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Positive psychology in health management

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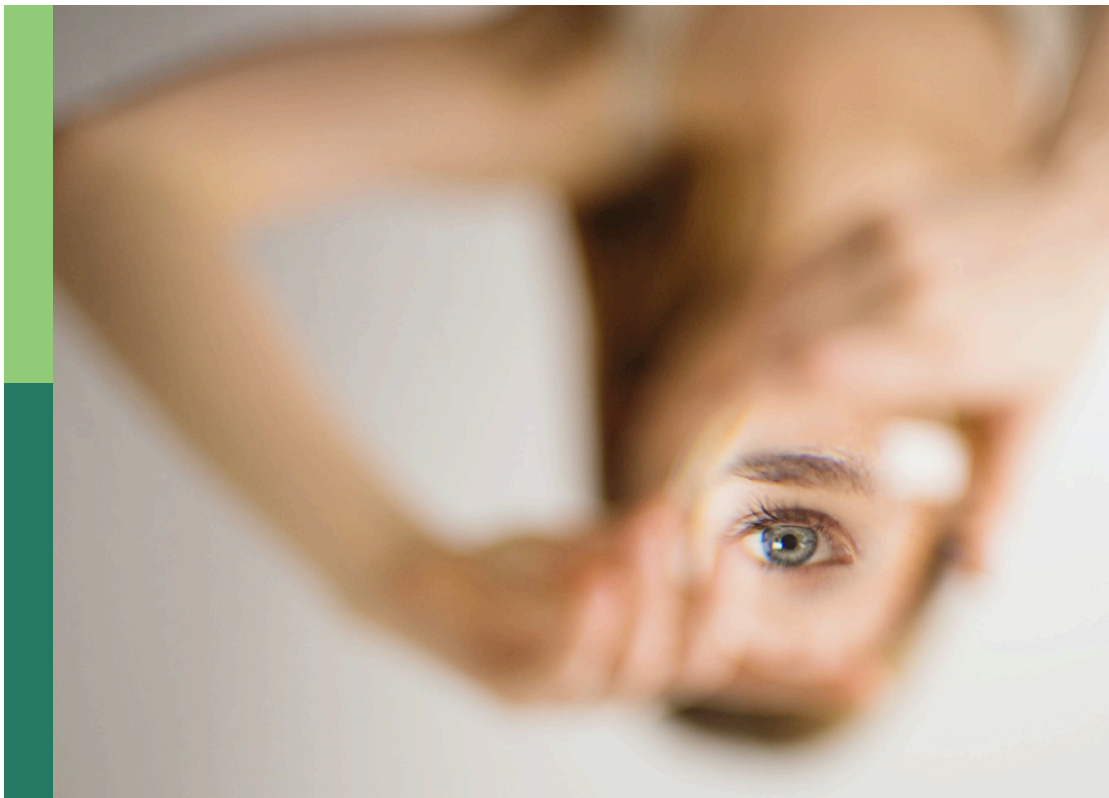

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Positive psychology in health management

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Editorial: Positive psychology in health management

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Editorial on the Research Topic
Positive psychology in health management

Positive psychology aims to understand how people can better their lives, and ultimately, flourish. Since Martin Seligman spearheaded this movement, focusing on the positives in life rather than focusing on the negatives, substantial research has been conducted. This research indicates that positive psychological resources, including resilience, self-efficacy, optimism, hope, self-efficacy, and self-esteem, can assist individuals in developing their personal capabilities. These capabilities are associated with higher levels of physical, psychological, social, and behavioral wellbeing (Seligman, 2019).

Health management is a broad topic encompassing various aspects of health-related issues, involving policy-making, legal regulation, workforce management, healthcare quality, and specific disease management. There has been a noticeable increase in research applying positive psychology to health management (Rusk and Waters, 2013). The growing body of theoretical and empirical studies demonstrates that positive psychological theories have positive effects on the patients' physical and mental health, quality of life, as well as on healthcare workers' job satisfaction, burnout, and quality of work life (Rusk and Waters, 2013; Goyal et al., 2014; Gruman and Budworth, 2022). Over the past decade, disease management and health workforce management have emerged as two major subjects extensively investigated in the context of positive psychology (Aspinwall and Tedeschi, 2010). By integrating positive psychology and health management together, this is field seeks to foster cutting-edge ideas and research to explore multidisciplinary approaches of positive psychology in disease management and health workforce management.

This call for submissions on *Positive psychology and health psychology* has received an excellent response. The Research Topic comprises 16 studies involving over 10 thousands participants, which have garnered a total of 26,525 total views and 7,102 downloads worldwide until drafting this editorial. The studies encompass a diverse range of populations, including patients with conditions such as breast cancer (Ma, Wan et al.), acute leukemia (Peng et al.), and COVID (Zheng et al.), as well as those living with HIV (Orth and Van Wyk) and schizophrenia (Dong et al.). Additionally, it includes studies on populations facing stress, such as general populations (Burke and Dunne), empty nesters (Song et al.), and employees (Bala Subramanian et al.). Furthermore, the Research Topic addresses health providers, including family doctors (Sun et al.), health professionals (Wang et al.) nurses (Guo et al.), and emergency physicians (Xu et al.). It also encompasses studies on various student populations, including college students (Liu et al.; Ma, Li et al.), university students

(Chen et al.), and nursing students (Huang et al.).The findings derived from the current Research Topic align closely with the aims outlined this topic:

1) They demonstrate how the construct of positive psychology mitigates negative consequences for patients and family coping with disease burden. For instance, post-traumatic growth is positively correlated with social support (Ma, Wan et al.). Additionally, the pillars of Lifestyle medicine serve as predictors of psychological flourishing (Burke and Dunne), while resilience mediates mental health literacy and positive coping styles (Song et al.).
2) They also illustrate how the construct of positive psychology mitigates the negative consequences for healthcare workers experiencing job-related stress. This includes the mediating effect of culture on positive leadership and quality of work and life (Sun et al.), as well as individual and organizational resilience acting as predictor of job performance (Wang et al.). Furthermore, psychological capital serve as a predictor of anxiety and depression (Xu et al.), and gratitude mediates distributive justice and organizational citizenship behaviors (Bala Subramanian et al.).
3) The findings demonstrate how positive psychology helps to mitigate the negative consequences of learning stress. This encompasses emotion regulation and positive psychological capital as predictors of depression, with stress beliefs and core self-evaluations of procrastination mediating these effects (Liu et al.; Ma, Li et al.). Additionally, learning motivation and target positioning on emotion regulation and happiness (Chen et al.), while resilience and positive coping style affect the relationship between maladaptive perfectionism and academic procrastination (Huang et al.).
4) They also explore the efficacy, effectiveness and implementation of positive psychology-based intervention for patients or healthcare workers to promote resiliency. This includes cognitive intervention intervention for improving quality of life (Peng et al.), online expressive writing for reducing psychological distress (Zheng et al.), WeChat-based self-compassion training to enhance the treatment adherence (Dong et al.), and a nurse-manager dualistic intervention program to alleviate burnout (Guo et al.).
5) Finally, the findings contribute to the development of culturally sensitive and contextually innovative theories and instruments. Notably, they aid in the conceptualizing of mental wellness among adolescents living with HIV (Orth and Van Wyk). These findings hold significant potential for advancing future theoretical and empirical studies in this field.

However, several limitations should be emphasized here. First, a majority of the articles employed an observational cross-sectional design, primarily focusing on examining mediation or moderation effects. Consequently, the full potential of positive constructs in enhancing long-term adaptation outcomes under stress remains incompletely elucidated (Lam et al., 2012). Secondly, one of our aims was to discern distinct adaptation trajectories under stress, where positive psychological resources could exert an effect. Regrettably, this goal was realized in the current Research Topic. Third, there is a notable scarcity of articles dedicated to theory and instrument development. Future research endeavors should be directed toward formulating novel theories and instruments to delve deeper into the construct within positive psychology (Southwick et al., 2014). Fourthly, the examination of the efficacy, sustainability and implementation challenges of complex intervention programs targeting various health-related stressful population should be the next stride in advancing our understanding (Goyal et al., 2014; Skivington et al., 2021).

Author contributions

AW: Writing – original draft, Writing – review & editing. FH: Writing – review & editing. YG: Writing – review & editing. FL: Writing – review & editing. YS: Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Lifestyle medicine pillars as predictors of psychological flourishing

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Positive Psychology Interventions (PPI) are widely applied to improving wellbeing and helping individuals flourish. At the same time, Lifestyle Medicine (LM) offers an opportunity to boost PPI and psychological research, by expanding its capacity beyond psychology, to include the body and social environment. However, little is known about the relationship between LM and positive psychology flourishing models. Flourishing is as a stage of optimal human functioning that goes beyond moderate wellbeing. The objective of this cross-sectional study was to, (1) identify which of the six LM pillars (sleep, physical exercise, eating well, alcohol intake, social engagement, stress management) best-predicted flourishing; (2) examine the relationship between the number of LM pillars used by individuals and flourishing; and (3) determine the odds of using LM pillars by flourishers. A total of 1,112 participants, mostly female professionals (73%), aged 40–59 (77%), based in Ireland, completed an online survey. Regression analysis showed that all six LM pillars predicted flourishing as measured by the PERMA Profiler (including the Physical Health component) and the Mental Health Continuum (MHC). Moreover, the chi-square and odds ratio analysis showed that those who flourished were three times more likely to use 3–6 LM pillars than those who were moderately well; and nine times more likely than languishers. The results are discussed in the context of their contribution to enhancing the population's health and wellbeing.

KEYWORDS

lifestyle medicine, PERMA model, mental health continuum model, physical health and psychological wellbeing, flourishing, positive psychology

Introduction

Since its inception, positive psychology aimed to explore valued subjective experiences, such as wellbeing (Seligman and Csikszentmihalyi, 2000), which was later renamed flourishing. Flourishing is as a stage of optimal human functioning that goes beyond moderate wellbeing. There are two main models and assessments of flourishing: the Wellbeing Model, otherwise known as the PERMA model (Seligman, 2013), and the

Mental Health Continuum (MHC) Model (Keyes, 2002). While other wellbeing models, such as Psychological Wellbeing (Ryff, 1989), or Subjective Wellbeing (Diener et al., 2018) focus primarily on either affective or cognitive aspects of wellbeing, flourishing models incorporate both. Furthermore, what differentiates flourishing models from other wellbeing frameworks is that they are related to the positive assets that prevent mental illness and improve wellbeing, they combine affective and cognitive components, and they assume that wellbeing is a composite of all the elements comprising the model (Moneta, 2014; Burke and Arslan, 2021). However, more research is required to assess whether the assumptions relating to flourishing models are accurate (Ryff, 2022).

Over the years, a range of Positive Psychology Interventions (PPIs) were developed, that focused on enhancing the positive components of flourishing. These interventions provided evidence that each tool reduces mental health issues and results in positive outcomes, such as wellbeing and associated elements (Parks and Biswas-Diener, 2013). These tools are aimed at altering cognition or affect and include such interventions as gratitude, savoring, and the best-possible-self activities (Sin and Lyubomirsky, 2009; White et al., 2019). The flourishing components of many PPIs also include happiness, relationships and locus of control (Lyubomirsky et al., 2005; Bryant and Veroff, 2007; Round and Burke, 2018; Borelli et al., 2020).

Focused on psychological tools, for years, the field of positive psychology has notoriously disregarded the body (Hefferon, 2016; Burke and Arslan, 2021). However, in recent years, calls to incorporate body and mind have paved the way toward bringing together the fields of positive psychology and lifestyle medicine (LM) (Lianov et al., 2019; Dunne and Schubert, 2021).

Lifestyle medicine involves the use of evidence-based, lifestyle and therapeutic interventions to prevent, treat and reverse non-communicable diseases (NCDs) (Frates et al., 2021). These illnesses include cardiovascular disease (CVD), respiratory disease, Type 2 Diabetes, metabolic syndrome (associated with abdominal obesity, high blood pressure, high fasting blood glucose, and triglycerides as well as abnormal blood cholesterol), certain cancers, mental health issues, and suicide (ACLM, 2022b).

Lifestyle medicine was developed to combat the emerging crisis related to the rise of NCDs, which account for approximately 41 million deaths (71%) globally each year (WHO, 2021). Eighty-five percent of the 15 million premature deaths that happen annually occur in low to middle-income countries (WHO, 2021). The specific causes of these premature deaths include CVD (17.9 million), cancer (9.3 million), respiratory illness (4.1 million), and diabetes (1.5 million) (WHO, 2021). NCD-related premature deaths in Ireland (2019) are attributed to CVD (28.7%), cancer (30.3%), respiratory disease (13.4%), mental disorders (6.3%), and diseases of the digestive system (3.5%) (CSO, 2019).

The risk factors associated with NCDs and premature death are divided into (a) genetic (predominantly of epigenetic origin), (b) environmental (air and water pollution, as well as high UV radiation from the sun), (c) sociodemographic (age, gender, race, ethnicity, general education level, health education literacy, and income), (d) the capacity to self-manage (tobacco and alcohol use, physical activity, weight, food choice, and dental care) and (e) factors related to medical conditions (medications, blood pressure, blood lipids, blood glucose, obesity, and stress) (Budreviciute et al., 2020).

The six pillars of LM include, (1) the consumption of a predominantly whole food, plant-based diet; (2) daily physical activity; (3) adequate sleep; (4) cultivating stress management techniques and behaviors; (5) avoiding risky substances, especially tobacco and alcohol; and (6) social engagement (Frates et al., 2021).

LM recognizes the importance of psychosocial wellbeing, motivation, behavior change science, readiness to change, and the therapeutic alliance between healthcare professionals and service users as significant contributors to a total state of health. Significant interest lies in integrating evidence-based psychosocial interventions such as PPI, with positive lifestyle changes related to the pillars of LM (Morton, 2018; Lianov et al., 2019; Burke and Arslan, 2021; Dunne and Schubert, 2021). However, more research is required to understand the nature and impact of integrating these approaches for better health. Recently, Przybylko et al. (2021) tested a 10-week intervention that combined PP and LM, which resulted in increased levels of flourishing in the experimental group compared with the control group, thus suggesting that LM and PPI can complement each other to enhance positive outcomes (Przybylko et al., 2021). Briefly, 510 participants were recruited into a randomized controlled trial (RCT) designed to test the capacity of a lifestyle intervention, to increase flourishing, compared to a wait-list control group. This 10-week online programme combined PPI approaches (practicing daily positive speech and developing a positive outlook, mindfulness and cultivating kindness for self and others, and exposure to nature) with LM-related practices (eating well, adequate rest and sleep, and daily exercise). Flourishing was measured using the Huppert and So conceptualization (Huppert and So, 2013).

Individual LM pillars can also have a positive impact on wellbeing and mental health. Recently, physical activity was associated with higher wellbeing and better sleep, after 3,323 Iranian citizens were surveyed during community lockdowns throughout the COVID-19 pandemic (Akbari et al., 2021). In addition, a study of more than 80,000 United Kingdom citizens found that eating fruit and vegetables daily, was linked to a significant increase in wellbeing; wellbeing peaked with 7 daily portions of fruit and vegetables (Blanchflower et al., 2013).

Recently, Burke et al. (2022) reviewed PP and LM interventions and reported over 100 tools that demonstrated positive psychological outcomes, such as flourishing for typical

positive-psychological interventions. Therefore, preliminary evidence suggests that PPI and practices can likely synergize health outcomes when integrated with LM approaches and vice versa. However, more evidence is required about the relationship between LM pillars and flourishing.

The aim of this study was to examine the following questions: (1) which of the six LM pillars predicted wellbeing; (2) what is the relationship between the number of LM pillars used and flourishing; and (3) what are the odds of flourishers using LM pillars compared with participants who languished.

Materials and methods

This is a cross-sectional study that uses data collected online between December 2020 and February 2021, the aim of which was to assess participants' wellbeing. The current analysis explored one aspect of the study, i.e., the relationship between the two main flourishing scales the MCC and PERMA Profiler (incl. Physical Health component) with individual LM pillars. This research received ethical approval from the Social Research Ethics Committee at Maynooth University.

Participants

One thousand, one hundred and twelve participants (73% female), located in the Republic of Ireland, completed an online survey. Forty-eight percent were over 50 years of age (n = 498), 36% were aged 40–49 years (n = 396), while 16% were in the 18 to 39 age bracket (n = 178). A purposive sampling method was applied in primary and post primary schools. The inclusion criteria for participation were that participants were over 18 and worked as educational leaders in a school in Ireland. Thus, all the participants were professionals employed by the Department of Education in Ireland. The survey link was sent out *via* social network and educational organizations (Irish Primary Principals Network and National Association of Principals and Deputy Principals) that agreed to disseminate it to their members.

Measures

Lifestyle medicine pillars

Due to the lack of a validated instrument to assess the use of LM pillars, in the current survey, participants were asked a question "*What actions do you take to look after your physical and mental wellbeing? Please tick all that apply*." and requested to tick all the responses that applied to them, thus participants' responses were binary. Their options included: (1) ensuring good sleep hygiene (consistent bedtime, sufficient duration, comfort, darkness, avoid devices emitting blue light, etc.), (2) regular exercise, (3) social activities, hobbies, and interests, (4) healthful food choices most of the time, and (5) moderate alcohol intake. Each option represented the main LM pillars and the prevalent or generic behaviors associated with them. Alcohol was identified as an example of the pillar relating to substance use. In Ireland, one in five adults smoke (Sheridan et al., 2018), while seven out of ten adults consume alcohol regularly (O'Dwyer et al., 2021). Furthermore, Ireland was one of two European countries where alcohol consumption did not decline during the COVID-19 pandemic (Kilian et al., 2021). Therefore, alcohol consumption was selected as the example of substance use in the current study. To identify perceived stress, participants were asked to assess how much stress they experienced in the past 3–4 months, using a 3-point scale (*a little*; *moderate*; *a lot*). The scale was transformed into a binary variable (*a lot of stress*; *moderate*; *a little stress*) to match other variables and conduct the chi-square and the odds analysis. A 3-point scale was used because if binary "stress" vs. "no-stress" options were applied, participants who experience moderate levels of stress would self-identify as being stressed. This would skew the results, given that moderate levels of stress can be good for wellbeing (Aschbacher et al., 2013).

Mental health continuum

Mental health continuum is a 14-item measure on a 6-point Likert scale ranging from "never" to "every day." It comprises three components, (1) emotional, (2) social, and (3) psychological wellbeing. The following is a sample question, "In the past month, how often did you feel . . . satisfied with life." The scale was scored using Keyes's (2009) recommended syntax as continuous data (overall MHC, and its components) and categorical data (flourishing vs. not flourishing; flourishing, moderate health, languishing). Flourishing mental health is reported when individuals experience at least one of the three signs of emotional wellbeing and at least six of the eleven signs of social and psychological wellbeing during the past month "every day" or "almost every day." Individuals who score "never" or "once or twice" during the past month, on at least one measure of emotional wellbeing, and low levels on at least six measures of social and psychological wellbeing are reported as languishing (poor mental health). Individuals who are neither flourishing nor languishing are diagnosed with moderate mental health. Past research showed excellent reliability at a = 0.80 (Keyes, 2009). The reliability in the current sample was also excellent at $\alpha = 0.93$.

PERMA profiler

The PERMA Profiler is a 23-item measure on an 11-point Likert scale. The scale responses range, from "never" to "always," "not at all" to "completely," or "terrible" to "excellent." The PERMA overall score is a mean of five components (Positive Emotions, Engagement, Relationships,

TABLE 1 Participants' prevalence of engaging with lifestyle medicine (LM) pillars.

Lifestyle medicine pillars	*N*	%
Sleep hygiene	633	56.9
Regular exercise	680	61.2
Social activities	434	39
Healthful food choices	650	58.5
Moderate alcohol intake	572	51.4
Perceived stress	295	26.5

Meaning in Life, Accomplishment) and additional one-item question relating to happiness. Each of the five components comprises three-item questions. Question example, "Taking all things together, how happy would you say you are?" In addition to the measure of PERMA wellbeing, additional components have been added by researchers to use if required, i.e., three-item components assessing Physical Health and Negative Emotions, and one-item instrument assessing loneliness are offered as optional measures. In the current research, we added the Physical Health component to compliment the measure of psychological wellbeing, Past reliability of the scale is very good and ranges between α = 0.72–0.94 (Butler and Kern, 2016). The current study showed excellent reliability of the overall construct at α = 0.91 and the Physical Health component at α = 0.92.

Statistical analysis

SPSS (Version 27, IBM, 2021) was used to conduct the statistical tests. The analysis included descriptive analysis, Pearson Correlation, Multiple Regression, Chi-square Test of Independence. There was no missing data, as all responses were forced.

Results

The LM pillar most frequently used by participants to enhance their wellbeing was exercise (n = 680, 61.2%), followed by eating well (n = 650, n = 58.5%), sleeping (n = 633, 56.9%), moderating alcohol use (n = 572, 51.4%), social engagement (n = 434, 38%), and stress management (n = 295, 26.5%). See Table 1 for further detail. In relation to the MHC measure, most of participants were flourishing (n = 598, 54%), followed by those who reported being moderately well (n = 477, 43%), and languishing (n = 37, 3.3%). Furthermore, in the current sample, the mean for MHC was M = 3.14, SD = 0.84; for PERMA, M = 7.05, SD = 1.69; for the Physical Health component of PERMA, M = 6.95, SD = 2.37.

