review and meta-analysis. *BMC Cancer*. 2018;18(1):124. <https://doi.org/10.1186/s12885-018-3990-9>.
- Sun H, Lv H, Zeng H, Niu L, Yan M. Distress Thermometer in breast cancer: systematic review and meta-analysis. *BMJ Support Palliat Care*. 2022;12(3):245–252. <https://doi.org/10.1136/bmjspcare-2021-002960>.
- Duan Y, Wang L, Sun Q, et al. Prevalence and determinants of psychological distress in adolescent and young adult patients with cancer: a multicenter survey. *Asia Pac J Oncol Nurs*. 2021;8(3):314–321. <https://doi.org/10.4103/2347-5625.311005>.
- Soleimani M, Kollmannsberger C, Bates A, Leung B, Ho C. Patient-reported psychosocial distress in adolescents and young adults with germ cell tumours. *Support Care Cancer*. 2021;29(4):2105–2110. <https://doi.org/10.1007/s00520-020-05723-3>.
- Chan A, Poon E, Goh WL, et al. Assessment of psychological distress among Asian adolescents and young adults (AYA) cancer patients using the distress thermometer: a prospective, longitudinal study. *Support Care Cancer*. 2018;26(9):3257–3266. <https://doi.org/10.1007/s00520-018-4189-y>.
- Abdelhadi OA, Pollock BH, Joseph JG, Keegan THM. Psychological distress and associated additional medical expenditures in adolescent and young adult cancer survivors. *Cancer*. 2022;128(7):1523–1531. <https://doi.org/10.1002/cncr.34064>.
- Batty GD, Russ TC, Stamatakis E, Kivimäki M. Psychological distress in relation to site specific cancer mortality: pooling of unpublished data from 16 prospective cohort studies. *BMJ*. 2017;356:j108. <https://doi.org/10.1136/bmj.j108>.
- Silvers JA, Peris TS. Research Review: the neuroscience of emerging adulthood - reward, ambiguity, and social support as building blocks of mental health. *JCPP (J Child Psychol Psychiatry)*. 2023;64(7):989–997. <https://doi.org/10.1111/jcpp.13776>.
- Xie J, Ding S, He S, Duan Y, Yi K, Zhou J. A prevalence study of psychosocial distress in adolescents and young adults with cancer. *Cancer Nurs*. 2017;40(3):217–223. <https://doi.org/10.1097/NCC.0000000000000396>.
- Corey AL, Haase JE, Azzouz F, Monahan PO. Social support and symptom distress in adolescents/young adults with cancer. *J Pediatr Oncol Nurs*. 2008;25(5):275–284. <https://doi.org/10.1177/1043454208321117>.
- Mayerson NH. The character strengths response: an urgent call to action. *Front Psychol*. 2020;11:2106. <https://doi.org/10.3389/fpsyg.2020.02106>.
- Strecker C, Huber A, Höge T, Hausler M, Höfer S. Identifying thriving workplaces in hospitals: work characteristics and the applicability of character strengths at work. *Appl Res Qual Life*. 2020;15(2):437–461. <https://doi.org/10.1007/s11482-018-9693-1>.
- Krohnea H. Stress and coping theories. *International Encyclopedia of the Social & Behavioral Sciences*. 2001;2:15163–15170. https://www.researchgate.net/publication/282958312_Stress_and_Coping_Theories.
- Xie J, Liu M, Zhong Z, et al. Relationships among character strengths, self-efficacy, social support, depression, and psychological well-being of hospital nurses. *Asian Nurs Res*. 2020;14(3):150–157. <https://doi.org/10.1016/j.anr.2020.06.002>.
- Hobfoll SE. Conservation of resources. A new attempt at conceptualizing stress. *Am Psychol*. 1989;44(3):513–524. <https://doi.org/10.1037/0003-066x.44.3.513>.
- Mo Q, Tan C, Wang X, Soondrum T, Zhang J. Optimism and symptoms of anxiety and depression among Chinese women with breast cancer: the serial mediating effect of perceived social support and benefit finding. *BMC Psychiatr*. 2022;22:635. <https://doi.org/10.1186/s12888-022-04261-y>.
- Ss H. A study of the effects of managers' good character traits and perceived organizational support of employees. *J Educ Health Promot*. 2021;10. https://doi.org/10.4103/jehp.jehp_531_20.
- Duan W, Wang Y. Latent profile analysis of the three-dimensional model of character strengths to distinguish at-strengths and at-risk populations. *Qual Life Res*. 2018; 27(11):2983–2990. <https://doi.org/10.1007/s11136-018-1933-1>.