Relationship between flourishing and lifestyle medicine pillars

The Pearson Correlation test was used to assess the strength of relationship between all the wellbeing measures (MHC, PERMA and Physical Health) and the six pillars of LM. Small to moderate relationship was found between all the variables at $p < 0.001$. See Table 2 for details.

Multiple Regression was used to respond to the research question 1 and assess the ability of all six pillars to predict wellbeing using the MHC Model, the Wellbeing Model (PERMA) and the Physical Health component of the PERMA Profiler. Preliminary analyses were conducted to ensure there were no violations of the assumptions of normality (residuals), linearity, multi-collinearity, and homoscedasticity. Bonferroni correlation was applied to adjust for alpha inflation. The first model accounted for 19% of variance in MHC [R^2 = 0.19, $F_{(6,1105)}$ = 43.61, $p < 0.001$]. All LM pillars were statistically significant, with the three highest beta values showing for stress (β = 0.23, $p < 0.001$), social (β = 0.14, $p < 0.001$), and exercise (β = 0.12, $p < 0.001$). The second model accounted for 16% of the variance in PERMA [R^2 = 0.16, $F_{(6,1105)}$ = 35.94, $p < 0.001$]. All the LM pillars were statistically significant at $p < 0.05$, with the highest beta values showing for stress (β = 0.22, $p < 0.001$), social (β = 0.16, $p < 0.001$). The third model accounted for 26% of variance in Physical Health [R^2 = 0.26, $F_{(6,\ 1105)}$ = 63.11, $p < 0.001$]. Five out of six LM pillars were statistically significant, with the highest values reported for exercise (β = 0.22, $p < 0.001$). The only pillar that was not statistically significant was sleep. See Table 3 for details.

The odds of using lifestyle medicine pillars

A chi-square test of independence was performed to respond to the research question 2 and 3 by examining the relation between those who are moderately well vs. flourishing and those who are languishing vs. flourishing in relation to using 0–2 vs. 3–6 LM pillars in their lives. The results showed that individuals who flourished, compared to moderately well, were more likely to use 3 or more LM pillars X^2 (1, N = 1075) = 78.12, p = 0.000. Similarly, those who flourished were more likely to use 3–6 pillars compared to individuals who languished X^2(1, 635) = 36.68, $p < 0.001$. Furthermore, the odds ratio model showed that individuals who were flourishing were three times more likely to use 3–6 LM pillars than those who were moderately well (OR = 3.10, 95% CI = 2.41, 3.99); and those who flourished were nine times more likely to use 3–6 LM pillars than those who languished (OR = 8.83, 95% CI = 3.96, 19.71).

TABLE 2 Pearson correlation between wellbeing measures and the six pillars of lifestyle medicine (LM).

	MHC	PERMA	Health	Sleep	Exercise	Social	Eating	Alcohol
PERMA	0.699*							
Health	0.466*	0.520*						
Sleep	0.217*	0.196*	0.180*					
Exercise	0.240*	0.206*	0.339*	0.249*				
Connection	0.264*	0.268*	0.279*	0.208*	0.233*			
Eating	0.201*	0.172*	0.307*	0.210*	0.238*	0.147*		
Alcohol	0.188*	0.155*	0.201*	0.165*	0.119*	0.224*	0.159*	
Stress	0.05*	0.286*	0.299*	0.128*	0.140*	0.204*	0.110*	0.078*

*$p < 0.001$.

TABLE 3 Multiple regression models to assess the ability of lifestyle medicine (LM) pillars to predict variance in wellbeing using mental health continuum (MHC), PERMA, and physical health.

Variables	B	SE	β	R^2	F for change
Sleep	0.16	0.05	0.09*	0.19	43.61
Exercise	0.21	0.05	0.12**		
Social	0.23	0.05	0.14**		
Eating	0.16	0.05	0.09*		
Alcohol	0.16	0.05	0.10*		
Stress	0.44	0.05	0.23**		
PERMA					
Sleep	0.29	0.10	0.09*	0.16	35.94
Exercise	0.32	0.10	0.09*		
Social	0.55	0.10	0.16**		
Eating	0.26	0.10	0.08*		
Alcohol	0.22	0.10	0.07*		
Stress	0.83	0.11	0.22**		
Health					
Sleep	0.07	0.13	0.02	0.26	63.11
Exercise	1.06	0.14	0.22**		
Social	0.64	0.14	0.13**		
Eating	0.94	0.13	0.20**		
Alcohol	0.45	0.13	0.10**		
Stress	1.13	0.14	0.21**		

*$p < 0.05$, **$p < 0.001$.

Discussion

This is the first research identifying a direct link between the six LM pillars and wellbeing, using the MHC and PERMA models of flourishing. These findings are in line with previous research that describes the positive impact of individual LM pillars on increased wellbeing (Blanchflower et al., 2013; Akbari et al., 2021; Burns and Fardfini, 2021). However to date, no research has investigated the collective impact of engaging all the LM pillars on flourishing.

Moreover, the current study identified that those who used 3–6 LM pillars were more likely to flourish. Specifically, flourishers were three times more likely than those who were moderately well and nine times more likely than languishers to use three or more LM pillars. This is in contrast with other research showing that when using psychological interventions to enhance wellbeing, the number of wellbeing activities is not necessarily correlated with more improvement in wellbeing. Individuals tend to disengage from these activities due to boredom caused by repetition (Lyubomirsky and Layous, 2013; Parks and Biswas-Diener, 2013).

The reason for the difference between the impact of LM pillars and psychological interventions on flourishing may lie in the mechanisms through which LM pillars influence wellbeing. For example, eating a varied and healthy diet with an emphasis on fruit and vegetables, is known to promote a healthy gut microbiome (Appanna, 2018). Healthy gut flora metabolize food to produce neurotransmitters (serotonin from tryptophan), as well as short chain fatty acids such as butyrate (from complex dietary carbohydrates) that can stabilize mood and stimulate the Vagus nerve (Cryan et al., 2019). Therefore, combining a healthy diet (Appanna, 2018) with exercise (Peluso and Guerra de Andrade, 2005) might have a synergistic impact on the positive regulation of neurotransmitters and endorphins, compared with either, practiced in isolation. Conversely, although we know that cultivating optimism (Lee et al., 2019) is important for health and wellbeing, it might not have the same impact as diet on our mood, for the reasons described above. Further research is required to confirm the impact of LM pillar dosage on flourishing using varied sample populations. It will be necessary to explore the intricacies of practices related to LM pillars, compared with typical PPIs, such as gratitude or savoring.

More importantly our findings offer an opportunity for researchers and practitioners to expand on existing PPIs, to address the shortage of interventions aimed at improving positive outcomes (Pawelski, 2020). Moreover, this research provides evidence that higher levels of psychological wellbeing can be accomplished by not only using psychological tools but also *via* interventions that aim to enhance physical wellbeing, such as exercise, eating well or maintaining good sleep hygiene. Future research should explore this link further, by delving deeper into the individual LM pillars as part of the model. For

example, it will be important to include tobacco and other risky substances in the substance-control pillar. Likewise, LM places a strong emphasis on consuming a healthy, predominantly plant-based or vegetarian diet for reducing the risk of developing NCDs (ACLM, 2022a). It will be crucial to examine links between standard Western, vegetarian, pescatarian, flexitarian, lacto-ovo and vegan diets and flourishing. In addition, given the positive impact of healthy behaviors linked to the LM pillars, on aging (both chronological and epigenetic) (Vodovotz et al., 2020), future research should explore the links between PPI and LM in this field.

Interestingly, the LM pillar most frequently used by participants in this study to enhance their wellbeing was exercise. Exercise can have a positive influence on reducing the symptoms of affective disorders. For example, Jabakhanji et al. (2022) analyzed data from a network meta-analysis of 7,240 patients regarding the most cost-effective treatment for depression among patients in remission with coronary artery disease. They found that exercise was most effective in preventing depression when examined 8 weeks post-intervention (Jabakhanji et al., 2022). The current study provides additional evidence on the role exercise plays in helping individuals flourish, and not only reducing illness. This is important, given the scant research relating to the impact of exercise on flourishing, rather than the reduction in illness (Salama-Younes, 2011). Future research needs to examine the bidirectional nature of flourishing and exercise and delve deeper into the frequency and types of exercise, not only whether participants exercise or not.

To illustrate this point, the Biopsychosocial Religion and Health (BRH) Study of Seventh-Day Adventists is a prospective longitudinal study that examined health data (approximately 96,000 North American participants and members of the Seventh-Day Adventist religion) between 2006 and 2011 (Lee et al., 2009). After assessing 5,789 participants from this BRH study, the researchers found a bidirectional relationship between exercise and flourishing, specifically related to the ratio of positive to negative affect (Leibow et al., 2021).

Finally, this study may contribute to research exploring the link between positive mental health and healthy lifestyle practices in healthcare, counseling and coaching contexts. For example, the Make Every Contact Count (MECC) initiative in Ireland (HSE, 2022) and the United Kingdom (Lawrence et al., 2016) involves training healthcare professionals to use every engagement with service users as an opportunity to support behavior changes that can contribute toward healthier lifestyles. This approach involves social prescribing (Husk et al., 2019) and the provision of important information on the pillars of LM as they contribute to health. MECC is especially important for patients suffering from chronic diseases and the prevention of these diseases in otherwise healthy service users. Evidence-based information regarding the positive connection between the pillars of LM and flourishing is very useful for healthcare workers employing MECC in the clinic or the community. Likewise, it is essential for mental health workers, counselors, psychotherapists and coaches to access empirical data describing the positive relationship between human flourishing and everyday lifestyle practices. Whole person health, which incorporates the Salutogenic model (Antonovsky, 1996), is now widely viewed as integrating mental and physical wellbeing with positive social and environmental health (Kligler, 2022). The findings of this study will add to the increasing body of evidence highlighting the links between positive mental health and healthy lifestyle practices.

Limitations

Despite the significant benefits and novel findings, the current research has three main limitations. Firstly, this homogenous sample included only professionals, the majority of whom were female, aged 40 plus. Participants were members of a specific cohort of leaders in education, which may have influenced the results. Further research should consider sampling a general and more diverse population. Secondly, past research showed that on average, between 10 and 15% of the population experiences languishing at any given time (Keyes, 2002). In the current sample, only 3% of participants reported languishing, meaning that the current sample has an unusually low prevalence of risk for mental health issues. The reason for it may be due to participants' profession or age. Future research will include a more diverse and general sample of population, including non-leaders. Finally, the questions used to assess participation in LM pillars require expansion and development. Further research will include more concise and specific questions related to each pillar. These questions will expand on the multiple nuances associated with LM pillars and not simply include questions that require dichotomous yes/no answers. For example, we will expand questions on physical activity to include the type of activity, duration and intensity. The lack of a validated instrument that measures the extent of engagement with all LM pillars is a problem that requires urgent attention.

Conclusion

The current research provides preliminary evidence showing that psychological flourishing can be predicted by examining the level of engagement with the six pillars of LM. Furthermore, it demonstrated that flourishers were three times more likely to use 3–6 LM pillars than individuals who reported moderate wellbeing; moreover, they were nine time more likely to use 3–6 LM pillars than those who languished. This novel finding opens the door to using LM pillar-based

interventions as an alternative to, or in conjunction with PPIs, to cultivate flourishing.

These findings can be used by researchers to further explore the link between LM and flourishing, especially by expanding on the behaviors associated with each LM pillar. We hope that this research will encourage professionals (e.g., healthcare staff, counselors, and coaches) to help clients engage the LM pillars, to not only improve their physical health and reduce illness, but also to enhance their psychological wellbeing. Finally, policymakers are encouraged to consider and incorporate LM pillars as part of the guidelines for improving public health and wellbeing.

Data availability statement

The data analyzed in this study is subject to the following licenses/restrictions: no restrictions. Data is available upon request. Requests to access these datasets should be directed to JB.

Ethics statement

The studies involving human participants were reviewed and approved by the Maynooth University. The patients/participants provided their written informed consent to participate in this study.

Author contributions

JB collected the data. JB and PD co-wrote a manuscript. Both authors contributed to the article and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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A WeChat-based self-compassion training to improve the treatment adherence of patients with schizophrenia in China: Protocol for a randomized controlled trial

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Background: At present, adherence to antipsychotic treatment is often poor, leading to the recurrence of symptoms. This increases the likelihood of the patient experiencing disability and thus increases the disease burden for the patient, their family, and society as a whole. However, to date, there is no clear evidence regarding the effect of medication adherence interventions on outcomes for patients with schizophrenia. Moreover, the traditional intervention methods are limited by manpower and resources in low- and middle-income countries. Recent studies have demonstrated that increasing a patient's level of self-compassion may improve their treatment adherence. Online mental health care interventions have advantages in terms of feasibility and acceptability for patients with schizophrenia. In this regard, a WeChat-based self-compassion training protocol to improve patient treatment adherence was designed in this study and will be evaluated in the future to determine its impact on patients with schizophrenia.

Methods: The protocol for the randomized controlled trial (RCT) is based on the SPIRIT 2013 statement. This parallel RCT will aim to recruit 392 patients with schizophrenia who will be randomized at a 1:1 ratio into a 3-week intervention or control group. Both groups will receive routine care. The intervention group will also receive WeChat-based self-compassion training, which requires participants to complete three tasks every day, including a reading task, a meditation task, and a self-compassion journal task. The control group will receive WeChat-based psychological health education, which will only require participants to read positive articles about psychological health every day. Medication adherence, self-compassion, stigma, and social support will be measured at baseline (T_0), immediately after the intervention (T_1), and 3 weeks after the intervention (T_2). Program

feasibility will be evaluated throughout the course of the study, and acceptability will be measured immediately after the intervention (T_1).

Expected results: The intervention described here will address the barriers to accessing mental health care for people with schizophrenia, including patients' desire for independent management, difficulty accessing providers, and concerns about privacy and stigma. The current study provides guidance for clinical nurses to carry out psychological intervention, with the ultimate aim of addressing the problems associated with a shortage of psychological professionals in low- and middle-income countries.

KEYWORDS

schizophrenia, treatment adherence, self-compassion, stigma, WeChat, online, research design

Introduction

Most guidelines recommend continuous treatment with antipsychotic medication to prevent relapse or recurrence of psychotic symptoms during the first few years following the first psychotic episode (Galletly et al., 2016; Crockford and Addington, 2017; Shimomura et al., 2020). However, studies have shown that adherence to antipsychotic treatment is often poor; between 41 and 61% of patients do not take the medication as prescribed (Valenstein et al., 2006), and the reported relapse rate is 42% due to poor medication compliance in patients with chronic schizophrenia (Acosta et al., 2009). In China, 55∼76% of patients with schizophrenia relapse because of drug withdrawal (He and Li, 2018). High recurrence not only increases the possibility of disability but also results in a serious disease burden for the families of patients and society. According to previous reports, the disability rate in schizophrenia is as high as 92.50% (Insel, 2010). Inclusion of disability when measuring disease burden has been particularly influential in highlighting schizophrenia as a leading contributor to disease burden. Observing differences in disability-adjusted life years (DALYs) demonstrates that the large burden of schizophrenia experienced in lower- and middle-income countries is around four times the burden experienced by high-income countries (Charlson et al., 2018). This is largely attributable to the significant population growth and aging of low- and middle-income countries, resulting in a greater proportion of the population of an age where the risk of schizophrenia is greatest (Charlson et al., 2018). Therefore, services to improve treatment adherence and prevent disease recurrence are important to respond to the high disability rate and disease burden among patients with schizophrenia, particularly in low- and middle-income countries.

Uzer-Kremers et al. (2020) first explored the relationship between self-compassion and treatment adherence among patients with schizophrenia in an investigation study. The results indicated that improving the self-compassion of patients with schizophrenia may increase their level of treatment adherence. Mindfulness-based interventions (Rimes and Wingrove, 2011), compassion-focused therapy (CFT) (Gilbert, 2014), and mindful self-compassion (MSC) (Neff and Germer, 2013) are training programs and intervention techniques proposed to increase a patient's level of self-compassion. However, most of these therapies are based on group interventions, which are complex and require the input of professionals. Low- and middle-income countries lack the mental health professionals required for such interventions (McKenzie et al., 2004). Moreover, given the widespread public discrimination and prejudice against mental illness, seeking face-to-face psychotherapy is often challenging for patients with schizophrenia. With the development of the Internet, several researchers have conducted online interventions, which have advantages in terms of feasibility and acceptability and may lower the treatment-seeking threshold for patients (Josephine et al., 2017). The published literature to date also provides strong evidence for the feasibility of using smartphones to enhance the treatment adherence of people with schizophrenia (Firth and Torous, 2015). In recent years, online interventions based on self-compassion for patients with mental illness have been developed and have demonstrated positive effects. However, to date, there are no published studies to support the effectiveness of online self-compassion training among patients with schizophrenia.

Background

While some studies of existing psychological interventions have demonstrated their effectiveness in improving medication adherence among patients with schizophrenia, including

compliance therapy (CT), adherence therapy (AT), cognitive behavior therapy (CBT), and motivational interviewing (MI), other studies have reported that these interventions do not improve medication adherence (O'Donnell et al., 2003; Bechdolf et al., 2005; Barkhof et al., 2013; Schulz et al., 2013). The CT or AT or MI is multicomponent and complex, differs widely in their content and implementation, and lacks standardized interventions for patients with schizophrenia, leading to different research results (Hartung et al., 2017). Furthermore, people who are highly self-critical and shame-centered tend to respond poorly to standard CBT and consider CBT to be "emotionally heavy and unpleasant" (Barnes et al., 2013). A systematic review found no clear evidence to support the effectiveness of these medication adherence interventions on the outcomes of patients with schizophrenia (Hartung et al., 2017). Nonetheless, interventions to improve medication adherence among individuals with psychotic symptoms warrant further investigation (Hartung et al., 2017). Moreover, many of the interventions currently available require significant manpower and resources, making them less practical for low- and middle-income countries that lack these mental health professionals (McKenzie et al., 2004).

Recent theoretical developments suggest that self-to-self relating may be a critical process in the recovery of psychosis (Andrew et al., 2010). Self-to-self relating refers to the way in which individuals relate to themselves; it can be considered as an intrapersonal relationship (Andrew et al., 2010). Self-criticism causes distressing experiences of psychosis, whereas compassionate self-acceptance results in empowered action and promotes recovery and growth during psychiatric rehabilitation (Waite et al., 2015). However, during rehabilitation, patients with psychosis often adopt self-criticism to deal with their difficulties and maintain their self-esteem and self-identification (Lawrence and Lee, 2014). Highly self-critical people habitually experience feelings of inferiority, worthlessness, shame, failure, and guilt, and are often reluctant to seek support (Krieger et al., 2019). The higher the level of self-criticism, the more shame people will experience (Krieger et al., 2016). Furthermore, one-third to half of all patients with schizophrenia feel ashamed for suffering from this disease, and the stigma persists in the remission period of the disease (Gerlinger et al., 2013). Patients will select strategies such as confidentiality or isolation rather than help-seeking to avoid these feelings (Cadario et al., 2012). Stigma affects all stages of treatment, from attitude and approach to treatment plan selection (Stentzel et al., 2018). In clinical work, due to the fear of drug side effects and medicine-taking behavior that may expose their disease, patients with schizophrenia will reduce or even stop the drug themselves to avoid stigma (He, 2018).

The most common intervention that focuses on self-criticism and the stigma of mental illness is cognitive behavioral therapy (CBT), which is to challenge the content of negative thoughts, address cognitive biases in the processing of emotional information, and alleviate psychological symptoms (Vazquez et al., 2018). However, studies have shown that the influence of CBT may be overestimated (Cuijpers et al., 2016). Further, people who are highly self-critical and shame-centered tend to respond poorly to standard CBT and consider CBT to be "emotionally heavy and unpleasant" (Barnes et al., 2013). Self-compassion is a positive emotion regulation strategy and emotional arousal state (Neff and Germer, 2013). People with high levels of self-compassion tend to respond with understanding and acceptance when facing difficult emotions, rather than with avoidance (Neff and Germer, 2013). Some qualitative studies have also demonstrated the effect of self-compassion on patients with mental illnesses (Ashworth et al., 2015; Ashfield et al., 2020; Bratt et al., 2020). After completing self-compassion training, patients tend to accept rather than criticize themselves as having a problem. In recent years, scholars have demonstrated the value of self-compassion for treatment adherence in a variety of clinical populations, including patients with fibromyalgia, chronic fatigue syndrome, and cancer (Sirois and Hirsch, 2019). The relationship between self-compassion and treatment adherence among patients with schizophrenia has also been explored in an investigation study, with the results suggesting that improving self-compassion may increase the treatment adherence of patients with schizophrenia (Uzer-Kremers et al., 2020). Specifically, self-compassion supports individuals in developing a compassionate attitude toward themselves, prompting them to accept and understand their own diseases, thus reducing self-criticism and stigma and assisting in the maintenance of a positive attitude toward their responsibility for their own treatment.

There are many training programs and intervention techniques proposed to increase a patient's level of self-compassion, including mindfulness-based interventions, MSC, and CFT. CFT was developed specifically to build the capacity to experience compassion in high-shame and self-critical individuals (Gilbert, 2014); Braehler et al. (2013) randomized patients with a schizophrenia-spectrum disorder to either a CFT group or a control group. During the 4-month CFT, compassion skills, such as mindfulness, appreciation, imagery, attention, behavior, and reframing, were practiced, and expressive writing tasks were used to help members reflect on and integrate changes in their recovery from a compassionate stance. Finally, the results support the feasibility of group CFT in psychosis and suggest that changes in compassion can be achieved.

In recent years, new forms of online interventions based on self-compassion meditation and self-compassion writing therapy for patients with mental illness have been developed and have demonstrated positive effects. The intervention time is also getting shorter [6 weeks (Finlay-Jones et al., 2017; Rodgers et al., 2018; Andersson et al., 2020), 4 weeks (Mak et al., 2018, 2019; Beshai et al., 2020), 3 weeks (Albertson et al., 2015; Toole and Craighead, 2016), 2 weeks (Kelman et al., 2018; Stevenson et al., 2019; Halamová et al., 2020, 2021;

Schnepper et al., 2020; Seekis et al., 2020), and 1 week (Shapira and Mongrain, 2010) or less (Galla, 2016)]. For example, Albertson et al. (2015) randomized participants to either an intervention group (meditation via podcast) or a waitlist control group. The results indicated that the participants in the intervention group experienced significantly greater reductions in body dissatisfaction and body shame and greater gains in self-compassion and body appreciation after the 3-week meditation intervention, when compared to the control group. However, to date, there are no published studies to support the effectiveness of online self-compassion training among patients with schizophrenia. Compared with group interventions in a therapy room, online interventions can address barriers to accessing mental health care, such as patients' desire for independent management, limited funds, time constraints, transportation issues, difficulty accessing providers, and concerns about privacy and stigma (Josephine et al., 2017). Online interventions can also reduce the use of mental health resources in low- and middle-income countries, where these resources are scarce. A recent meta-analysis demonstrated that online interventions are as effective as face-to-face interventions for a variety of psychological and physical diseases (Carlbring et al., 2018). For example, the FOCUS smartphone app is a multifaceted mobile intervention that targets auditory hallucinations, mood, sleep, functioning, and medication adherence (Ben-Zeev et al., 2013). FOCUS has demonstrated similar efficacy to standard in-person psychosocial approaches in caring for people with schizophrenia. Other smartphone apps have also been effectively designed to address social functioning in patients with schizophrenia (Fulford et al., 2021). Therefore, it is meaningful to design an online self-compassion training program specifically for patients with schizophrenia.

The existing research on self-compassion has mostly been conducted in English-speaking countries. However, self-compassion theory is, in fact, inspired by Eastern Buddhism. Studying the localization of self-compassion in China is of great practical significance, and the development of an online intervention is in line with the inadequate mental health resources in China (McKenzie et al., 2004). WeChat is a free smartphone application; it is the most widely used social networking platform in China. Similar to Facebook, WeChat public accounts can send push notifications to their followers and alert them to new content. WeChat can be used to deliver health education messages in a cheaper and more visually appealing way compared to mobile phone SMS. Studies conducted in China have shown that WeChat is effective in health promotion interventions (He et al., 2017).

Considering the importance of improving treatment adherence, the effectiveness of a high level of self-compassion, the advantages of online interventions for patients with schizophrenia, and the widespread use of WeChat among people in China, this study describes a brief WeChat-based self-compassion training protocol to improve the treatment adherence of patients with schizophrenia in China.

Theoretical framework

The intervention program described in this study is based on four principles. First, self-compassion theory was taken as the theoretical basis. Self-compassion comprises three interacting components: self-kindness vs. self-criticism, a sense of common humanity vs. isolation, and mindfulness vs. over-identification (Neff and Germer, 2013). Self-kindness refers to the tendency to be caring and understanding toward the self rather than being harshly judgmental. Rather than attacking and berating oneself for personal shortcomings, the self is offered warmth, comfort, and unconditional acceptance. The sense of common humanity that comprises self-compassion involves recognizing that all people are imperfect, fail, make mistakes, and experience serious life challenges, rather than feeling isolated by the experience of imperfection. Mindfulness in the context of self-compassion involves being aware of one's painful experiences in a balanced way, which neither ignores nor amplifies painful thoughts and emotions. In addition, paying attention in an equilibrated way is important; this does not involve "over-identification," that is, being carried away by a dramatic storyline that exaggerates implications for self-worth. Therefore, we believe that patients with a high level of self-compassion tend to be caring and understanding rather than harshly judgmental about their diseases. They recognize that everyone will experience serious life challenges and be aware of their painful experiences in a balanced way, thus reducing self-criticism and stigma, and maintaining a positive attitude toward their responsibility for their own treatment.

First, the online self-compassion intervention studies in the literature were reviewed to determine the intervention content and intervention dose, including intervention form, frequency, time, and duration. The intervention aims to help participants to understand the meaning of self-compassion and to use the three components of self-compassion to help them actively cope with self-criticism and stigma, thereby improving their treatment adherence. Second, structured interviews were conducted with the target population (patients and nurses in an inpatient ward) to ensure that the program met the health needs of patients with schizophrenia and was consistent with the actual clinical situation. Third, an expert meeting (a group of eight experts including two senior doctors and two nurses in the field of schizophrenia, two psychologists, and two nursing experts) was held to ensure the scientific basis and feasibility of the intervention program. Finally, a research group meeting was conducted to identify all the detailed messages that would be published on the WeChat public account.

Study

Aim

The ultimate goal of this research is to evaluate the effectiveness, feasibility, and acceptability of a WeChat-based self-compassion training protocol to improve the treatment adherence of patients with schizophrenia in China. The specific objectives of the study are as follows:

Primary aim

To evaluate the effects of the WeChat-based self-compassion training on treatment adherence, relative to the control WeChat-based psychological health education.

Secondary aim

To evaluate the effects of the WeChat-based self-compassion training program on self-compassion, stigma, and social support; evaluate the feasibility of online training by examining enrollment, recruitment, retention, and journal task completion rates; and determine satisfaction and acceptability of the program by assessing eight single items on the intervention satisfaction scale.

Design

Trial design

The study will be an exploratory, parallel randomized controlled trial (RCT) comparing a 3-week WeChat-based self-compassion training protocol to a control condition with only WeChat-based psychological health education. The effects of the intervention on treatment adherence, self-compassion, stigma, and social support will be evaluated among patients with schizophrenia. Eligible participants will be randomly allocated to one of the two conditions (intervention or control) at a ratio of 1:1. The Consolidated Standards of Reporting Trials (CONSORT) (Schulz et al., 2010) flowchart is presented in **Figure 1**. The study protocol was developed and reported according to the Standard Protocol Items: Recommendations for Interventional Trials (SPIRIT) 2013 statement (Chan et al., 2013; **Supplementary File 1**).

Study setting

Participants will be recruited from the psychiatric wards at two hospitals in Hangzhou, Zhejiang, China. Both hospitals are tertiary public hospitals covering almost all patients with schizophrenia who seek medical help in Hangzhou. There is little difference in the clinical education and treatment protocols between the two hospitals. The intervention will be performed online.

Eligibility criteria

The research coordinator will confirm the eligibility criteria for each participant by screening their electronic medical records and communicating with the patient and their family members face-to-face.

Inclusion criteria:

(1) Patient must have been diagnosed with schizophrenia according to the International Classification of Diseases (ICD-10) criteria for the past year.

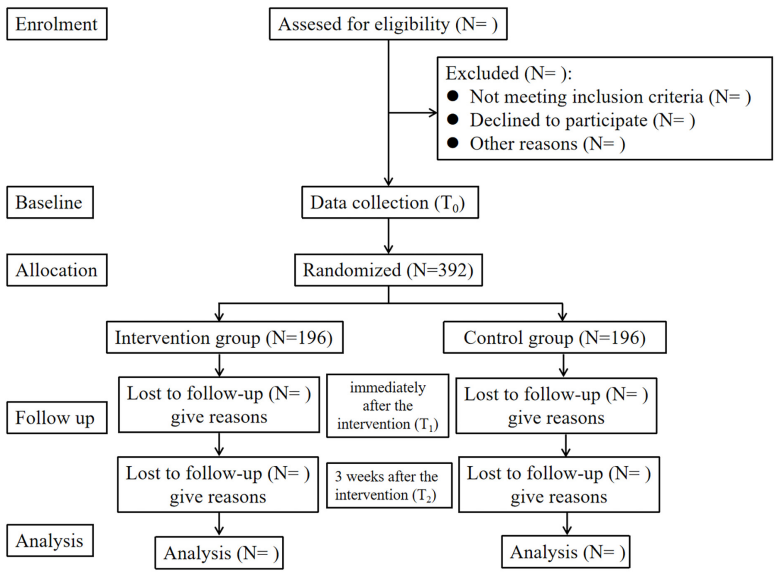

FIGURE 1
An overview of the study design.

(2) Patients must be over 18 and under 65 years.
(3) Patient has achieved a curative effect that meets the clinical recovery standard according to the evaluation of psychiatrists.
(4) Patient must have normal cognitive, expression, and comprehension abilities and the ability to fill in the questionnaire correctly.
(5) Patient must own a smartphone and be able to use WeChat.
(6) Informed consent must be obtained from the patient and one of their family members.

Exclusion criteria:

(1)] Patients suffering from other mental disorders.
(2) Patients with severe organic brain lesions and physical diseases.
(3) Patients participating in other psychological interventions.
(4) Patients who have previously received clinical guidance similar to that provided in this study.

Rejection criteria:

The rejection criteria are as follows: patients who did not meet the inclusion criteria and who met the exclusion criteria but were mistakenly recruited into the study.

Abscission criteria:

(1) Patients have deteriorated mental conditions during the course of the study.
(2) Patients quit the study.
(3) Patients could not be contacted during the intervention, and they did not complete the intervention tasks as required.
(4) Patients did not complete post-intervention evaluation.

Sample size

The sample size of the study was calculated using the G*Power 3.1 software package (Faul et al., 2007). With a power of 0.80, an alpha set at 0.05, and an effect size of 0.3 for the primary outcome, the Medication Adherence Rating Scale (MARS) score (Çetin and Aylaz, 2018), it was determined that each group would need 176 patients with schizophrenia. Given an attrition rate of 10%, a minimum of 392 participants (196 in each group) is required.

Recruitment, randomization, and allocation

Potential participants in the hospital will be identified by screening the electronic medical records on each psychiatric ward to determine those who have achieved a curative effect that meets the clinical recovery standard. These potential participants will then be contacted by a research coordinator to determine their eligibility, their ability to fill in the questionnaire, their interest in participation, their experience using WeChat, and their willingness to sign the consent form (including one of their family members). The aims of the study and participants' right to withdraw at any time will be explained to eligible participants verbally and via an information sheet. Individuals will be able to ask the research coordinator questions about the study.

After signing the written informed consent and completing the basic demographic questionnaire and baseline evaluation, all eligible participants will be randomized to either the intervention group or the control group at a 1:1 ratio. Participants will be randomized individually using a computer-generated sequence of random numbers generated with SPSS 25. Allocation concealment will be achieved through sequentially numbered, opaque, sealed envelopes. The random sequence will be generated by an independent researcher not involved in patient enrollment and the baseline assessment. The envelope will only be opened after obtaining consent, confirming the patient's eligibility, and performing the baseline evaluation. Then, the responsible clinical psychiatric nurses, who will facilitate the intervention in this study, will be informed of the intervention allocation. Given that the participants will either receive direct access to the WeChat-based self-compassion training or the WeChat-based psychological health education, participants will be blind to their allocation.

Participants assigned to the WeChat-based self-compassion training will receive access to the intervention WeChat group. The control group will receive access to another WeChat group. The two WeChat groups will be set with management authority such that the patients will not be able to enter the group without the consent of the responsible clinical psychiatric nurses, who will be the managers of the WeChat groups. All participants in the intervention WeChat group will be asked to scan a two-dimensional code to subscribe to and register with the "Self-compassion Tour" module of the WeChat public account. All participants in the control WeChat group will also be asked to scan another two-dimensional code to follow a WeChat public account in order to read positive articles about psychological health. Because they will not be able to register with the "Self-compassion Tour" module, they will not be able to access the information in the module. This will avoid between-group contamination through the direct sharing of messages sent via WeChat.

Intervention

The clinical psychiatric nurses will run the intervention. They will be trained face-to-face for 2 days by the research team and will be required to master the contents and methods of the WeChat-based self-compassion intervention. Clinical psychiatric nurses who pass the examination will act as the nurses responsible for the WeChat-based self-compassion training intervention. The training protocol developed by the researcher is totally independent and different from the clinical education received at the hospital. The "Self-compassion Tour"

module includes the following three tasks: a reading task, a meditation task, and a self-compassion journal task. Each message in the intervention will be compiled by one research team member who will develop appropriate multimedia content using videos, pictures, or records to effectively convey the meaning of each message. Each message will be revised according to expert opinion and subsequently approved by the research team members. The messages will be published on the WeChat public account "Self-compassion Tour" every day on time. Each task is described in detail below. The key themes of the "Self-compassion Tour" are summarized in **Table 1**. The function of the "Self-compassion Tour" system is shown in **Figure 2**. The interface of the "Self-compassion Tour" is shown in **Figure 3**.

Reading task

The content provided for reading will be updated daily according to the theme of the week. Participants will be able to read the new messages and review the message history of all content published on the WeChat public account. The messages will be shown in the form of text, videos, and pictures. The content of the first week will be focused on theoretical knowledge in relation to self-compassion. The aim is for participants to understand the meaning of the three levels of self-compassion and be able to start the self-compassion journal task. The second and third weeks will be focused on positive stories about people suffering from schizophrenia. These 2 weeks are a complement to the "sense of common humanity" gained in group therapy, where patients are able to view their experiences as part of a common experience of many people with schizophrenia (Lawrence and Lee, 2014), fostering acceptance by other group members (Ashfield et al., 2020). Reading new messages on the WeChat group will take approximately 10 min every day. At the end of the reading, two small tests will be inserted to check whether the participant has read the content carefully.

Meditation task

In the 3-week online self-compassion meditation intervention, participants will be asked to listen to an audio recording regularly each week (at least once per day) (Albertson et al., 2015). Three different guided self-compassion meditations that were taught in the MSC program will be used for the intervention (Neff and Germer, 2013). For example, the first week will be the "compassionate body scan," which aims to help the participant feel connected with their body and give their body sympathy, peace, and gratitude. Accompanied by the audio, the participants will be asked to sit or lie down, put their hands on their heart, remind themselves to be kind to themselves, and then scan from the top of their head to their feet and pay attention to the feeling of every part of the body. The task will take approximately 10 min every day.

Self-compassion journal task

This task is a modification of the self-compassion journal exercise on Professor Neff's self-compassion website.[1] The content of the weekly journal will differ in relation to the theme of the week. For example, in the first week, participants will be asked to "keep a journal from the perspective of mindfulness, a sense of common humanity and kindness." They will be presented with prompts, such as "at some point during the day when you have a few quiet moments, write in your journal about anything that you felt bad about, anything you judged yourself for, or any difficult experience that caused you pain. For each event, use mindfulness, a sense of common humanity, and kindness to process the event in a more self-compassionate way." Participants will be asked to try to write in their daily self-compassion journal for approximately 15 min, with guidance. All diaries will be delivered to the clinical psychiatric nurses via online documentation links on the WeChat public account, and participants will be instructed on the basis of their writing in order to better use the three components of self-compassion to help them actively cope with difficult emotions.

Task completion will be tracked every day. When the participant completes the task for the day, they will be required to click "I have completed the task" in the WeChat group;

1 http://www.selfcompassion.net/

TABLE 1 Key themes of the "Self-compassion Tour".

Week	Theme	Task		
		Reading task	**Meditation task**	**Self-compassion journal task**
Week 1	Understanding self-compassion	Introduction of self-compassion	The compassionate body scan	Keep a journal from perspectives of mindfulness, a sense of common humanity and kindness
Week 2	Understanding self-criticism and stigma	Stories of being self-kindness to oneself who are also suffering from schizophrenia	loving-kindness meditation	Keep a journal from perspectives of finding your own strengths
Week 3	Improve treatment adherence	Stories of Coping with difficult feelings and emotions of adhering to treatment	Affectionate Breathing	Keep a journal from perspectives of encouraging yourself to recovery

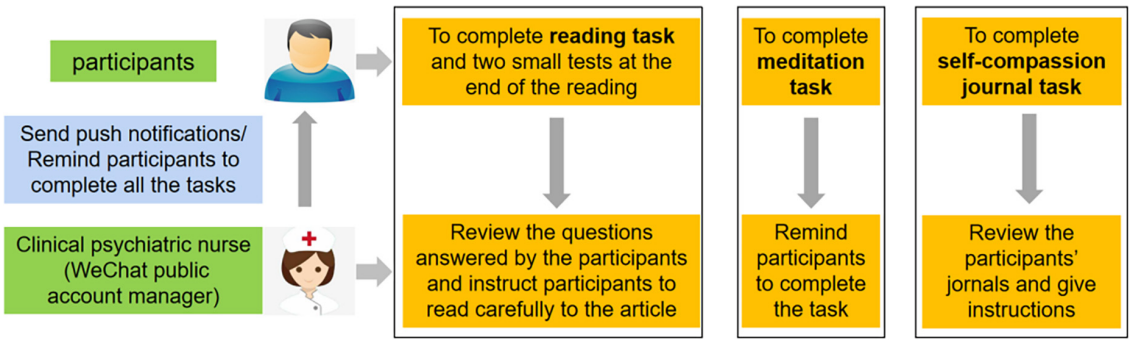

FIGURE 2
Function of the 'Self-compassion Tour' system. Figure created with Microsoft Office PowerPoint.

FIGURE 3
The interface of the 'Self-compassion Tour'. **(A)** Notification of new messages, **(B)** reading task, **(C)** meditation task, **(D)** self-compassion journal task. Figure created with Microsoft Office PowerPoint.

if the participant fails to complete the task before 8.00 p.m. that day, they will receive a private WeChat reminder message from the clinical psychiatric nurse. If participants have any questions about task completion, they will be able to leave a message on the WeChat public account, and the clinical psychiatric nurse will reply as soon as possible. All questions and answers on the WeChat public account will be visible to all participants in the intervention group (all the participants will be assured of anonymity by using special code numbers to identify themselves). The information forwarding function will be disabled, and participants will be told not to share the messages with others, such as by taking screenshots, in order to minimize potential contamination.

The control group will follow another WeChat public account which will provide psychological health education. Participants in the control group will only be required to read excerpts of articles from books about psychological health. The articles will be organized into three sections (one section per week): challenges faced by those with mental disorders, signs of bad emotions, and psychological health self-management recommendations. The articles will be updated daily for 3 consecutive weeks.

Adverse events, if any, are expected to be minor. At the start of every week, participants will be asked whether they experienced any physical discomfort, emotional discomfort or distress, or an increase in problems in relationships with others in the past week. With regard to reporting adverse events, data from the intervention and control arms will be combined, and descriptive statistics will be used to evaluate the frequency and severity of adverse events. All collected adverse events will be reported.

Instruments and measures

Demographic and other personal data

Participants' demographic information will be collected, including gender, age, previous residence, marital status, education, economic status, employment status, and duration of illness.

Primary outcomes

Patient adherence

The Medication Adherence Rating Scale (MARS) (Thompson et al., 2000) will be used in our study. The 10-item measure assesses patients' attitudes, beliefs, and behavior toward taking medicine on a scale set to "yes" and "no" options for each item. The MARS is a reliable tool to measure medication compliance of patients with schizophrenia 1 week before the measurement point (Friemann and Wciórka, 2013).

Secondary outcomes

Self-compassion

Self-compassion will be measured using the Self-Compassion Scale (SCS) (Neff, 2003). This self-reported scale consists of 26 items designed to measure the six subcomponents of self-compassion: mindfulness, over-identification, sense of common humanity, isolation, self-kindness, and self-judgment; each item is rated on a 5-point scale. Item scores are used to generate a total self-compassion score. In the present study, the Chinese version of the SCS has shown good values for reliability and validity, and Cronbach's α is set at 0.84 for the total score (Chen et al., 2011).

Stigma

Stigma will be measured using the Stigma Assessment Scale for mental illness, particularly in Chinese, a widely used measure of stigma (Zeng et al., 2009). This self-reported scale measures stigma along three dimensions: (1) socialization (related to the discrimination of patients in social and interpersonal communication), (2) competence (involves patients experiencing public discrimination against their personal abilities), and (3) therapy (related to patients' experience of treatment, side effects, and neglect by medical staff). The scale is a self-reported measure comprising 32 items, and each item is rated on a 4-point scale. Item scores are used to generate a total stigma score. The scale has demonstrated good internal consistency in mental illness samples, and Cronbach's α is set at 0.9.

Social support

Social support will be measured using the Social Support Rating Scale (SSRS) (Xiao and Yang, 1987). This self-reported scale consists of 10 items designed to measure the three dimensions of an individual's social support: objective support (the actual support received by the patient), subjective support (the support that the patient can experience or emotional support), and support utilization (the active use of various social supports by individuals, including the way of talking, the way of asking for help, and the way of participating in activities). Item scores are used to generate a total social support score, and the higher the total score, the better the degree of social support. SSRS has good reliability and validity with Cronbach α and KMO of 0.72 and 0.637, respectively.