- Ford T, Lipson J, Miller L. Spiritually grounded character: a latent profile analysis. *Front Psychol*. 2022;13:1061416. <https://doi.org/10.3389/fpsyg.2022.1061416>.
- Spurk D, Hirschi A, Wang M, Valero D, Kauffeld S. Latent profile analysis: a review and "how to" guide of its application within vocational behavior research. *J Vocat Behav*. 2020;120:103445. <https://doi.org/10.1016/j.jvb.2020.103445>.
- Johansen R, Espetvedt MN, Lyshol H, Clench-Aas J, Myklestad I. Mental distress among young adults - gender differences in the role of social support. *BMC Publ Health*. 2021;21(1):2152. <https://doi.org/10.1186/s12889-021-12109-5>.
- Kim HR, Kim SM, Hong JS, et al. Character strengths as protective factors against depression and suicidality among male and female employees. *BMC Publ Health*. 2018;18(1):1084. <https://doi.org/10.1186/s12889-018-5997-1>.
- Whiston A, Bocking CLH, Semkowska M. Towards personalising treatment: a systematic review and meta-analysis of face-to-face efficacy moderators of cognitive-behavioral therapy and interpersonal psychotherapy for major depressive disorder. *Psychol Med*. 2019;49(16):2657–2668. <https://doi.org/10.1017/S0033291719002812>.
- Johansen SHM, van der Graaf WTA, van der Meer DJ, Manten-Horst E, Husson O. Adolescent and young adult (AYA) cancer survivorship practices: an overview. *Cancers*. 2021;13(19):4847. <https://doi.org/10.3390/cancers13194847>.
- L L, Y D, H C, et al. Effect of group online-based peer support intervention on psychological distress of adolescent and young adult cancer patients: a randomized controlled trial. *Support Care Cancer : official journal of the Multinational Association of Supportive Care in Cancer*. 2024;32(8). <https://doi.org/10.1007/s00520-024-08765-z>.
- Li W, Xu Y, Luo X, et al. Alleviating excessive worries improves Co-occurring depression and pain in adolescent and young adult cancer patients: a network approach. *Neuropsychiatric Dis Treat*. 2022;18:1843–1854. <https://doi.org/10.2147/NDT.S376408>.
- Sun H, Yang Y, Zhang J, et al. Fear of cancer recurrence, anxiety and depressive symptoms in adolescent and young adult cancer patients. *Neuropsychiatric Dis Treat*. 2019;15:857–865. <https://doi.org/10.2147/NDT.S202432>.
- Coccia PF, Pappo AS, Beupin L, et al. Adolescent and young adult oncology, version 2.2018, NCCN clinical practice guidelines in oncology. *J Natl Compr Cancer Netw*. 2018;16(1):66–97. <https://doi.org/10.6004/jnccn.2018.0001>.
- Chen W, Zheng R, Baade PD, et al. Cancer statistics in China, 2015. *CA A Cancer J Clin*. 2016;66(2):115–132. <https://doi.org/10.3322/caac.21338>.
- Miller KD, Fidler-Benaoudia M, Keegan TH, Hipp HS, Jemal A, Siegel RL. Cancer statistics for adolescents and young adults, 2020. *CA A Cancer J Clin*. 2020;70(6): 443–459. <https://doi.org/10.3322/caac.21637>.
- Sun H, Thapa S, Wang B, Fu X, Yu S. A systematic review and meta-analysis of the distress thermometer for screening distress in asian patients with cancer. *J Clin Psychol Med Settings*. 2021;28(2):212–220. <https://doi.org/10.1007/s10880-020-09705-9>.
- Tang LL, Zhang YN, Pang Y, Zhang HW, Song LL. Validation and reliability of distress thermometer in Chinese cancer patients. *Chin J Cancer Res*. 2011;23(1):54–58. <https://doi.org/10.1007/s11670-011-0054-y>.
- Zhou Y, Duan Y, Zhou J, et al. Character strength-based cognitive-behavioral therapy focusing on adolescent and young adult cancer patients with distress: a randomized control trial of positive psychology. *J Happiness Stud*. 2024;25(7):84. <https://doi.org/10.1007/s10902-024-00795-y>.

36. Xiao S. The theoretical basis and research application of the Social Support Rating Scale. *Chin J Clin Psychol*. 1994;(2):98–100. <https://d.wanfangdata.com.cn/periodical/QK199400672019>.