Program feasibility

Program enrollment, recruitment, retention, and diary completion data will be gathered to measure program feasibility: (1) enrollment rate = number of patients who meet inclusion criteria/number of people with schizophrenia; (2) recruitment rate = number of patients who agreed to participate in the study/number of patients who meet the inclusion criteria; (3) retention rate = number of patients who complete the intervention/number of patients who agreed to participate in the study; and (4) diary completion rate = actual number of completed journals/required number of completed journals.

Program acceptability

Participants' satisfaction with and acceptability of the intervention will be assessed immediately after the intervention using eight single items on the Intervention Satisfaction Scale, which refers to the Intervention Satisfaction Scale by Campo et al. (2017). The content includes the acceptability of the intervention (two items) and the satisfaction of the intervention plan and implementation (six items), such as the frequency, duration, and length of the training. Our primary benchmark for acceptability is an average score of 4 or higher on participants' responses to two items on this scale: (1) "Overall, I really enjoyed the self-compassion training" and (2) "I would recommend the self-compassion training to other patients with schizophrenia." The other six items assessing satisfaction with the intervention are set to "yes" and "no" options for each item: "Generally speaking, I prefer online training," "For me, a total of 3 weeks of training is appropriate," "For me, about 45 min a day for training is the right length," "For me, once a day of every task for 3 weeks is the right frequency," "I am satisfied with the content of the training," and "For me, most of the time I can complete my training in a quiet and undisturbed environment."

Data collection and management

Table 2 shows the schedule of enrollment, interventions, and assessments. Feasibility outcomes will be evaluated throughout the course of the study. Other data will be collected online using questionnaires presented in an online format.[2] Measurements will be taken at baseline (T_0), immediately after the intervention (T_1), and 3 weeks after the intervention (T_2). Participants will complete the baseline measurement by scanning a two-dimensional code to obtain their questionnaire. At T_1 and T_2, the questionnaires will be sent to participants by WeChat. All participants will receive up to two reminders to complete the T_1 and T_2 measurements, regardless of protocol adherence or any previously uncompleted online questionnaires. Participants will be informed that they will receive a gift after completing the online questionnaires to promote retention.

Online website servers will be used to collect all data, according to the hospital security guidelines and policies; all

2 www.wjx.com

TABLE 2 SPIRIT figure, schedule of enrollment, interventions, and assessments.

	Study period				
	Enrollment	Allocation	Post-allocation		
			Intervention		
Timepoint	**T_0**	**0**	**0**	**T_1**	**T_2**
Enrollment:					
Eligibility screen	×				
Informed consent	×				
Allocation		×			
Intervention					
Intervention group (WeChat-based self-compassion training)		⟷			
Control group (WeChat-based psychological health education)		⟷			
Instruments					
Demographic and other personal data	×				
Primary outcomes					
Patient adherence	×			×	×
Secondary outcomes					
Self-compassion	×			×	×
Stigma	×			×	×
Social suppor	×			×	×
Program feasibility		⟷		×	
Program acceptability				×	

web-based information transmission will be encrypted. Baseline data and follow-up data will be saved first on the website and then wirelessly uploaded into an Excel database via an Internet server. Data entry will be accomplished by individuals external to the research team, and data analysis will be completed without referring to the allocation information.

Statistical methods

The baseline characteristics of the sample will be compared using χ^2-tests for categorical variables and Student's *t*-test or Mann–Whitney *U*-test for quantitative variables.

Statistical analyses will be performed on the basis of the intention-to-treat approach, which will include all randomized participants. The extent of missing data will be analyzed. We will explore missing data patterns and determine the type of missing data (missing completely at random, missing at random, and not missing at random). We will use multiple imputations to substitute missing values and conduct sensitivity analyses for datasets with and without imputed data.

Descriptive statistics will be used to evaluate study feasibility and acceptability. We will use linear mixed models with time (pre-intervention vs. post-intervention measures) as a within-group effect, study condition (intervention condition vs. control condition) as a between-group effect, and the interaction effect between these two effects to evaluate the efficacy of the WeChat-based self-compassion training intervention on patient adherence, self-compassion, stigma, and social support. This primary analysis will be performed using the data from the baseline and 3-week post-assessment. We will conduct within-group analyses using repeated measures ANOVA (pre-intervention, post-intervention, and follow-up measures) and paired *t*-tests when comparing only two time points to analyze the stability of the short-term effects of the intervention on patient adherence, self-compassion, stigma, and social support. Moreover, the correlation among self-compassion, stigma, social support, and patient adherence will be analyzed using Pearson correlation. The results will be reported with 95% confidence intervals. Bilateral $p \leq 0.05$ shows a statistically significant difference. All data will be analyzed using SPSS 24.0.

Ethical considerations

This study was approved by the Human Research Ethics Committee (REDACTED). All participants and one of their family members will be required to sign an informed consent form, which includes details of the intervention goals and procedures. Interventions and questionnaires will be conducted after written informed consent is obtained from each recruited participant. Participants will be informed of the freedom to withdraw from the study at any time and will be assured of anonymity by using special code numbers to identify themselves. All of the collected data will be pseudo-anonymized and kept confidential. Only members of the research team will be able to re-identify the participants. If the intervention proves to be effective, then participants in the control group will also receive the WeChat-based self-compassion training after

the study is completed. The trial is registered at the Chinese ClinicalTrials.gov.

Validity and reliability

This study uses a rigorous research design, an RCT with a representative and predetermined sample. It uses instruments with high validity, reliability, and statistical analysis, which can effectively reduce bias and enhance the generalizability of research results beyond the target population. Moreover, trial participants, outcome assessors (no researchers will be directly involved during data collection, as questionnaires are online), and data analysts of the research will be blinded to intervention allocation to reduce the biases in the evaluation of the effects of the intervention. The study protocol is in accordance with the SPIRIT reporting guidelines (Chan et al., 2013).

Discussion

Although previous research supports the notion that psychological outcomes among people living with mental illness can be improved following online-based self-compassion interventions, to date, there are no published studies on this issue among patients with schizophrenia. We expect that the psychological program described here will help patients with schizophrenia to increase their level of self-compassion, cope with experiences of self-criticism and stigma, and avoid confidentiality and unsociability, so as to ultimately improve treatment adherence. The planned RCT will contribute evidence on the effectiveness of using the WeChat platform to support patients with schizophrenia. Online training is a flexible, low-cost, sustainable mode of delivery. It also addresses the barriers to accessing mental health care for people with schizophrenia, including patients' desire for independent management, difficulty accessing providers, and concerns about privacy and stigma. This study provides guidance for clinical nurses to carry out psychological intervention so as to improve treatment adherence among patients with schizophrenia. The evidence obtained from the described RCT, which will be led by clinical nurses, will help to address the problem of a shortage of psychological professionals in low- and middle-income countries and will also provide information for the provision of mental health services and policies. Furthermore, the self-compassion knowledge gained from this study could be used to plan a culturally appropriate program for people with other mental illnesses. This could be particularly useful during the COVID global pandemic when access to mental health services may be limited due to restricted movement, and web-based options may be more accessible.

Limitations

Although we have carefully crafted this protocol, this study has some limitations. First, this intervention will be conducted for 3 weeks, and some participants may not be able to complete the study because of changes in their emotions or loss of follow-up. Second, we may not be able to avoid participation bias, as participation in the study is voluntary. Third, restricting the study to patients with a smartphone and being able to use it may cause a selection bias, which could reduce the generalizability of our results. This limitation is common in online intervention. Finally, we will not be able to monitor the level of usage of the WeChat public accounts during the trial because of the limited function of the WeChat public account; therefore, determining the extent to which higher intervention adherence is associated with higher benefits on outcomes will not be possible.

Conclusion

In this study, the scientific problem was first identified by reading the current literature. Specifically, it is clear that patients with schizophrenia often adopt self-criticism and feel shame when dealing with their difficulties, leading to poor medication adherence. Then, the research group established a conceptual framework around this problem, specifically self-compassion theory and the relationship between medication adherence and self-compassion. Then, an evidence-based intervention program was established through literature review; structured interviews with patients and nursing staff were conducted to modify the intervention program from the perspective of the stakeholders. Finally, the intervention program was professionally perfected through expert meetings. In the next step, our research group will formally implement this RCT. If this online intervention for patients with schizophrenia is effective, it will then be implemented in hospitals and communities to improve treatment adherence among patients with schizophrenia in China.

Data availability statement

The original contributions presented in this study are included in the article/**Supplementary material**, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving human participants were reviewed and approved by the Medical Ethics Committee of Zhejiang

Chinese Medical University. The patients/participants provided their written informed consent to participate in this study.

Author contributions

DD and C-ZS conceived of the study. T-YM, J-YX, Z-NZ, J-ND, and Q-ZZ collected material. DD drafted the manuscript. DD and T-YM met with C-ZS to discuss the protocol. All authors helped to draft and approved of the final version of this article.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2022.931802/full#supplementary-material

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Rethinking mental health wellness among adolescents living with HIV in the African context: An integrative review of mental wellness components

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Objective: Adolescents living with HIV (ALHIV) are considered to be at heightened risk for developing mental health problems in comparison to their peers due to the burden of living with a stigmatized condition and managing a chronic condition. Poorer mental health outcomes among ALHIV are associated with lower rates of adherence to anti-retroviral therapy (ART). It is necessary to improve mental wellness among ALHIV as this acts as a buffer against developing mental health problems which, if left untreated can evolve into mental health disorders. Research on mental wellness concepts among ALHIV is underdeveloped which is associated with a lack of appropriate measures of mental wellness. We conducted an integrative review to conceptualize mental wellness and consider the critical components for measuring mental wellness in ALHIV.

Method: An integrative review of published literature focusing on mental wellness of ALHIV in the African context was conducted. The process was guided by the PRISMA operational steps. As part of our problem identification phase, we drew on findings from a previous systematic review of mental wellness instruments and a qualitative photovoice study on exploring the experiences of ALHIV, to develop an initial framework of 13 mental wellness concepts and behaviors which informed the search strategy.

Results: The review included 17 articles from which we identified six mental wellness concepts: Connectedness, Sense of Coherence (SOC), Self-esteem, Self-acceptance, Hope for the Future and Spirituality as well as six behaviors facilitating mental wellness: Coping, Resilience, Purpose in Life (goals), Self-efficacy, Adherence Self-efficacy, and Leisure Activities. All of these concepts and behaviors have been noted in our previous research (systematic review and qualitative work), with the exception of adherence self-efficacy. Based on the findings from this review and our previous work, we adapted the Salutogenic Model of Health developed by Antonovsky in 1987, to propose a Salutogenic Model of Mental Wellness (SMoMW) for ALHIV in the African context. This SMoMW may be used to develop an age and culturally appropriate measure of mental wellness for ALHIV.

Conclusion: The findings from this review used to conceptualize mental wellness among ALHIV which can be used to develop a measurement of mental wellness.

KEYWORDS

mental wellness, adolescents living with HIV, integrative review, mental health, Africa

Background

Mental health as an integral component of overall health and wellbeing, has received global acknowledgment, as evidenced in its inclusion in the Sustainable Development Goals (SDGs), the World Health Organization's (WHO) Mental Health Action Plan (2013–2030), WHO's mental health gap action programme (mhGAP) and the United Nations Children's Fund (UNICEF) development of the Measurement of Mental Health Among Adolescents at the Population Level (MMAP) (World Health Organization, 2013, 2020a; UNICEF, 2019). Adolescent mental health, in particular, is receiving more attention, because adolescence is a time of critical development that sets the course for mental health and wellness across the life course (World Health Organization, 2014; Bentley et al., 2019). UNICEF argues that since half of all mental disorders have their onset during adolescence, intervention during the adolescent years is essential to prevent the development of chronic mental illness conditions.

Further, WHO observes that 1 in 7 adolescents between the ages of 10–19 years, experience a mental health disorder (World Health Organization, 2020b). The prevalence of mental health disorders accounts for 13% of the global burden of disease among adolescents, with suicide being reported as the fourth leading cause of death among 15–19 years old (World Health Organization, 2020b). It is further reported that adolescents living with HIV (ALHIV) are at increased risk of experiencing ill mental health (compared to their peers) due to the double burden of living with a stigmatized infectious disease and a managing a life-long chronic condition (Vreeman et al., 2017; Woollett et al., 2017; Sherr et al., 2018; Laurenzi et al., 2020). Findings from a recent systematic review reported high prevalence rates of mental health problems among ALHIV, with 24–27% of participants scoring positive for having a psychiatric disorder and 30–50% showing symptoms of emotional and behavioral difficulties or significant psychological distress (Dessauvagie et al., 2020). Other research with ALHIV report high prevalence rates of symptoms of depression, anxiety, post-traumatic stress disorder (PTSD), internalized stigma, hopelessness, fear, or suicidality (Woollett et al., 2017; Sherr et al., 2018; West et al., 2019; Okumu et al., 2021; Nguyen et al., 2022). Further, it is shown that these poor mental health outcomes are associated with increased incidence of risky behaviors, sub-optimal adherence to antiretroviral therapy (ART) and low retention in care (RiC)—which, in turn, may lead to viral load rebound and virologic failure (Hudelson and Cluver, 2015; Chory et al., 2022; Nguyen et al., 2022).

WHO defines mental health as more than the absence of illness, but as "a state of wellbeing, in which an individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and is able to make a contribution to his or her community" (World Health Organization, 2019). However, in mental health research, mental illness has been predominantly used as a euphemism for (or indicator of) mental health. This formulation of mental health excludes mental wellness, which is critical to the prevention of mental illness (or disorders) and the over-all promotion of positive mental health (Keyes, 2005). In the case of adolescents living with a chronic condition (such as ALHIV) [positive] mental wellness is a critical buffer against developing mental health disorders and for self-management of their chronic condition.

To date, mental wellness concepts for adolescents, particularly ALHIV, are underdeveloped and lack robust measurement instruments to stimulate research on this topic. Studies on mental wellness have been done with adult populations and applied to adolescents (Keyes, 2005; Roscoe, 2009; Ahanonu and Jooste, 2016). While research has shown that there are some similarities between adolescents and adults, it should also be considered that adolescence is a unique developmental period that is characterized by rapid physiological and neurological growth and cognitive development (UNAIDS, 2016; Lake et al., 2019), that occurs within the social context of various transitions to adulthood. Therefore, more research is necessary to explore what mental wellness means for adolescents, especially those living with a chronic condition like HIV, to develop culturally and age-appropriate instruments that can be used to monitor and evaluate progress on improving their overall mental wellbeing. This review aims to conceptualize mental wellness among ALHIV in the African context and consider the critical components for measuring mental wellness [state and behavior] in ALHIV (Orth and van Wyk, 2022). This integrative review forms part of a multi-phase study aimed at developing an instrument to measure mental wellness among ALHIV.

Abbreviations: ALHIV, Adolescents living with HIV; ART, Antiretroviral therapy; SDGs, Sustainable Development Goals; SMoMW, Salutogenic Model of Mental Wellness; SOC, Sense of Coherence; UNICEF, United Nations Children's Fund; WHO, World Health Organization.

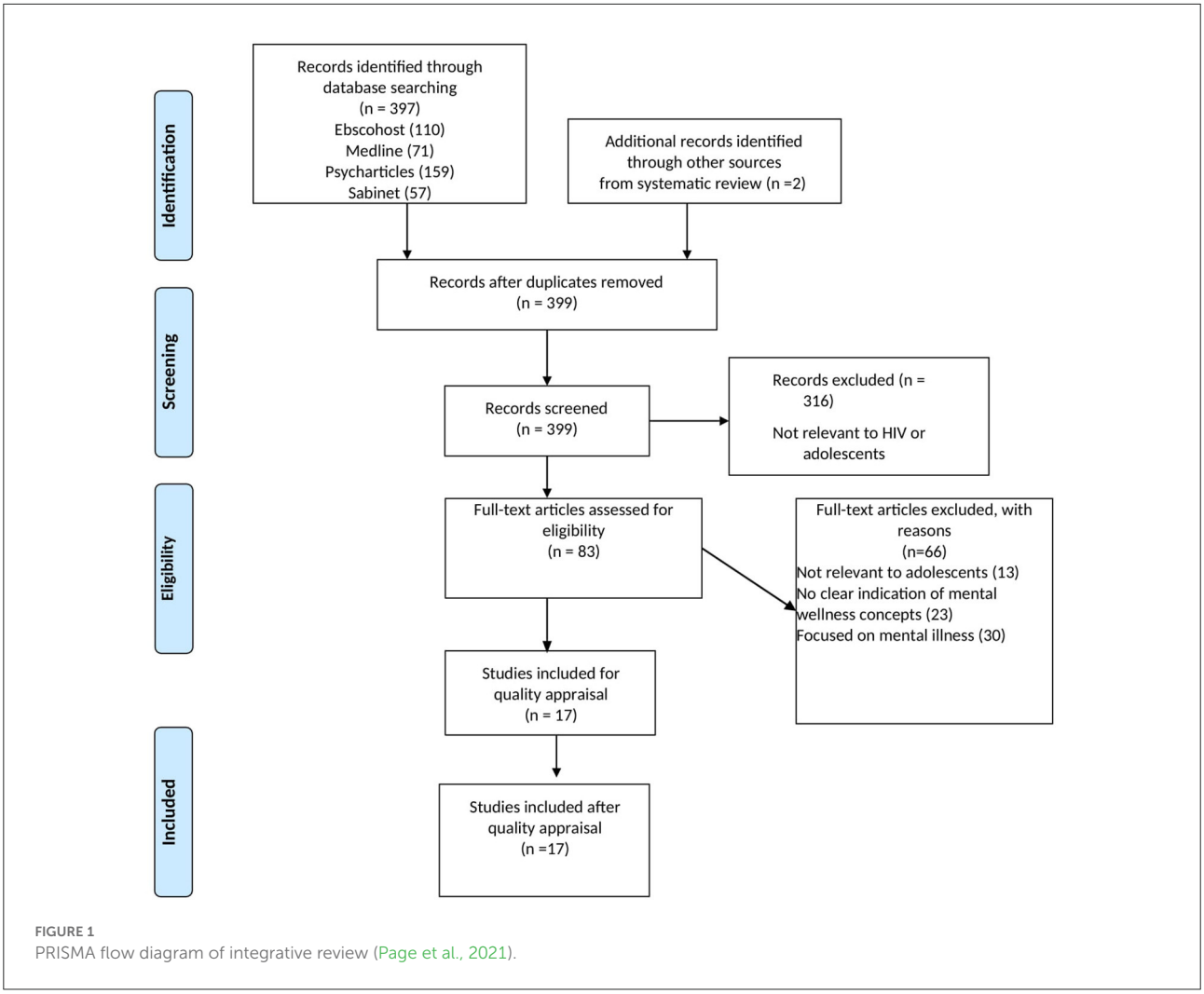


FIGURE 1
PRISMA flow diagram of integrative review (Page et al., 2021).

Methods

The methods for this review have been described in detail in the protocol (Orth and van Wyk, 2022). The integrative review has been identified as a unique tool in healthcare for synthesizing theoretical and empirical evidence investigations available on a given topic or phenomena to provide a more comprehensive understanding of a certain healthcare problem or other phenomenon. To accomplish this, a range of methodologies may be utilized to fully capture the context, processes, and subjective elements of the topic under investigation (Souza and De, 2010). Therefore, integrative reviews can contribute to theory development and have practical applicability to informing policy and programmes (Whittemore and Knafl, 2005). The existing body of literature on mental health among adolescents is varied and complex as there are many concepts associated with mental health research ranging from positive aspects such as "resilience" and "self-efficacy" to negative aspects such as "depression" and "anxiety". As such, it is not possible for one study to capture all the dimensions associated with mental health. To provide a complete picture of the available literature and to fully investigate the concept of mental wellness among ALHIV, we followed the integrative review steps proposed by Whittemore and Knafl (2005): (1) problem identification; (2) literature search; (3) data evaluation; (4) data analysis: and (5) presentation of the integrative review guided by the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) guidelines (Figure 1) (Page et al., 2021).

Problem identification

As described in the protocol (Orth and van Wyk, 2022) the problem identification is a crucial step in an integrative review, and as such, this was treated as a phase in itself. From our initial reading of the literature, we have identified two recurring issues: firstly, there is a lack of validated mental health instruments for

adolescents; and secondly, despite a growing body of research, the question of how mental wellness should be defined remains largely unresolved (Roscoe, 2009; Manderscheid et al., 2010; Manwell et al., 2015). To investigate this, we have proposed to follow two research questions to aid problem identification:

1) How is the concept of mental wellness defined in research involving adolescents?
2) What indicators of mental wellness are being explored/investigated in research?

To answer the abovementioned questions, we conducted a systematic review of all instruments used to measure mental wellness in adolescents (Orth et al., 2022). The sub-analysis of instruments used among adolescents living with a chronic condition (Orth and van Wyk, 2021a) revealed that Health-Related Quality of Life (HRQoL) instruments were frequently used to measure physical and psychosocial wellbeing among adolescents living with a physical chronic condition. However, these HRQoL instruments often include mental illness and mental wellness indicators which raises the question—to what degree is the absence of mental disorder symptoms equal to a high degree of mental wellness? As such, we argued that more instruments need to be developed in LMICs to give insight into which constructs of mental wellness are important to improving overall mental wellbeing for adolescents living in these contexts (Orth and van Wyk, 2021a; Orth et al., 2022). Though there was a lack of clear definition of mental health, we identified 13 mental wellness concepts from 79 instruments, namely: life satisfaction, mental wellbeing [general], resilience, self-efficacy, self-esteem, connectedness, coping, self- control, mindfulness/spiritual, hope, sense of coherence, happiness, and life purpose (Orth et al., 2022).

To explore the relevance of these 13 concepts for ALHIV, we conducted a second order analysis of qualitative data that emanated from a photovoice study exploring the experiences of ALHIV receiving ART at three public healthcare facilities in the Western Cape metropole of South Africa (Orth and van Wyk, 2021b). The photovoice technique allowed participants to lead the narrative and express themselves creatively through taking photographs with cell phone cameras (Orth and van Wyk, 2021b). As they spoke about their experiences, discussions around what mental wellness means to them emerged naturally. Through discourse analysis we identified six themes that depicted mental wellness concepts that were prominent in their experiences, namely: connectedness, spirituality and mindfulness, social coherence and awareness, self-esteem, self-acceptance, and sense of coherence. In addition, the adolescents gave accounts of six behaviors facilitating mental wellness namely: self-efficacy, coping, resilience, life purpose, engagement in enjoyable life activities and physical functioning (Orth and van Wyk, 2021b). The findings from the systematic review and photovoice study provided us with an initial framework of concepts and behaviors that informed our understanding of potential domains to include in developing a mental wellness instrument. However, as we explored each of these concepts further, we noted that traditional definitions of several of the concepts were not clearly delimited and overlapped with one another. For example, in the literature concepts like "self-esteem", "self-worth" and "self-acceptance" are often not clearly distinguished from one another. To address this problem, we used the mental wellness concepts and behaviors identified in the systematic review and photovoice study and developed a search strategy for the integrative review to further investigate the meaning of these to aid in the conceptualization of mental wellness among ALHIV.

Literature search

We systematically searched the following databases: Ebscohost (Psycharticles, Academic Search Premier, SocIndex), Educational Resource Information Center (ERIC), Medical Literature Analysis Retrieval System Online (MEDLINE) and Sabinet. We performed multiple searches using each of the identified concepts: (connectedness OR social support OR belonging), (cope* OR coping*), (hope), (purpose in life OR meaning in life OR sense of purpose), (physical functioning OR physical wellbeing), (resilience), (self-acceptance), (self-efficacy), (self-esteem), (sense of coherence), (spirit* OR mindful*) AND (adolescen* OR teenage* OR young people OR youth) [AND] (HIV OR living with HIV). The search was completed at the end of April 2022 and included all studies published up until that period.

Inclusion and exclusion criteria

The integrative review allows for an iterative process. Based on the findings from the previous studies, we adjusted the search from our original protocol, which aimed to include all adolescent populations to only focus on ALHIV (Orth and van Wyk, 2022). The purpose of this review is to identify mental wellness concepts that are significant to older ALHIV (aged 15–19 years), with the aim of developing an instrument that can be used to measure mental wellness of ALHIV living in South Africa. Our study selection was guided by the Population, Intervention, Comparison, Outcome and Time (PICOT) criteria (see Table 1).

Inclusion criteria

- ALHIV (perinatally and behaviorally acquired) aged 10–19 years
- Studies based in the African context
- Clear focus on the identified mental wellness concept
- Qualitative, quantitative or mixed-methods studies

TABLE 1 PICOT based inclusion criteria for literature review.

Patient population	Adolescents living with HIV in the African context
Intervention or interest	Definition or explanation of the identified mental wellness concepts and behavior
Comparison	Not applicable
Outcomes	Mental wellness, psychological wellbeing, positive mental health
Time	Any time

Exclusion criteria

- Studies focusing on or including mental illness as a concept
- Studies that were not peer reviewed

Data evaluation

The screening and reporting of the review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guideline and checklist (Figure 1). The number of hits for each search was recorded and exported to Endnote for review. The Mixed Methods Appraisal Tool (MMAT) was used to assess the methodological quality of the studies as it allows for summarizing the overall quality across a range of study designs (Hong et al., 2018). This allowed us to ensure that all the included studies were of good quality. After finalizing the selection of included articles, we extracted the data into an excel sheet focusing on (1) Bibliometric data (authors, title, year, country), (2) population group (age and sample size), (3) study design (type of study, methods) and (4) outcome of interest (mental wellness concepts defined or measured in the article).

Data analysis

We extracted the relevant data and organized it in an excel sheet to prepare for the analysis. The data was analyzed using a narrative framework analysis for qualitative and quantitative studies. Framework analysis involves engaging in a systematic process of data familiarization and identifying a thematic framework to chart the data (Snilstveit et al., 2012). Depending on the study and phenomena under investigation, an initial framework can either be borrowed from previous studies or can be developed from key concepts (Whittemore and Knafl, 2005; Snilstveit et al., 2012). As mentioned, our analytical framework was developed by using the mental wellness concepts and behaviors identified from the systematic review (Orth et al., 2022) and photovoice data (Orth and van Wyk, 2021b). We then applied the analytical framework by comparing and indexing the mental wellness concepts that were extracted from articles in the integrative review with the concepts in our framework (i.e., connectedness, coping, hope, purpose in life, physical functioning, resilience, self-acceptance, self-efficacy, self-esteem, sense of coherence, spirituality). Emerging concepts that were not represented in the initial framework were subsequently added to the list. Once all the concepts were presented in the updated analytical framework, we charted the data by defining each concept (as defined in the included studies) (Table 2).

Findings

The integrative review included 17 studies that focused on the mental wellness of ALHIV in the African context. As the review included both qualitative and quantitative studies, sample sizes ranged from 5 to 702. The majority of studies included in this review were conducted in South Africa ($n = 5$) and Uganda ($n = 5$). Most of the included studies used qualitative designs ($n = 12$) (Petersen et al., 2010; Midtbø, 2012; Mburu et al., 2014; Bernays et al., 2015; Shabalala et al., 2016; Woollett et al., 2016; Zanoni et al., 2019; Bakeera-Kitaka et al., 2020; Govindasamy et al., 2020; Kimera et al., 2020; Gitahi et al., 2021; Rencken et al., 2021); with only three quantitative [cross-sectional (Gitahi et al., 2021), longitudinal randomized clinical trial (Nabunya et al., 2020), secondary analysis (Nöstlinger et al., 2015)] and two mixed-methods study (Dow et al., 2018; Kaunda-Khangamwa et al., 2020). This may be indicative of a lack of mental wellness instruments for ALHIV, or it may reflect the research trends focusing on measuring the prevalence of mental health problems in ALHIV (Kidia et al., 2015; Vreeman et al., 2017; Laurenzi et al., 2020).

From the included studies we identified six mental wellness concepts: Connectedness, Sense of Coherence (SOC), Self-esteem, Self-acceptance, Hope for the Future and Spirituality as well as six behaviors facilitating mental wellness: Coping, Resilience, Purpose in Life (goals), Self- efficacy, Adherence Self-efficacy, and Leisure Activities (Table 2). All of these concepts and behaviors have been noted in our previous research (systematic review and qualitative work), with the exception of adherence self-efficacy. However, as our focus for this review was on ALHIV, this finding is not surprising. Studies have shown that adherence self-efficacy plays an important role in maintaining adherence—ALHIV (behaviorally or perinatally infected) are in a stage where they gradually experience greater responsibility—including learning to manage their health. Therefore, having a high sense of adherence self-efficacy can ease their transition to adult clinical care.

Based on our research, we argue that the above-mentioned concepts are significant indicators of mental wellness among ALHIV in the African context—however, Africa is a diverse continent and ALHIV are not a heterogenous group. For example, the study by Adegoke and Stein (Adegoke and Steyn, 2018) explore how resilience manifests among HIV

TABLE 2 Mental wellness concepts and behaviors from the review.

Mental wellness concept/behavior	Definition or interpretation	Quotes from included studies	References
Connectedness	Sense that one has satisfying relationships with others, believing that one is cared for, loved, esteemed, and valued, and providing friendship or support to others	"It seems the combination of disclosure and social support gave the adolescents a unique group feeling, a feeling of belonging, which seemed to be some of the key factors in their development of self-esteem and coping with HIV"	Adegoke and Steyn, 2018; Dow et al., 2018; Govindasamy et al., 2020; Kimera et al., 2020; Gitahi et al., 2021
		"In another study examining the benefits of family and social relationships for health and mental health of PLWH, family functioning significantly contributed to ART adherence and quality of life. Thus, strengthening positive family support and minimizing negative family interactions are crucial for increasing adherence rates"	Petersen et al., 2010; Midtbø, 2012; Mburu et al., 2014; Nöstlinger et al., 2015; Nabunya et al., 2020
		"Along with family members, peers who were also living with HIV featured prominently as a source of psychosocial support and friendship. Adolescents reported that through such peer connections, they could share coping strategies, make each other feel valued and offer each other a sense of identity"	Shabalala et al., 2016; Zanoni et al., 2019; Rencken et al., 2021
Coping	Coping refers to cognitive and behavioral efforts to manage (master, reduce, or tolerate) a troubled person-environment relationship	"At the interpersonal level, family and peer support emerged as key to assisting adolescents to cope"	Petersen et al., 2010; Midtbø, 2012; Mburu et al., 2014; Woollett et al., 2017; Adegoke and Steyn, 2018; Dow et al., 2018
		"Also at the individual level, a couple of adolescent respondents indicated how positive thinking and having goals for the future helped them to cope and suggested that instilling these in other children may be useful"	
Self-acceptance	A positive attitude toward yourself; acknowledge and accept multiple aspects of yourself including both good and bad qualities; and feel positive about your past life.	"It has been suggested that peer support group therapy for HIV positive adolescents positively affects their acceptance and perception of their disease"	Mburu et al., 2014; Bernays et al., 2015; Lentoor et al., 2016; Woollett et al., 2016; Zanoni et al., 2019
		"Although some adolescents reported that internalized HIV stigma had affected their ability to engage socially, many of these adolescents said that they were able to accept their situation eventually, regain their self-esteem, and interact with their families and peers, which in turn strengthened their self-efficacy and resilience."	
		"Being self-assured and accepting oneself were the basis of this self-esteem"	
Resilience	The ability to mentally withstand or adapt to uncertainty, challenges, and adversity.	"The most salient theme to emerge from the study in relation to individual-level factors that might influence adolescents' experience of living with HIV was their resilience, sometimes tempered by internalized stigma"	Mburu et al., 2014; Woollett et al., 2016; Adegoke and Steyn, 2018; Zanoni et al., 2019; Kaunda-Khangamwa et al., 2020
		"Features of resilience in this group were underscored by beliefs and character traits that enabled their ability to manage their adversity, as well as social behaviors that created the agency necessary for success"	

(Continued)

TABLE 2 (Continued)

Mental wellness concept/behavior	Definition or interpretation	Quotes from included studies	References
Self-esteem	A person's overall subjective sense of personal worth or value	"They are able to talk about their health with other HIV positive adolescents and it is also suggested that peer support groups enable the adolescents to develop good self-esteem" "Some of them reported that knowing their status was a strength to them, one boy stating that "we have self-esteem because we know our status"" "By disclosing their status to peers, the adolescents in my study showed that they were empowered and, in a position, to take their own decisions regarding who to disclose to and where to seek support. This indicates self-esteem and confidence"	Mburu et al., 2014; Nöstlinger et al., 2015; Woollett et al., 2016; Gitahi et al., 2021
Hope for the future	Emotion characterized by positive feelings about the immediate or long-term future.	"Considering the participants in my study, most of them were thriving and managed to remain positive, even though they knew they had HIV and had to be on ART for the rest of their lives. Most of them had hopes and dreams for the future and had specific thoughts about what they wanted to do when they grew older" "Hope was identified as an important motivation for protection. Many hoped that if they continued to adhere to their treatment, they would be able to live long enough to finish school, get a good job, get married, and have their own children. Some hoped that finally a cure for HIV might be found."	Bernays et al., 2015; Adegoke and Steyn, 2018; Bakeera-Kitaka et al., 2020; Kimera et al., 2020
Spirituality	Psychological process of bringing one's attention to the internal and external experiences occurring in the present moment; concern for or sensitivity to things of the spirit or soul.	"Additionally, many reported that they trusted God and prayed for good health, wisdom, courage, strength and cure in future. As a result, they were more optimistic that all will be well with them in future" "A strong theme emerging from adolescent participants was the idea that their own belief systems set the stage for their ability to be resilient. Many participants demonstrated a belief in fate with a comfort in the conviction that one is on the path one should be"	Woollett et al., 2016; Adegoke and Steyn, 2018; Kimera et al., 2020
Sense of Coherence	Degree of meaningfulness (motivational), comprehensibility (cognitive), and manageability (behavioral) that people feel in their life	"HIV positive adolescents, who thrive in spite of difficult challenges, can be said to have a strong SOC and resources at hand that enable them to cope with the challenges or stressors present in their lives. The knowledge of what these resources are can be used to promote SOC, leading to increased quality of life and wellbeing for this group of adolescents." "In other words, it can be said that disclosure was a main contributing GRR in enabling many of these adolescents develop and strengthen their SOC, which furthermore contributes to a movement toward health"	Midtbø, 2012; Woollett et al., 2016
Purpose in life (goals)	You have goals in life and a sense of directedness; feel there is meaning to your present and past life; hold beliefs that give life purpose; and have aims and objectives for living.	"Adolescents were motivated and had a sense of purpose. Some adolescents described carrying out an expanded range of duties, such as caring for their own children or younger siblings who were or were not living with HIV, with resilience, a deep sense of responsibility, hope for the future and optimism that eclipsed any sense of living with a chronic disease."	Midtbø, 2012; Govindasamy et al., 2020

(Continued)

TABLE 2 (Continued)

Mental wellness concept/behavior	Definition or interpretation	Quotes from included studies	References
		"Importantly, these goals appeared to promote wellbeing by providing a sense of purpose and making them feel socially valued"	
Self-efficacy	A person's particular set of beliefs that determine how well one can execute a plan of action in prospective situations. Self- efficacy is a person's belief in their ability to succeed in a particular situation.	"Observable ART adherence levels depend on a range of factors, including self-efficacy i.e., the person's perception of their own ability to accomplish a behavioral task, which influences a person's development or maintenance of a health behavior at the affective, cognitive and motivational levels"	Mburu et al., 2014; Gitahi et al., 2021
		"In addition, many participants demonstrated self-reliance that was key to self-esteem: 'If you don't believe in yourself, who will?"	
Leisure activities	Engaging and participating in activities that bring enjoyment	"Family, friends and leisure activities were also important positive factors that contributed to wellbeing"	Midtbø, 2012
		"Most of them also had leisure activities which they enjoyed, and some were very passionate about these activities, finding it a very important part of their lives"	
		"Leisure activities such as sports and drama were also activities that some of the participants were very passionate about. As mentioned, participation is connected to meaningfulness, which is the motivational component"	
Adherence Self- efficacy	Belief in one's ability to successfully adhere to treatment plans	"More specifically, adherence self-efficacy –defined as the confidence in one's ability to adhere to treatment plans, has been documented as an important predictor of medication adherence in the treatment of HIV and other medical conditions"	Gitahi et al., 2021

positive adolescent Yoruba girls. The findings from the study demonstrate how the Yoruba culture may enable resilience (through and emphasis on family ties and social cohesion) or constrain it through gender relations that often perpetuate gender inequalities which put adolescent girls (especially those living with HIV at risk) (Adegoke and Steyn, 2018). As many of the included studies are qualitative, we argue that the development of the mental wellness measure will facilitate research investigating these concepts among ALHIV in the African context to better understand the role and influence of culture on mental wellness.

Table 2 provides a definition of each concept followed by quotes from the included studies to illustrate how the particular mental wellness concept or behavior is associated with improved mental wellness and/or physical health outcomes in ALHIV. Similar to the findings from our systematic review and qualitative work (Orth and van Wyk, 2021b; Orth et al., 2022), the quotes confirm that the mental wellness concepts and behaviors do not operate independently; rather these are interconnected and work collaboratively to promote mental wellness. For example, the study by Dow et al. (2016) focused on developing a mental health intervention for ALHIV in Tanzania to improve their resilience—to accomplish this, the intervention included resilience strategies to cope with stressful events such as enabling and supporting strong familial and social relationships, addressing stigma (using cognitive behavior therapy techniques to change negative thoughts to positive ones) and instilling hope for the future. According to Dow et al. the participants found the intervention to be highly acceptable and feasible and was associated with increased resilience among ALHIV. However, it is not clear from the study how mental health was measured—the authors' mention that participants were given a pre-intervention questionnaire which included mental health, but this is not reported. While the main aim of the mental health intervention was to improve resilience among ALHIV, the qualitative findings suggest that mechanisms used to trigger resilience, were associated with improvements in other mental wellness outcomes such as connectedness (familial and social relationships), self-esteem and self-acceptance (stigma reduction) and hope for the future. As such, it is critical to utilize measures that can capture a range of associated mental wellness outcomes. Without appropriate instruments, it is impossible to draw conclusions about the efficacy of interventions aimed at improving mental wellness. Measures that assess various mental wellness concepts/behaviors in parallel are useful, as these provide precise indications

regarding the relationship (pathways) between these concepts and behaviors. Furthermore, such measures may provide information regarding the contribution of each of these mental wellness concepts and behaviors in heterogenous populations of ALHIV, and that can be critical in assessing interventions to improve treatment outcomes. This lends support for the need for integrated measures of mental wellness for ALHIV rather than instruments measuring single concepts/behaviors such as self-esteem for example.

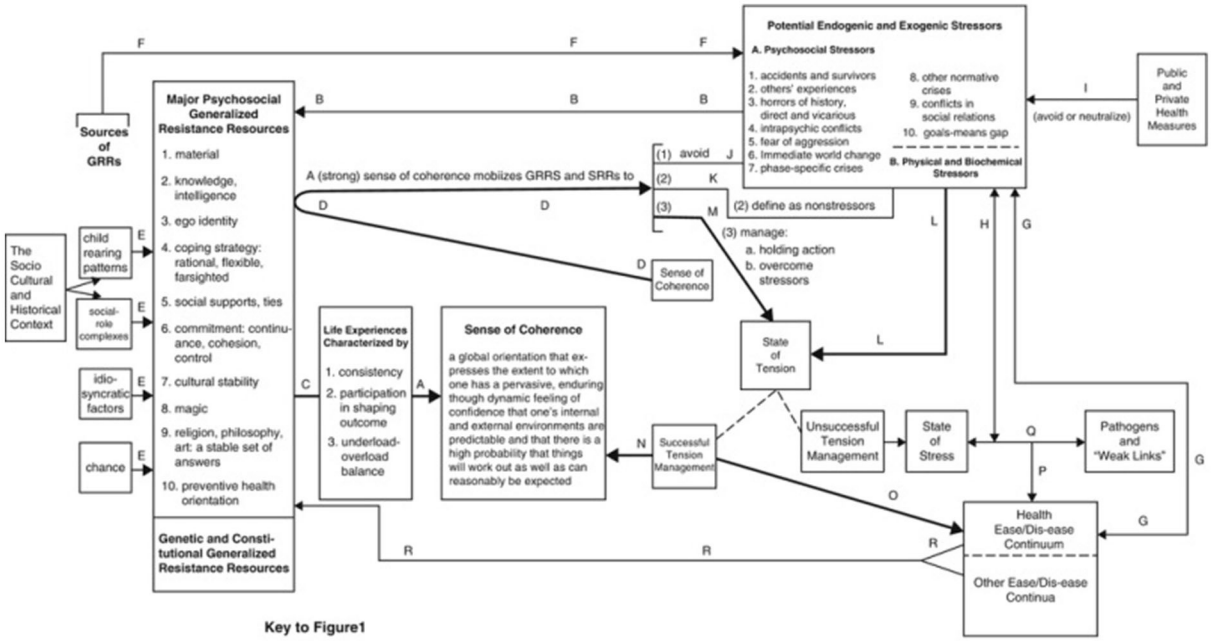
Toward a model of mental wellness

In this integrative review we unpacked the meaning of mental wellness for ALHIV, with the express aim of informing the development of an appropriate research instrument to measure mental wellness for ALHIV. Therefore, our approach moves away from traditional pathological inquiry of what causes mental illnesses to a salutogenic exploration of "what promotes mental wellness". As such, we turn our attention to SOC which emerged as a key concept in our research and is considered to represent "the origins of health" from a salutogenic approach (Antonovsky, 1987; Mittelmark et al., 2015). SOC reflects the coping capacity of people to deal with everyday life stressors and consists of three elements: comprehensibility (cognitive—extent to which the problem/stressor understood), manageability (behavioral—perceived availability of resources and belief in ability to use successfully use them) and meaningfulness (motivational—extent that one wishes to cope) (Antonovsky, 1987; Mittelmark et al., 2015). SOC is a developmental concept which begins to form during adolescence and stabilizes by the age of 30 years (Antonovsky, 1987; Braun-Lewensohn et al., 2015; Mittelmark et al., 2015; Hochwälder, 2019; Carlén et al., 2020; Mjøsund, 2021). Therefore, from a life-course perspective, strengthening SOC as a health promoting factor may improve overall physical and mental wellness in later life.