37. Duan W, Bu H. Development and initial validation of a short three-dimensional inventory of character strengths. *Qual Life Res*. 2017;26(9):2519–2531. <https://doi.org/10.1007/s11136-017-1579-4>.
38. Chen J, Zebrack B, Embry L, Freyer DR, Aguilar C, Cole S. Profiles of emotional distress and growth among adolescents and young adults with cancer: a longitudinal study. *Health Psychol*. 2020;39(5):370–380. <https://doi.org/10.1037/hea0000843>.
39. Green SB. How many subjects does it take to do A regression analysis. *Multivariate Behav Res*. 1991;26(3):499–510. https://doi.org/10.1207/s15327906mbr2603_7.
40. Tein JY, Coxe S, Cham H. Statistical power to detect the correct number of classes in latent profile analysis. *Struct Equ Model*. 2013;20(4):640–657. <https://doi.org/10.1080/10705511.2013.824781>.
41. Liu X, Lv Y, Ma Q, Guo F, Yan X, Ji L. The basic features and patterns of character strengths among children and adolescents in China. *Studies of Psychology and Behavior*. 2016;14:167–176. <https://psybeh.tjnu.edu.cn/EN/Y2016/V14/I2/167>.
42. Pelz M, Kidd C. The elaboration of exploratory play. *Philos Trans R Soc Lond B Biol Sci*. 2020;375(1803):20190503. <https://doi.org/10.1098/rstb.2019.0503>.
43. Marchak JG, Christen S, Mulder RL, et al. Recommendations for the surveillance of mental health problems in childhood, adolescent, and young adult cancer survivors: a report from the International Late Effects of Childhood Cancer Guideline Harmonization Group. *Lancet Oncol*. 2022;23(4):e184–e196. [https://doi.org/10.1016/S1470-2045\(21\)00750-6](https://doi.org/10.1016/S1470-2045(21)00750-6).
44. Lydon-Staley DM, Zurn P, Bassett DS. Within-person variability in curiosity during daily life and associations with well-being. *J Pers*. 2020;88(4):625–641. <https://doi.org/10.1111/jopy.12515>.
45. Martinez-Calderon J, García-Muñoz C, Cano-García FJ, Heredia-Rizo AM. Spiritual well-being, faith, meaning in life, peace, and purpose in life for cancer-related fatigue: systematic review with meta-analysis and meta-regressions. *J Cancer Surviv*. 2024. <https://doi.org/10.1007/s11764-024-01579-2>. Published online April 18.
46. Cheng Q, Xie J, Duan Y, et al. The psychological distress of gastrointestinal cancer patients and its association with quality of life among different genders. *Support Care Cancer*. 2024;32(6):329. <https://doi.org/10.1007/s00520-024-08533-z>.
47. Berke DS, Reidy D, Zeichner A. Masculinity, emotion regulation, and psychopathology: a critical review and integrated model. *Clin Psychol Rev*. 2018;66:106–116. <https://doi.org/10.1016/j.cpr.2018.01.004>.
48. Delhom I, Melendez J, Satorres E. The regulation of emotions: gender differences. *Eur Psychiatr*. 2021;64:S836. <https://doi.org/10.1192/j.eurpsy.2021.2209>. S836.
49. Nolen-Hoeksema S. Emotion regulation and psychopathology: the role of gender. *Annu Rev Clin Psychol*. 2012;8:161–187. <https://doi.org/10.1146/annurev-clinpsy-032511-143109>.
50. Yan T, Chan CWH, Chow KM, Zheng W, Sun M. A systematic review of the effects of character strengths-based intervention on the psychological well-being of patients suffering from chronic illnesses. *J Adv Nurs*. 2020;76(7):1567–1580. <https://doi.org/10.1111/jan.14356>.
51. Sivaratnam J, Cabano EMP, Erickson TM. Character virtues prospectively predict responses to situational stressors in daily life in clinical and subclinical samples. *Hist Philos Logic*. 2022;35(4):458–473. <https://doi.org/10.1080/10615806.2021.1967333>.
52. Chae H, Park SH, Garcia D, Lee SJ. Cloninger's TCI associations with adaptive and maladaptive emotion regulation strategies. *PeerJ*. 2019;7:e7958. <https://doi.org/10.7717/peerj.7958>.
53. Teng S, Wang M, Han B, et al. The relationship between post-traumatic stress and negative emotions in patients with breast cancer: the mediating role of emotion regulation. *J Psychosoc Oncol*. 2022;40(4):506–518. <https://doi.org/10.1080/07347332.2021.1950885>.