Antonovsky originally proposed SOC as the core concept of his Salutogenic Model of Health—which is aimed at explaining the origins of health and to describe how health can be promoted by focusing on wellness (Antonovsky, 1987; Braun-Lewensohn et al., 2015; Mittelmark et al., 2015; Hochwälder, 2019; Carlén et al., 2020; Mjøsund, 2021). The Salutogenic Model of Health was developed as an alternative to the pathological view of health/disease to improve health promotion by focusing on what makes people healthy. Unlike the pathological view, the salutogenic approach rejects the idea that homeostasis is a basic human condition; rather it argues that disease, illness, and decline are the norm (Antonovsky, 1987; Mittelmark et al., 2015). From this perspective, all individuals experience daily life stressors which causes immediate tension—however this tension may be resolved through effective coping and management strategies. Disease or illness occurs when the individual experiences long term stress resulting from their inability to resolve tension. As such, it is more constructive to focus on ways to improve an individual's adaptability to daily life stressors to promote overall health and wellness (Figure 2).

According to Antonovsky (Antonovsky, 1987; Mittelmark et al., 2015) the Salutogenic Model of Health represents a continuum model in which health is the result of continuous everyday life interactions between the individual, their experience of inevitable social, economic, cultural, psychosocial, and biological stressors, the availability of and access to health promoting resources and their capabilities in identifying and mobilize these resources to effectively overcome tensions resulting from stressors. Within this model, SOC reflects the individual capability to identify and mobilize resources, and the resources that promote health and facilitate coping with stressors are called Generalized Resistance Resources (GRRs) which can be genetic, material, constitutional and/or psychosocial resources (Antonovsky, 1987; Mittelmark et al., 2015). Based on this model, if an individual has a well-developed SOC and GRR, they are better able to identify SRRs and develop coping strategies to overcome specific challenges—for example a study by Polhuis et al. (2020) demonstrated how the Salutogenic Model of Health may be used to identify turning points and coping styles to help people with type 2 diabetes to adopt healthy eating habits.

In reviewing SOC and the Salutogenic Model of Health, we found it to be useful in illustrating the relationships and associations between the mental wellness concepts and behaviors identified in this review. As such we propose an adapted Salutogenic Model of Mental Wellness (SMoMW) for ALHIV (Figure 3) may be used to develop an instrument to measure mental wellness among ALHIV (Benz et al., 2014; Mittelmark et al., 2015). Similar to the Salutogenic Model of Health, the SMoMW views mental wellness along a continuum which may be influenced by individual interaction with everyday life stressors. As the model emphasizes the role of context, it can be applied to adolescents in general or those living with a chronic condition like HIV. Within the SMoMW, the Life Situation represents the macro socio-cultural and historical context that shape individual lived experiences. This macro context may serve to build up or detract GRRs—for example, for ALHIV, HIV knowledge acquisition is considered to be an important resistance resource (GRR). However, age (life situation) plays an important role in knowledge HIV acquisition—older ALHIV who have been disclosed to may learn more about how to effectively manage adherence than younger adolescents who have not been disclosed to. As such, younger ALHIV may experience different daily stressors than older ALHIV due to their lack of knowledge which could negatively. On the other hand, stressors they experience from the lack of knowledge may be buffered by protective family relationships (connectedness) to help them manage their illness until they are old enough to be disclosed to. Similarly, as they grow older, adolescents are more likely to develop a stable Ego (self- acceptance, self-esteem



Key to Figure1

Arrow A: **Life experiences shape the sense of coherence.**
Arrow B: Stressors affect the generalized resistance resources at one's disposal.
Line C: **By definition, a GRR provides one with sets of meaningful, coherent life experiences.**
Arrow D: **A strong sense of coherence mobilizes the GRRs and SRRs at one's disposal.**
Arrows E: **Childrearing patterns, social role complexes,** idiosyncratic factors, and chance **build up GRRs.**
Arrow F: The sources of GRRs also create stressors.
Arrow G: Traumatic physical and biochemical stressors affect health status directly; health status affects extent of exposure to psychosocial stressors.
Arrow H: Physical and biochemical stressors interact with endogenic pathogens and "weak links" and with stress to affect health status.
Arrow I: Public and private health measures avoid or neutralize stressors.
Line J: A strong sense of coherence, mobilizing GRRS and SRRs, avoids stressors.
Line K: A strong sense of coherence, mobilizing GRRS and SRRs, defines stimuli as nonstressors.
Arrow L: **Ubiquitous stressors create a state of tension.**
Arrow M: **The mobilized GRRs (and SRRs) interact with the state of tension and manage a holding action and the overcoming of stressors.**
Arrow N: **Successful tension management strengthens the sense of coherence.**
Arrow O: **Successful tension management maintains one's place on the health ease/dis-ease continuum.**
Arrow P: Interaction between the state of stress and pathogens and "weak links" negatively affects health status.
Arrow Q: Stress is a general precursor that interacts with the existing potential endogenic and exogenic pathogens and "weak links."
Arrow R: Good health status facilitates the acquisition of other GRRs.

Note: The statements in bold type represent the core of the salutogenic model.

FIGURE 2
Antonovsky's salutogenic model of health (Mittelmark et al., 2015).

etc) which may help them process the availability of GRRs and their ability to successfully utilize them (Antonovsky, 1987; Mittelmark et al., 2015). Additionally, ALHIV life situation may also exacerbate or ease their exposure to and experience of life stressors. For example, genetics may play a role in how an ALHIV experiences treatment fatigue or side effects (including neurological effects from long term use). Both the exposure to potential life course stressors and GRRs can influence to what extent an individual experiences life as coherent and meaningful. ALHIV who are able to utilize the GRRs available to them are more likely to experience consistency in their day to day lives (positive influence on adherence and development), balance responsibilities and leisure and be active participants in decisions which affect their lives. These life experiences shape SOC—which reflect the mental wellness concepts and behaviors identified in the review to promote mental wellness.

The SMoMW may be useful in developing a mental wellness measure for ALHIV. Not only does it emphasize the role of SOC and the associated concepts/behaviors as integral to mental wellness, but it also frames the dynamic interaction between SOC and health-promoting factors and stressors in relation to living with HIV over the life-course. Therefore, an instrument developed from the SMoMW may be beneficial as it would allow us to interrogate and explore the mental wellness needs of ALHIV as a heterogenous group with diverse demographic, social and clinical traits.

Strengths and limitations

To our knowledge, this is the first review aimed at identifying and defining mental wellness concepts and behaviors that are relevant to ALHIV in the African context. The integrative review method has been critiqued for its potential for bias and lack of rigor (Whittemore and Knafl, 2005). However, a strength of this study is that the search strategy was developed through a rigorous process which involved a systematic review and a photovoice study which speaks to the validity of the concepts

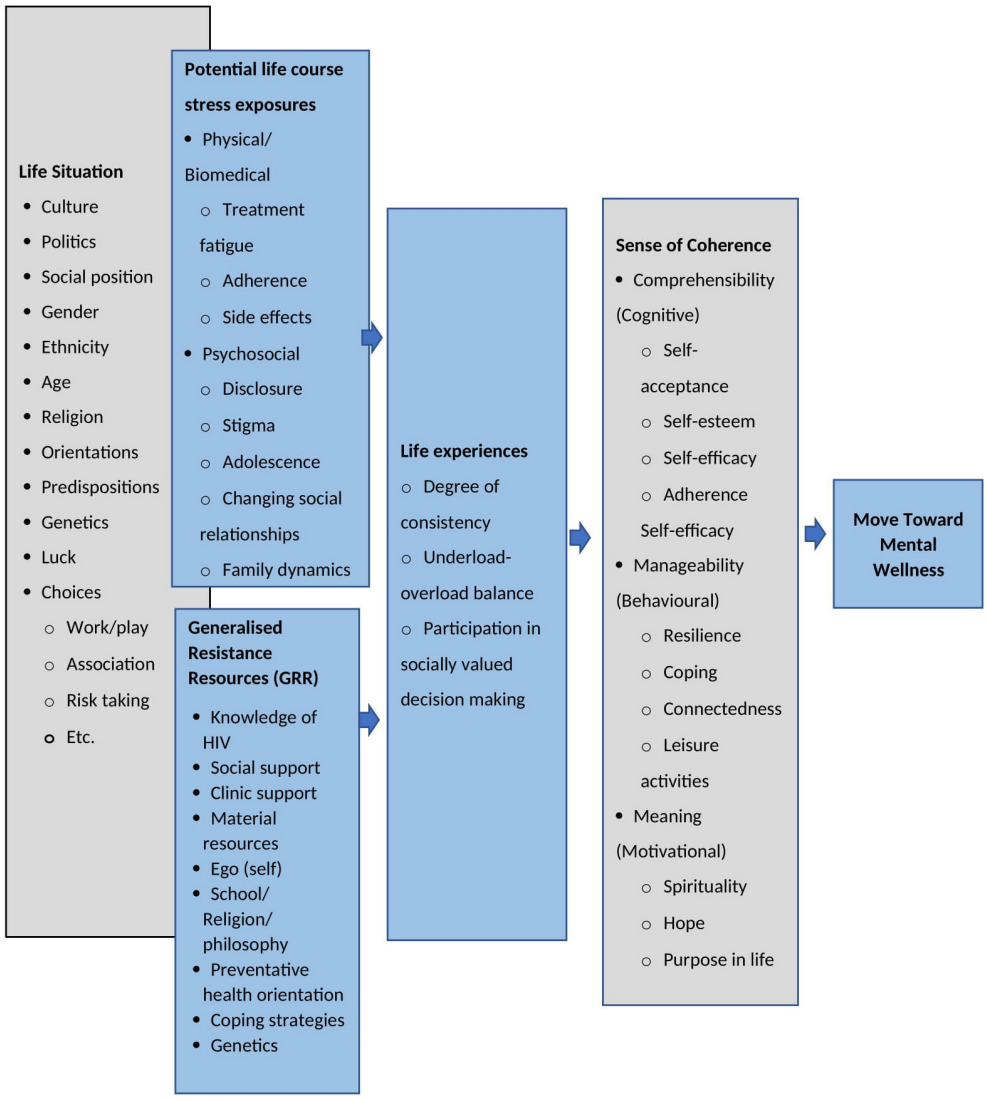


FIGURE 3
Salutogenic model of mental wellness for adolescents living with HIV adapted from Antonovsky, 1987 (Mittelmark et al., 2015) and Benz et al. (2014).

identified. However, we acknowledge that studies may have been omitted from the search due to access restrictions. Additionally, while we attempted to keep search terms as broad as possible, the lack of clear definitions of the included concepts may have resulted in articles being unintentionally omitted.

Conclusion

The findings from the integrative review highlight the mental wellness concepts and behaviors which are significant to ALHIV in the African context. Based on the findings from this review, as well as our previous systematic review and qualitative work, we propose a Salutogenic Model of Mental Wellness for ALHIV that can be used to develop a mental wellness instrument. This instrument includes the following concepts: Connectedness, Self-esteem, Self-acceptance, Hope for the Future and Spirituality and behaviors: Coping, Resilience, Purpose in Life (goals), Self-efficacy, Adherence Self-efficacy, and Leisure Activities which are related to overall Sense of Coherence (SOC) to promote overall mental wellness. Such an instrument may be used to measure impact of interventions aimed at measuring mental wellness among ALHIV. Additionally, the instrument may provide much needed data on different mental wellness mechanism that can help us to better understand the relationship between different mental wellness concepts and behaviors, the significance for diverse groups of ALHIV and how these work together to influence and support adherence behaviors.

Author contributions

ZO contributed to the conceptualization and management of the review process, fieldwork, data extraction, provided leadership and input to the review team at each stage of the project and the conceptualization, drafting, technical aspects, and critical revisions of the manuscript. BV contributed to the conceptualization of the review, fieldwork, draft write up, revisions and editing of the manuscript, provided leadership, and input to the review team at each stage of the project, contributed to the conceptualization, technical aspects, and critical revisions of the manuscript. Both authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Influence of distributive justice on organizational citizenship behaviors: The mediating role of gratitude

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Distributive justice is known to have important emotional and affective outcomes. The present study explores the role of distributive justice as an antecedent to feelings of gratitude toward the organization. Borrowing from social exchange theory, we investigate the mediating role of gratitude in the relationship between "perceived fairness in distributive justice" and "employees' organization citizenship behaviors (OCB)." Time-lagged, multi-source data was collected from 185 employees and their supervisors employed in a large manufacturing organization based in East India. Two significant findings emerge. First, the results indicate that feelings of gratitude signal fair distribution of benefits such that the employees go beyond the call of the duty to invest in OCB. Second, engagement in such acts seems to nullify their social debts highlighted in the social exchange perspective. Thus, a strong moral emotion, gratitude is a powerful vehicle that drives employees to act in the organization's interests because doing is desirable and rightful. Implications for theory and practice are discussed.

KEYWORDS

gratitude, distributive justice, organizational citizenship behavior (OCB), social exchange theory, positive emotion

Introduction

Over two decades of research has established that gratitude positively impacts personal wellbeing (Watkins et al., 2019), and social wellbeing (Tsang and Martin, 2019). Literature examining the positive outcomes of gratitude is well documented (Cameron et al., 2011; Spence et al., 2013). As a vital emotional resource, gratitude is defined as "a generalized tendency to recognize and respond with grateful emotion to the roles of other people's behavior in the positive experiences and outcomes that one obtains" (McCullough et al., 2002, p. 112).

In order to understand and appreciate the definition, it is noteworthy to highlight two salient aspects of it. First, the manifestation of gratitude is unconstrained and unrestricted by the magnitude of the effort it takes to express their thanksgiving (Emmons et al., 2019; Tsang and Martin, 2019). Second, response to the benefits received

is based upon the "experience" of the perceived benefits one receives. Put differently, expression of gratitude manifests in behavior that exceeds the call of duty, scope of responsibility, boundaries of one's work domain, and the norms of reciprocity (Algoe et al., 2013; Bock et al., 2016; Di Fabio et al., 2017; Fehr et al., 2017).

Events are known to trigger not just cognitive evaluations but also emotional appraisals (Cropanzano et al., 2019). Individuals not only think but also feel about their experiences at the workplace. While the cognitive responses to events of perceived justice have been studied extensively (Colquitt and Zipay, 2015), understanding of the emotional response that stems from justice-related outcomes remains inchoate (Verma and Yu, 2019). Despite the widespread speculation that moral behavior evokes moral emotions of gratitude, we came across only two studies (Ford et al., 2018; Verma and Yu, 2019) that have examined the relationship between organizational justice and gratitude. Of these, Wang et al. (2018) examined the combined relationship of gratitude (positive emotion) and anger (negative emotion) on interactional justice. Studied the relationship of three justice types (procedural, distributive, and interactional justice) with work engagement mediated through positive emotions- pride and gratitude.

Because the judgment about justice being fair is not cast in stone, employees may be inclined to use their feelings as a proxy for attributing fairness to justice-related events. Emotions can help seal the gap between objective justice and perceived justice. Thus, responses such as "I don't think that the outcomes are fair" are emotionally laden, reflecting how people feel about events; rather than mirroring their thoughts associated with such events (Colquitt and Zipay, 2015). Importantly, distributive justice, defined as the "fairness of the decision outcomes" (Colquitt et al., 2013), may hold the key to whether employees consider their organizations fair. Such feelings can evoke employee gratitude (Fehr et al., 2017; Kersten et al., 2021).

On one hand, perceptions of distributive justice signal worthiness to its recipients—whether (or not) the organization values their contribution. On the other, employees also assess whether the organization's distribution decisions went to deserving employees. In an organization, employees experience and express gratitude for a multitude of reasons (Locklear et al., 2022). Such reasons may include the opportunity to develop job-relevant technical skills, promotion to a higher grade, spot awards, exposure to working with top management teams, with senior members in the organization, or getting nominated for a marquee leadership development program. Recent studies have shown that individuals express gratitude not only to other individuals but also to the organization they work for Fehr et al. (2017), Jimenez (2018), Chen et al. (2020). Individuals infer the accuracy of deserving decisions by evaluating whether the rightful employees were rewarded.

In sum, this paper aims to examine the instrumental role of moral emotion originating from perceived fairness associated with distributive justice. First, while previous studies speculate that moral acts (e.g., distributive justice) may evoke moral emotions (e.g., gratitude), such claims lack empirical support (McCullough et al., 2002; Verma and Yu, 2019). Second, our understanding of whether the source of gratitude determines the direction of employees' discretionary behaviors remains unknown (Spence et al., 2013). A granular investigation of the perceptions of distributive justice and their association with gratitude can shed light while addressing the gaps.

We contribute to gratitude and justice literature in several ways. We consider the lack of attention paid toward perceptions of distributive (in) justice as an antecedent to gratitude as a gap, given that the justice perceptions may influence employees' voluntary behaviors benefitting the organization. Drawing upon social exchange theory (Blau, 1987), we suggest that employees feel obligated to volunteer for organizational cause when they perceive reward distribution norms as fair. When employees perceive their organization as fair, they go beyond reciprocity norms to benefit the organization by working harder. Our views are consistent with the affective component of social exchange theory that posits that moral emotions stem from moral actions and behaviors (McCullough et al., 2001b; Malti et al., 2020; Septianto et al., 2020). The following sections present the theoretical support and develop study hypotheses.

Influence of organizational justice on organization citizenship behaviors-o—a social exchange perspective

More than half a century of research on social exchange signals the role of positive emotions that play a role in influencing voluntary actions targeted toward the benefactor (DeCremer, 2007; Fortin et al., 2015; Wang et al., 2021). Studies show a positive relationship between organizational justice and organization citizenship behaviors (OCB) (Rahman and Karim, 2022). Meta-analytic report (Colquitt et al., 2013) endorses that distributive justice may significantly influence OCB directed toward the organization (OCB-O).[1]

Justice perceptions stemming from exchange dealings can evoke positive or negative emotions (Lawler and Thye, 1999; Wu et al., 2017). For instance, these perceptions determine

1 It is important to mention the similarities and differences between OCB and extra-role behaviors. Both OCB and extra-role behavior are similar as both are not expected or formally defined in the job description (Lee and Allen, 2002) and neither are they rewarded (Vandyne et al., 1995). However, the fundamental difference between the two is that while OCB is affiliative and promotive (Bergeron and Thompson, 2020), extra-role behaviors can be both promotive and prohibitive. Stated differently, OCB-O is always beneficial to the organization (Tremblay et al., 2022) but extra-role behavior ("challenging" dimension) may put the organization at risk (Organ, 1997).

affective-emotional states and corresponding responses that resonate with (in) justice (Moorman, 1991; Cropanzano and Mitchell, 2005).

Social exchange theory (Blau, 1987) posits that following the norms of reciprocity, individuals reciprocate positively or negatively for the benefits/harm they perceive. "Social exchange. refers to voluntary actions of individuals that are motivated by the returns they are expected to bring and typically do bring from others." (Blau, 1987, p. 91). Existing research has established the instrumentality of social exchange to understand dyadic relationships for reciprocal or resource exchange behaviors. The norms of reciprocity indicate that beneficial actions by one party would lead to a similar response by another party in a bilateral relationship (Cropanzano and Mitchell, 2005). Recent studies have shown that the receivers feel obligated to respond by returning tangible and intangible favors. Such favors can be social (e.g., influence, status, and love) and economic (e.g., money, information, goods, and service) (Muthusamy and White, 2005).

In the present study context, we consider perceptions of distributive justice from where tangible outcomes originate (Cohen, 1987; Leclercq et al., 2020) to form a fertile ground for the employee to experience and express their gratitude toward the organization. This form of gratitude stems from the desire to preserve and enhance the person's interest (e.g., supervisor) by paying his/her debts for the valued resources (outcomes) received.

Research suggests that when employees perceive their authority figures to be acting morally, such actions are likely to boost feelings of gratitude (Jiang and Qu, 2022) for two reasons. First, employees are likely to consider themselves fortunate to be part of an organization that emphasizes that its managers appear fair and transparent in allocating benefits (Cropanzano et al., 2019; Estreder et al., 2020). Second, being a beneficiary may boost employees' self-esteem since they are recognized for their valued contributions (Haider et al., 2019). Third, even if some employees do not receive any benefits *via* the social exchange, they might feel gratitude because distributive justice establishes norms of inclusion and exclusion in a manner that those worthy of benefits are visible and known (Lawler and Thye, 1999). "Gratitude results from the attribution of positive events to others" (Lawler and Thye, 1999); individuals could feel grateful so long as they perceive benefits to be awarded to deserving others.

This implies that if the employee believes that the organization fairly allocates rewards, he/she is likely to expend efforts in ways that benefit the organization (Yaakobi and Weisberg, 2020). By doing so, a grateful employee can express his positive feelings toward the organization of which the authority figure is a prominent part. By engaging in OCB-O, the employee perceives that s/he has repaid the moral debts that s/he owed to the organization, fulfilling the norms of social exchange.

Hypothesis development

Impact of distributive justice on organization citizenship behaviors– O

Despite the emergence of myriad theoretical perspectives, scholars agree that social exchange entails a multitude of interactions that create obligations (Emerson, 1987; Cropanzano and Mitchell, 2005). More importantly, these interactions are embedded within social exchanges resulting in corresponding actions that resonate with actions from where the behaviors originate (Blau, 1987). Such corresponding transactions create high-quality social ties (Cropanzano and Mitchell, 2005). When employees perceive the actions of authority figures as fair, they feel obliged to reciprocate, fulfilling the social reciprocity norms. Fair actions may signal the legitimacy and trustworthiness of the organization because superiors act as custodians of policy and rules. In a related study, Aryee et al. (2002) reported that organizational trust mediated justice perceptions on organizational commitment, job satisfaction, and intentions to quit. We propose that fairness perceptions would encourage employees to give time beyond time to volunteer for OCB-O because doing so satisfies the needs of felt obligation (Eisenberger et al., 2001). As such, exchange relationships entail repayment within a given period. The repayment rules may stem from either local folklore or out of morality (Cropanzano and Mitchell, 2005). In either case, employees may act for the organization's benefit because superiors appear transparent and trustworthy in their dealings. One way to repay moral debts is to act in ways that benefit others—including the organization.

> *Hypothesis 1: Perceptions of distributive justice encourage employees to engage in OCB-O.*

Indirect effects of distributive justice on organization citizenship behaviors -O *via* gratitude

Distributive justice is outcome-oriented and tangible (Cohen-Charash and Spector, 2001), wherein the beneficiary assesses the fairness of benefit/distribution. It is different from procedural justice, which is defined as "an individual's perceived fairness of the rules applied to a decision-making process" (Colquitt, 2001, p. 386). Interactional justice is "an individual's perceived fairness of interpersonal treatment during interactions, thus highlighting the notions of respect, politeness, honesty, and dignity one receives from others" (Luo, 2007, p. 647).

Given that distributive justice determines "who gets what" (Cohen, 1987), employees who perceive that they have received benefits that meet or exceed their expectations should feel

gratitude (Sun et al., 2019). Since gratitude is a moral emotion, it creates a sense of moral obligations (Greenbaum et al., 2020) among people who socially "owe" to their benefactors. Such indebtedness provides the motivational drive for OCB-O (Fehr et al., 2020). By engaging in OCB-O, the employees' actions would be consistent with the norms of reciprocity outlined in the moral exchange perspective (Bergeron and Thompson, 2020).

Any support the organization offers to rightful employees should trigger a moral obligation to reciprocate (Ritzenhöfer et al., 2019). If not reciprocated, the employee may perceive the social exchange as "unequal" and feel "indebted." Hence, employees reciprocate the obligation through positive discretionary behaviors, such as OCB-O. This is in sync with the core premise of the social exchange theory (Jonkman, 2020). There is a positive relationship between justice perceptions and citizenship behavior (Organ, 1997; Masterson et al., 2000). The employee may "go the extra mile" to volunteer in organizational initiatives in reciprocation for the perceived "fair justice."

We propose that distributive justice should positively relate to gratitude toward the organization due to the latter's outcome focus. Managers as authority figures are vested with decision-making powers (both administrative and developmental), which they need to execute as a matter of their role prerogative. To function as effective managers, people with administrative responsibilities need to allocate rewards and incentives to their subordinates to motivate them to perform better. In other words, when others (both recipients and non-recipients of benefits) perceive those reward allocations are justified, they would intuitively presume that due procedures were followed to arrive at a benefit decision (Cropanzano et al., 2019). In contrast, if the outcomes are not seen as fair, the subjects would raise the alarm about the consistency of the procedures that were followed in arriving at the outcome decision (Colquitt et al., 2013). Feelings of gratitude originate from attribution judgments about fairness (Lawler and Thye, 1999). When employees perceive that the norms of distributive justice have not been flouted, they should feel grateful even if they are not direct recipients of the benefits since the criteria to be classified as a beneficiary is evident and transparent. These sanguine views are consistent with the affective component of moral exchange theory (Blau, 1987), which posits that moral emotions stem from moral actions and behaviors.

Justice-related events follow positive or negative emotions based on fairness perceptions (Colquitt and Zipay, 2015). Literature has considered distributive justice to be "cold" given the outcome-directedness (Jonkman, 2020; Leclercq et al., 2020). However, employees' fairness perceptions are not only based on "cold" cognitive aspects but also on "hot emotion-laden" responses to events (Colquitt and Zipay, 2015). Employees not only think about the "unfairness" but also feel it is unfair. When benefits are awarded to deserving employees, it signals that authority figures in the organization have been fair and consistent in passing rewards to worthy employees whose contributions are valued by the organization (Cropanzano et al., 2019). Because moral behavior is known to be associated with moral emotions (Colquitt and Zipay, 2015), when employees consider that authority figures of the organization have moral ways, they should feel grateful. Recipients of benefits should naturally feel grateful for what they receive; the non-recipients should feel equally grateful that the benefits went to deserving employees and that the organization is fair and transparent in allocating benefits.

Further, research illustrates that when people report moral feelings of gratitude, they feel obliged to repay what they owe, following the norms of reciprocity that underlie rules for social exchange (Spence et al., 2013; Cropanzano et al., 2019; Wang and Koerber, 2020). Since supervisors are bona fide representatives of the organization, employees would want to reciprocate positively by working harder and going beyond duty to repay the debts they presumably owe. Stated formally, we hypothesize:

> *Hypothesis 2: Feelings of gratitude toward the organization will mediate the relationship between employee perception of distributive justice and their subsequent engagement in OCB-O*

Materials and methods

Sample and procedure

The study was conducted in a large manufacturing organization based in East India. The Human Resource (H.R.) department was keen to know the employees who are most likely to volunteer for community welfare activities as they had undertaken a community development project for a cluster of villages surrounding the manufacturing facility. We recruited the participants by asking them to volunteer for a study to capture their views of organizational practice. One of the authors was associated with this organization at the time of data collection. An online survey collected the data from employees and their superiors, across two periods. The H.R. Deptt provided the email ids for the employees and their supervisors. We sent an email with a covering note explaining the study's purpose and assured the response's confidentiality. The H.R. department identified the employees and supervisors. Both the employees and supervisors completed the survey during work hours. Of the 434 employees, 203 employees submitted the survey. The elimination of missing values gave us 195 usable data points (a 45 percent response rate). We then emailed 160 supervisors with whom these 195 employees had a direct reporting relationship. We received completed surveys from 150 supervisors (94 percent response rate). Thus, our final sample comprised 185 employees with corresponding responses from their supervisors.

The employees' average age was 32 years (s.d. = 4.5). The employees' average tenure in the organization (OG) was 2.43 (s.d = 1.20) (Table 1). There were 33% female respondents, and the rest were males.

Measures

Gratitude to the organization

Studies have contextualized gratitude toward the organization, coach, and sports team (Chen and Kee, 2008; Akgün et al., 2016; Chen and Chang, 2017). For the present study, we measured employees' gratitude toward their organization. At time 1, employees completed a 10-item measure of gratitude toward the organization. The scale was a modified version of The Gratitude Questionnaire (GQ-6) of McCullough et al. (2001a) and the Gratitude, Adjective (GAC) of McCullough et al. (2002). The sample item includes "When I think of my organization, I feel a sense of gratitude." Employees responded on a five-point Likert scale ("1"–never, "5"–always). After checking for reliability ($\alpha = 0.94$) and validity, the item scores were added to form overall measures of gratitude to the organization.

Distributive justice

At time 1, employees completed a five-item measure of Niehoff and Moorman (1993) distributive justice scale. The sample item includes "I think that my level of pay is fair." Employees responded on a five-point Likert scale ("1"–strongly disagree, "5"–strongly agree). After checking for reliability ($\alpha = 0.77$) and validity, the item scores were added to form overall measures of distributive justice.

Organizational citizenship behavior directed toward the organization

At time 2, supervisors completed a five-item measure of Lee and Allen (2002) organizational citizenship behavior directed toward the organization about their subordinates. The sample item includes "This employee keeps up with developments in the organization." Supervisors responded on a five-point Likert scale ("1"–never, "5"–always). After checking for reliability ($\alpha = 0.80$) and validity, the item scores were added to form overall measures of organizational citizenship behavior directed toward the organization.

Higher scores indicate a higher value for all the constructs.

The proposed model is presented here (Figure 1).

Results

First, we conducted factor analysis using Mplus 8.3 (Muthén and Muthén, 2017). to verify that the items load appropriately to the desired constructs. We compared hypothesized three factors solution with two factors solution and a single-factor solution. Model fit was assessed through the root-mean-square error of approximation (RMSEA), the Tucker–Lewis Index (TLI), and the comparative fit index (CFI) as per the recommendations of the researchers (Hu and Bentler, 1999; Steiger, 2007; Hayes, 2012). The Table 2 shows that the three-factor solution ($\chi^2 = 218$, DoF = 102 and p-value < 0.01) is superior to two factors ($\chi^2 = 330$, DoF = 118 and p-value < 0.01) and single factor solution ($\chi^2 = 554$, DoF = 135 and p-value < 0.01).

After accepting the three factors solution, the correlation table and descriptive statistics were calculated (Table 1).

Table 3 presents the reliability and validity. The Cronbach's alpha value (Table 3) for all 3 constructs were above 0.7 (DJ = 0.77, OCB-O = 0.80, and OG = 0.94). The average values extracted (AVE) for the distributive justice (DJ), OCB, and OG were 0.46, 0.51, and 0.61, respectively. Since AVE was less than 0.5 for DJ, the composite reliability was checked to see if DJ fulfills the criterion of construct validity. The composite reliability for DJ, OCB, and OG were 0.77, 0.80, and 0.94, respectively. Though the AVE for DJ was slightly lower than 0.5, its C.R. was higher than 0.7, suggesting that DJ can be considered a valid construct.

After establishing the reliability and validity, regression analysis was conducted to validate the hypotheses. Since demographic variables can influence the perception of justice, gratitude and OCB, control variables were added to the analyses. Age, tenure, and gender were used as control variables. Table 4 presents the values of regression analysis.

We used multiple hierarchical regression for analyzing hypotheses. In Model 1, OCB as a dependent variable was regressed with control variables, but none of them turned out to be significant ($b = 0.00$, s.e = 0.0). In Model 2, DJ was added

TABLE 1 Estimated sample statistics for the latent variables.

Variable	Mean	*SD*	1	2	3	4	5	6
1. Gender	1.33	0.47						
2. Age	32.00	4.50						
3. Tenure^{+}	2.43	1.20						
4. DJ (T1)	3.43	0.72	–	–	–	1.000		
5. OCB-O (T2)	3.85	0.59	–	–	–	0.32**	1.000	
6. OG (T1)	3.78	0.71	–	–	–	0.55**	0.38**	1.000

N, 185. T1, Time 1; T2, Time 2; **$p < 0.01$; $^{+}$Tenure was an ordinal variable.

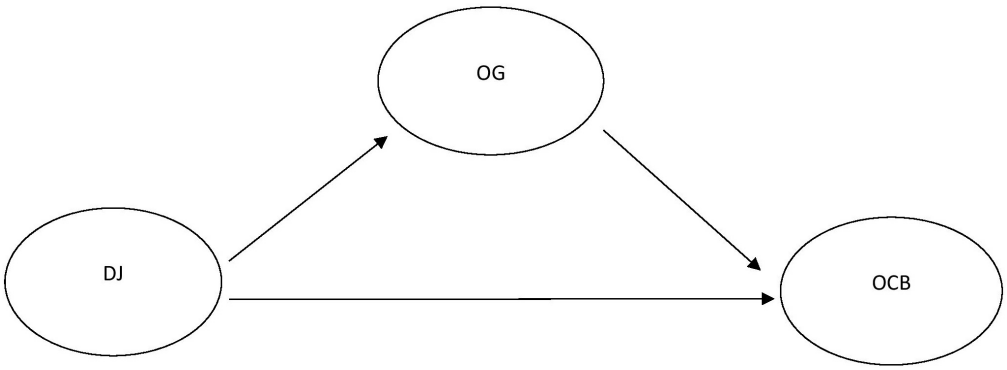

FIGURE 1
Proposed model.

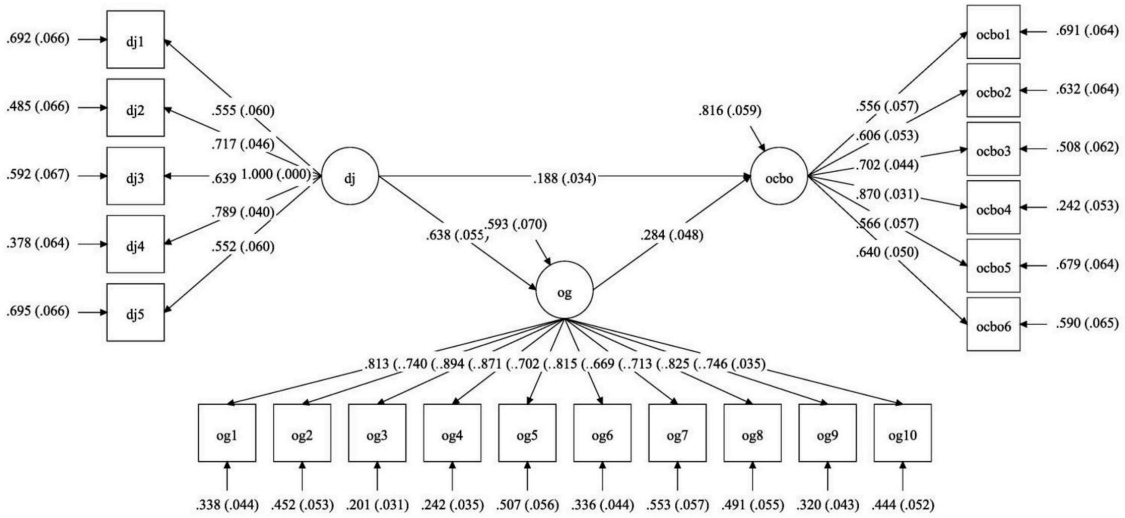

FIGURE 2
Summary of SEM result. Dj, distributive justice; Og, Gratitude toward organization; OCB-O, organizational citizenship behavior toward organization.

TABLE 2 Factor solution.

Model	N of parameters	Chi square	DoF	*P*-value
One factor	54	554	135	0
Two factors	71	330	118	0
Proposed three factors	87	218	102	0
Models comparisons				
One factor vs. two factors	–	221	17	0
Two factors vs. three factors	–	114	16	0

as an independent variable to see the incremental effects of it on the dependent variable. The results (b = 0.26, s.e = 0.58, p-value < 0.001) shows that the relationship between DJ and OCB was significant with a positive slope, which means with the increase of DJ, OCB-O also increases. In Model 3, gratitude was added as an additional independent variable. Addition of OG led to change in strength of DJ-OCB relationship (b = 0.1, s.e = 0.058, p = 0.1). OG was also positively and significantly related to OCB (b = 0.23, s.e = 0.069, p < 0.001). In Model 4, the dependent variable was changed to OG from OCB, and control

TABLE 3 Reliability and validity.

Indicator	DJ	OCB	OG
Cronbach's alpha	0.77	0.80	0.94
Composite reliability	0.77	0.80	0.94
Average variance extracted	0.46	0.51	0.61

variables were considered independent variables. In Model 5 DJ, was added as an independent variable of interest in addition to control variables. The results prove that DJ is positively and significantly related to OG ($b = 0.53$, s.e = 0.062, $p < 0.001$).

In the hypothesis, we predicted a positive relationship between distributive justice, and OCB-O toward the organization, mediated by gratitude. To examine the mediating role of gratitude, the indirect effects of DJ on OCB was calculated using process macros suggested by Preacher and Hayes. We used process macros with Mplus to obtain indirect effects. **Table 5** reports the results of direct, indirect and mediation.

The mediation analysis suggest that the total effect is significant ($b = 0.22$, s.e = 0.054, $p = 0.001$) and the indirect effect ($b = 0.16$, s.e = 0.058, $p = 0.012$) is significant as well but direct effect was found to be insignificant ($b = 0.092$, s.e = 0.063, $p = 0.14$). These results indicate that gratitude fully mediates the relationship between distributive justice and OCB-O.

The SEM model in which distributive Justice and OCB–O are associated through gratitude showed a good fit. The results suggested a good fit on most indices (CFI = 0.920, TLI = 0.904, SRMR = 0.06, RMSEA = 0.072, Chi-Square value = 365.720). While a value of more than 0.95 is ideal for CFI and TLI, (Hu and Bentler, 1999), a value above 0.90 is also considered acceptable for CFI (Hooper et al., 2008) and TLI (Forza and Filippini, 1998).

The general rule for a good fit of RMSEA is a value closer to 0.06 (Hu and Bentler, 1999), an astringent range of 0.06–0.08 is considered acceptable (Steiger, 2007; Hayes, 2012).

Since the total effects of DJ on OCB-O were significant, it lent support to our first hypothesis. Similarly, significant indirect effect ($b = 0.346$, s.e = 0.138, $p = 0.012$) lends support to the critical hypothesis (H2), suggesting that OG mediates the relationship between DJ and OCB-O.

Discussion

The study's purpose was to investigate the association between moral acts (e.g., distributive justice) and moral emotions (e.g., gratitude). Based on the moral affect aspect of the social exchange theory, perceived fairness in distributive justice evokes a higher level of gratitude toward the organization among the employees. Distributive justice is more relevant because the employees are more concerned about the consistency in allocating benefits. Our results suggest that the perceptions of distributive justice induced moral obligation to pay back to the organization, among employees. The employees go beyond the transactional norms of reciprocity.

Consistent with our main hypothesis, gratitude mediated the relationship between employees' perception of distributive justice and OCBO. Feelings of gratitude prompt the beneficiaries to repay their social debts by indulging in actions beyond the job description. The results are in sync with the previous studies that examined the moral emotion of gratitude and organizational justice (Verma and Yu, 2019; Ford et al., 2018) and between gratitude and OCBO (Spence and Brown, 2012; Spence et al., 2013). It is interesting to note that gratitude originating from distributive justice not only signals consistency in the allocation of benefits by the organization but also drives employees who may be beneficiaries to go beyond the call of duty to demonstrate OCBO.

Theoretical implications

The article contributes to understanding employee gratitude resulting from the work environment. First, we examined distributive justice as an antecedent to employees' feelings of gratitude toward their organization. When employees develop a perception of fairness in an organization, they tend to feel grateful to the organization (not only to the supervisor). Our results suggest that a fairness perception can also decide the directionality of gratitude feelings. It is equivalent to "counting the blessings" in the workplace (Layous, 2019).

Second, studies of gratitude in the organization have always been conceived as independent variables (Greenbaum et al., 2020), and the potential source of antecedents for gratitude in the context of the organization has been less explored (Ford et al., 2018; Guan and Jepsen, 2020). Our results extend organizational justice literature by suggesting that presence of distributive justice may induce feelings of gratitude among employees. Because distributive justice is outcome-driven, the implications are far-reaching. Thus, as a moral emotion, gratitude is the outcome of the "fair distribution of reward" in the workplace.

Third, employees tend to act positively toward the organization when they feel grateful. In line with the "moral reinforcement function" of the moral affect theory of gratitude (McCullough et al., 2002), grateful feelings reinforce a prosocial behavior toward the helper. Hence the employees volunteer

TABLE 4 Regression analysis.

	Dependent variable: OCB								Dependent variable: OG					
	Model 1			Model 2			Model 3		Model 4			Model 5		
Independent variables	Unstd B	S.E.	95.0% CI [B]	Unstd B	S.E.	95.0% CI [B]	Unstd B	S.E.	95.0% CI [B]	Unstd B	S.E.	95.0% CI [B]	Unstd B	S.E.	95.0% CI [B]
Intercept	3.91	0.05	[38.0–4.0]	2.57***	0.24	[2.09–3.0]	3.03***	0.21	[2.6–3.4]	3.82	0.07	[3.6–3.9]	1.98	0.22	[1.5–2.4]
Age	0	0	[0.00–0.00]	0	0	[0.00–0.00]	0	0	[0.00–0.00]	0	0	[0.00–0.00]	0	0	[0.00–0.00]
Tenure	0.01	0	[0.00–0.00]	0	0	[0.00–0.00]	0	0	[0.00–0.00]	0	0	[0.00–0.00]	0.01	0	[0.00–0.00]
Gender	0	0	[0.00–0.00]	0	0	[0.00–0.001]	-0.001	0	[0.00–0.00]	0	0	[0.00–0.00]	0	0	[0.00–0.00]
DJ				0.26***	0.05	[0.14–0.37]	0.1	0.058	[-0.00–0.22]				0.53***	0.062	[0.41–0.65]
OG							0.23***	0.069	[0.094–0.36]						
R Sqr (Adj.)			0.07			0.1		0.15				0.001			0.29

***$p < 0.001$.

in OCBO. By acting in instrumental ways to "give-back" to the organization *via* OCBO, gratitude is a powerful emotion through which employees display reciprocity behaviors outlined by the affect aspect of social exchange theory. Put differently, feelings of gratitude among employees may benefit the organization beyond what one intuitively expects through the transactional exchange.

Managerial implications

Since employee engagement is critical for an organization, our findings suggest that gratitude in employees may not only signal consistency of moral acts by managers but also motivate them to go beyond the call of duty. Research suggests that grateful employees engage in voluntary discretionary effort and act as custodians for the organization. They feel connected to the organization, are more engaged in producing high-quality work, and contribute actively to OCB-O (Turner, 2020).

A larger managerial implication is on highlighting distributive justice in all forms of organizational rewards and benefits. One way to this end is to communicate the criteria used to decide the allocation of rewards. More importantly, managers need to explain the exclusion criteria to vindicate who was not entitled to the benefits and for what reasons. Understandably, the beneficiaries may feel grateful for what they have received. However, for those who couldn't be included in the beneficiary list, it is quite natural for them to experience negative emotions. Managers need to explain the reasons in objective ways why they couldn't be considered. A tangible measure of success will empower employees with the knowledge of what needs to be done to succeed. The non-recipients of the beneficiaries need to be convinced that they did not deserve benefits. Employees may feel grateful to the organization for providing useful feedback and explanation for offering a detailed action plan for further improvement. In doing so, the non-recipients of benefit may consider distributive justice fair and transparent, one that exudes the deservingness of benefits among various employees.

Distributive justice as a source of gratitude emotion may have far-reaching effects across various H.R. practices, not limited to compensation and benefits. For instance, those chosen for a specific leadership role as part of the succession plan may feel grateful, while others who were under consideration but not selected may feel left out. Management needs to offer a valid explanation to employees who were equally talented but not selected for leadership roles (say) as part of the succession plan. For example, they can be given alternative positions such as subject matter experts or leading a greenfield project. In doing so, organization authorities can ensure that talented employees don't feel left out. Employees should value the effort taken by their reporting managers in making a strong business case for them, even if such efforts do not yield the expected results (McCullough et al., 2001a). Similarly, employees who aren't

TABLE 5 Indirect effects analysis.

Dependent variable: OCB					
Direct, indirect and total effects					
Independent variable: DJ			**Mediator: Gratitude**		
	Coefficient	***P*-value**	**S.E.**	***P*-value**	**[CI-95%]**
Indirect effects (H2)	*Unstandardized coefficient*	0.12	0.044	0.012	[0.012–0.21]
Indirect effects (H2)	*Standardized coefficient*	0.16	0.058	0.012	[0.054–0.28]
Total effects	*Unstandardized coefficient*	0.22	0.054	0.001	[0.11–0.32]
Direct effects (H1)	*Unstandardized coefficient*	0.092	0.063	0.14	[-0.03–0.21]

selected for the leadership development program may be offered a real-time project to feel that their contributions are equally valued. Put differently, employees can be "nudged" to count their workplace blessings.

Managing employee perceptions is critical in organizations. Employees may make "fairness evaluations" almost daily, given that distributive justice is outcome-driven. The findings suggest that employees feel grateful when they perceive distribution as fair. The results imply that organizations must make distribution fair, transparent, and inclusive. Fair distributional procedures will help form the right expectation of fairness. One way to promote fairness is to involve employees in forming fairness policies. When employees are involved in the process and organizations consider their input in designing the performance management system, there will be fewer chances of employees' grievances, leading to higher fairness perception and more gratitude.

By ensuring transparency and consistency in evaluations that affect outcomes, managers can ensure that employees of all types (not just beneficiaries) feel gratitude toward the organization and volunteer for different initiatives. Feelings of gratitude may supersede even the tangible rewards that organizations allocate. Such feelings among employees may create a more engaged workforce interested in acting in the organization's interests.

Limitations

The study is not without limitations. The data were collected from different stakeholders but not at the same time. Gratitude to the organization and perceived justice were measured at time T-1 from the employees. The supervisor at the time T-2 rated the OCB-O. But how much change in the perception of distributive justice or gratitude can't be attributed to change in OCB-O. This is one limitation.

Second, this is limited to one organization that constraints the generalizability of the data findings. Third, we didn't measure the effect of culture. Results have shown that gratitude manifests differently amongst cultures (Appadurai, 1985; Oishi et al., 2019) such as Korea, Japan, and India. Another limitation is that we did not measure the effect of a culture that may have contributed to the feeling of gratitude.

Third, all four aspects of organizational justice (Procedural justice, interactional justice, and informational justice) have an impact on employee gratitude and other organizational outcomes (Colquitt, 2001) because they are all interrelated in the employee's cognition. Hence, the change in gratitude or OCB-O can't be attributed solely to distributive justice. The other justice dimensions also might have interacted with distributive justice and thereby influenced the gratitude and or OCB-O. This is another limitation.

Directions for future research

Future studies can look into the impact of the whole array of justice perceptions on gratitude, and OCB-O. As mentioned above, justice perceptions are interrelated. Studying them together will further expand our knowledge of their influence on gratitude.

Gratitude also influences team processes and outcomes (Pillay et al., 2020). We suspect justice perceptions may influence collective gratitude and their corresponding team outcomes. We consider this a logical extension of the present study. While our respondents included both the beneficiary and non-beneficiary, it will be useful for future research to examine if employees consider distributive justice fair, even if they don't receive the benefit for a longer period.

Since distributive justice is outcome-driven, it may be useful to know how it affects daily gratitude and if employees volunteer for OCB-O daily. Subsequent studies may measure the variables as a daily diary study. We used a gratitude scale anchored around organization Scholars have talked about maintaining a gratitude diary (Leong et al., 2020). By collecting various behaviors from the gratitude diary of all employees, scholars can contextualize

the measure of gratitude at a department or function level to capture nuances a generic gratitude scale may miss. We leave this thought for further studies.

Conclusion

Distributive justice perceptions can anchor feelings of gratitude in ways that encourage employees to engage in voluntary actions beneficial to the organization. In doing so, the focal employee extends his/her moral emotions to a broader family—ultimately, the organization, whom the decision makers represent.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The patients/participants provided their written informed consent to participate in this study.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work, and approved it for publication.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Resilience and positive coping style affect the relationship between maladaptive perfectionism and academic procrastination among Chinese undergraduate nursing students

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Background: Previous studies have not investigated the role of resilience and coping style on the association between maladaptive perfectionism and academic procrastination among nursing undergraduates. However, how to mobilize the learning enthusiasm of nursing students and reduce the incidence of academic procrastination is an important factor to reduce nursing loss and improve nursing quality.

Objectives: To investigate the influence of maladaptive perfectionism, resilience and coping style on academic procrastination among Chinese undergraduate nursing students.

Methods: A cross-sectional study was conducted. A convenience sampling method was used to select 665 nursing undergraduates from March to May 2022 in China. Maladaptive perfectionism, coping style, resilience, and academic procrastination were measured using questionnaires. The descriptive analysis, Pearson's correlation analysis and the Hayes' PROCESS Macro in SPSS 25.0 were used to test the model.

Results: The results showed that nursing undergraduates' maladaptive perfectionism, resilience, positive coping style and academic procrastination were significantly correlated between every two variables, with coefficients ranging between −0.290 and 0.584. In addition, resilience played a partial mediating role in maladaptive perfectionism and academic procrastination, accounting for 15.70% of the total effect; in the meantime, this process was moderated by positive coping style.

Conclusion: Maladaptive perfectionism positively predicted nursing undergraduates' academic procrastination; as a mediating mechanism with moderating, resilience and positive coping style further explained how maladaptive perfectionism promoted the academic procrastination of nursing undergraduates. Understanding this mechanism is of great significance for

nursing educators to reduce the risk of academic procrastination in nursing undergraduates.

KEYWORDS

resilience, coping style, maladaptive perfectionism, academic procrastination, undergraduate nursing students

Introduction

Due to growing demand for nursing, unbalanced nurse-to-patient ratio and increasing job pressures, it is becoming increasingly difficult to recruit and retain nurses globally, which is undermining nursing outcomes worldwide (Jarrar et al., 2018; Li et al., 2020). Therefore, there is an urgent need for us to train more nursing students. However, many nursing students do not consider nursing an interesting major for various reasons (Larsen et al., 2012; Sela-Vilensky et al., 2020). This leads to higher dropout rates and prevents us from producing more professional and enthusiastic nurses (Bakker et al., 2019). In this case, reducing the incidence of academic procrastination (AP) is considered to be one of the effective ways to reduce nursing student attrition (Guo et al., 2019). Procrastination refers to the non-adaptive behavior that people involuntarily postpone a predetermined plan without a clear reason (Kandemir, 2014). AP is a form of procrastination in school situations and is related to the fulfilment of studying tasks. Some researchers interpreted AP as emotional discomfort experienced by individuals who delay embarking on a task that must eventually be completed (Lay and Schouwenburg, 1993). AP is common among medical college students, with about 13.8 to 49.9% of medical students reporting procrastination on learning tasks (Madhan et al., 2012; Mortazavi et al., 2015). AP will not only lead to a decline in school achievement, but also have a negative impact on college students' learning attitude (Kim and Seo, 2015; Balkis and Duru, 2016). In addition, college students with AP are at higher risk of negative emotions such as depression and anxiety (Onwuegbuzie, 2004; Martinčeková and Enright, 2020). what is worse, it even has a higher risk of taking their own life (Klibert et al., 2011; Flett et al., 2016). As a result, reducing the incidence of AP among nursing students is essential for consolidating the nursing force. Although there have been previous international studies on the AP of nursing students, few of these have involved Chinese nursing undergraduates (Custer, 2018; Guo et al., 2019). In China, nursing undergraduates are playing an increasingly important role in nursing education (Fu et al., 2022). Data from China show that nurses with advanced diplomas or bachelor's degrees are the most needed workforce at all levels of health care and in the primary care sector (Wang et al., 2016; Fu et al., 2022). The undergraduate stage is the key stage for the formation of professional concept, value and professional ability of nursing students (Gao et al., 2022). In view of the above considerations, it is essential to investigate the risk factors and the mechanisms associated with AP among Chinese nursing undergraduates, which may offer significative guidance for future education.

Background

Cognition and Behavior Theory (CBT) indicates that individual behavior is largely influenced by cognition, and studies have shown that procrastination is closely related to irrational worry and self-criticism (Knaus, 1973). Procrastinators often feel less confident in their ability to complete tasks, and thus delay the start of tasks (Knaus, 1973). Perfectionism is a tendency to pursue perfection in everything, and it is a personality trait that has an important influence on people's emotions and behaviors (Frost et al., 1990; Pishghadam and Akhondpoor, 2011). Current research finds that perfectionism is a multidimensional structure, which has both positive aspects, called adaptive perfectionism and negative aspects, called maladaptive perfectionism (MP; Egan et al., 2011). MP refers to the tendency of critical self-evaluation and worry about others' expectations and comments (Frost et al., 1990). Previous studies have shown that the proportion of perfectionists among nursing students in China is high, and more than one half of nursing students can be classified as perfectionists (Cheng and Liu, 2017). Studies have indicated that MP is associated with eating disorders, obsessive–compulsive disorders, depression, learner anxiety and suicidal ideation (Pishghadam and Akhondpoor, 2011; Kiamanesh et al., 2015; Jing and Jianing, 2018; Dorevitch et al., 2020). Research on the association between MP and procrastination has found that MP was significantly predictive of procrastination. Ferrari's study of both procrastinators and non-procrastinators found that procrastinators reported more MP (Ferrari et al., 1992). Later, Frost et al. (1993) investigated the association between perfectionism and procrastination. They found that concern over mistakes was significantly correlated with attitude toward procrastination and parental expectations and criticism were significantly correlated with frequency of procrastination (Frost et al., 1993). Previous studies have documented a link between MP and procrastination among college students (Chi et al., 2012; Chen et al., 2013). However, results on the extent to which MP affect the AP of nursing undergraduates in mainland China are still lacking. Given that nursing undergraduates are an

important part of the future nursing force in China, it is essential to investigate the association between MP and AP.

Resilience was defined as "an individual's behavioral tendency to adapt to changing circumstances and the ability to recover from stressful situations" (Block and Kremen, 1996). According to the Resiliency Model proposed by Richardson, resilience is not only affected by the individual's cognition and behavior, but also has a protective effect on the cognition and behavior (Richardson, 2002). Previous research has shown that as a special personality trait, there is a certain relationship between MP and self-esteem (Chen et al., 2013), while self-esteem and resilience have a certain correlation (Chung et al., 2021). Therefore, we speculate that there is also a certain relationship between MP and resilience. In addition, the essence of AP is the fear of failure and the lack of self-regulation ability in the face of the pressure of academic tasks (Chen et al., 2013). As a positive psychological trait, resilience can mobilize individual protective resources, help individuals cope well with adverse situations and maintain positive emotional states (Klika and Herrenkohl, 2013), so it should play a positive role in reducing AP.

Coping is an individual's cognitive and behavioral effort to reduce the negative effects of stress, which is usually divided into positive coping style (PCS) and negative coping style(NCS) (Patterson and McCubbin, 1987). Among them, the PCS refers to the individual's problem-solving oriented, actively seeking internal and external resources, so as to construct problem-solving strategies; The NCS refers to that individuals pay more attention to their own emotional experience when facing problems and solve problems by denying, escaping and fantasizing (Patterson and McCubbin, 1987). Although resilience may have a positive effect on AP and in general, it does not affect all individuals equally. In other words, individuals with different levels of coping style may differ in the patterns of correlation among resilience and AP. According to the Stress-Diathesis Model, individual coping style has an important influence on psychology and behavior (Monroe and Simons, 1991). Researchers have found that in positive situations, protective coping styles enhance the positive psychological and behavioral effects, while NCS weaken the positive psychological and behavioral effects(Hollister-Wagner et al., 2001; Fergus and Zimmerman, 2005). In conclusion, it can be concluded that PCS will enhance the positive effect of resilience on AP to some extent, while NCS will weaken the protective effect of resilience on AP.

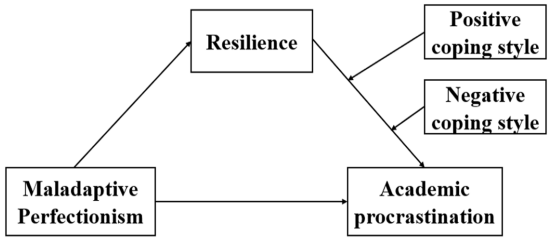

FIGURE 1
The theoretical model of this study.

The present study

Based on Cognitive Behavioral Theory, Resiliency Model and Stress-Diathesis Model, this study examined the effects of MP, resilience and coping style on AP among undergraduate nursing students in mainland China. The following hypotheses have been proposed (Figure 1):

H1: Maladaptive perfectionism is positively correlated with academic procrastination in undergraduate nursing students;

H2: Maladaptive perfectionism is negatively related to resilience in undergraduate nursing students;

H3: Resilience is negatively related to undergraduate nursing students' academic procrastination

H4: Resilience partially mediates the association between maladaptive perfectionism and academic procrastination

H5: Positive coping style plays a moderating role in the association between resilience and academic procrastination.

H6: Negative coping style plays a moderating role in the association between resilience and academic procrastination.

Materials and methods

Design

A cross-sectional survey was conducted from March to May 2022.

Participants

A convenience sampling method was used to recruit nursing undergraduates from two undergraduate universities in Henan, China from March to May 2022. Participants meet the following inclusion criteria: (1) full-time nursing undergraduates in Grade1, Grades2 and Grade3; (2) Know the purpose of the research and volunteer to participate in the research; And the exclusion criteria were students who did not complete all questionnaires for various

reasons. Equation $N = 4U\alpha^2S^2/\delta^2$ (Ni et al., 2009) was used to calculate the sample size. $S = 0.59$ is calculated from the pre-survey, the allowable errorδis set to 0.1, and α is set to 0.05, so $N = 4 \times 1.96^2 \times 0.59^2/0.1^2 = 535$. Taking into account the sampling error and possibility of invalid questionnaires, we distributed a total of 700 questionnaires. Finally, after removing 35 unqualified questionnaires, a total of 665 valid questionnaires were obtained.

Data collection

Before sampling, we discussed the contents and procedures of the questionnaire with the competent authority involved in each university. After obtaining permission from the competent authority, investigators will begin handing out paper questionnaires to students as they gather in a classroom (about 50 students at a time). Participants were not given any incentive or inducement throughout the test. Furthermore, participants were told that their answers to the questionnaire would be anonymous and confidential, and that the data collected would only be used for academic study.

Ethical considerations

This study has been reviewed and approved by Institutional Review Board of Henan Provincial Key Laboratory of Psychology and Behavior (reference: 20220107001), and is carried out in accordance with the Declaration of Helsinki.

Instruments

Demographic information

A demographic questionnaire assessed participant characteristics including age, gender, and residential area, etc.

The Chinese frost multidimensional perfectionism scale (CFMPS)

Frost Multidimensional Perfectionism Scale was compiled by Frost in 1990 to measure the cognitive, emotional and behavioral performance of perfectionists (Frost et al., 1990). Zi and Zhou (Fei and Xu, 2006) modified it according to the Chinese culture in 2006, and conducted reliability and validity tests to form the Chinese version of FMPS. The questionnaire included five dimensions of "Concern over Mistakes (CM)," "Organization," "Personal Standard (PS)," "Parental Expectations (PE)" and "Doubts about Actions (DA)," with a total of 27 items. "Organization" and "PS" was considered as adaptive perfectionism. "CM," "PE" and "DA" were considered maladaptive perfectionism. Cronbach's α of the five dimensions were 0.76, 0.81, 0.74, 0.70 and 0.64, respectively. In this study, 5-level Likert scale was used, with 1 indicating that "inconsistent" and 5 indicating that it was "completely consistent." Confirmatory factor analysis (CFA) was conducted to determine the convenience of the scale structure with the data collected within the scope of this study. CFA found that scale factor structure had an acceptable fit with the data ($\chi^2/df = 2.513$, RMSEA = 0.045, GFI = 0.929, AGFI = 0.915, IFI = 0.981, CFI = 0.979, TLI = 0.925). The internal consistency coefficient of maladaptive perfectionism in current study was 0.80.

Simplified coping style questionnaire (SCSQ)

The SCSQ was developed by Xie according to the characteristics of Chinese people (Xie, 1998). It was composed of two dimensions of positive coping and negative coping, with a total of 20 items. 4-level Likert scale were used in the questionnaire (1 = never, 4 = always). Positive coping consists of 12 items, which mainly describes some characteristics of positive coping, such as "try to see the good side of things"; Negative coping consists of 8 items, focusing on the characteristics of negative coping, such as "imagining that some kind of miracle might happen to change the status quo." The SCSQ had good validity in current study (CFA: $\chi^2/df = 2.727$, RMSEA = 0.048, GFI = 0.931, AGFI = 0.925, IFI = 0.976, CFI = 0.923, TLI = 0.953). The Cronbach's α of the two subscales in this study were 0.80 and 0.74, respectively.

Connor-Davidson resilience scale (CD-RISC)

CD-RISC was developed by Connor and Davidson in 2003, which includes 25 items and is divided into five dimensions: tenacity, tolerance of negative effect, positive acceptance of change, control and spiritual influences (Connor and Davidson, 2003). The Chinese version of CD-RISC was revised by Yu retaining 25 items of the original scale and adjusting it to three dimensions: tenacity, strength and optimization; Likert 5 scores were used (0 = never, 4 = almost always). CD-RISC (Chinese version) has been shown to have good reliability in the Chinese population (Cronbach's $\alpha = 0.91$; Yu and Zhang, 2007). The CD-RISC had good validity and reliability in current study (CFA: $\chi^2/df = 2.645$, RMSEA = 0.034, GFI = 0.936, AGFI = 0.947, IFI = 0.923, CFI = 0.958, TLI = 0.939).The Cronbach's α was 0.91.

Aitken procrastination inventory (API)

API is a self-assessment scale developed by Aitken (1982) to evaluate the persistent academic procrastination of college students. It has a total of 19 items and has been proved to have good internal consistency in the Chinese context (Chen, 2008). Likert 5 scores were used, with "1" meaning "completely inconsistent" and "5" meaning "completely consistent." Items 2, 4, 7, 11, 12, 14, 16, 17, 18 were inversely scored. Sample items are "I always start solving problems at the last minute; A high score indicated a higher degree of academic procrastination. The Cronbach's α in our study were 0.82.

Statistical analyses

All the data were analyzed using IBM SPSS statistics 25.0 and the PROCESS macro3.3. The demographic characteristics

of the participants were represented by descriptive statistics. Pearson correlation analysis was used to explore the association between MP, PCS, NCS, resilience and AP. Harman's single-factor test was used to evaluate the common method bias derived from self-reported data (Podsakoff et al., 2003). The mediating effect of resilience between MP and AP was tested by PROCESS Model 4 (Hayes, 2017). The moderating role of PCS and NCS was examined by the Model 16. In addition, we used the 5,000 resample bootstrapping method with a 95% CI to test the effect of the independent variable on the dependent variable through the mediating variable. All p values are two-sided, with $p < 0.05$ indicating a statistically significant result. The report of this study is strictly in accordance with the STROBE Statement (von Elm et al., 2007).

Validity and reliability/rigour

Firstly, all the instruments used in study have been adjusted and verified by Chinese culture and have good validity and reliability. In addition, before the formal investigation, all investigators were trained on registration, checking the completeness of questionnaires, and training on ethical tenets of conducting research. To reduce the risk of self-reported bias, the identities of all participants are kept strictly confidential. Finally, to ensure the rigor and accuracy of the statistical analysis, we invited a statistics professor to examine the data processing.

TABLE 1 Demographic characteristics of the study participants (N=665).

Variables		Number	%
Gender			
	Male	149	22.41
	Female	516	77.59
Grade			
	Freshman	275	41.35
	Sophomore	233	35.04
	Junior	157	23.61
Residential area			
	Urban	421	63.31
	Rural	244	36.69
Whether or not the only child			
	Yes	93	13.98
	No	572	86.02
Monthly income (¥)			
	<3,000	242	36.39
	3,000–6,000	338	50.83
	>6,000	85	12.78

Results

Common method biases tests

Harman's single-factor test extracted 20 factors with eigenvalues greater than 1. The first factor explained 14.967% of the total variances, which is below the recommended threshold of 40% (Podsakoff et al., 2003). It suggests that common method bias is unlikely to confuse the interpretation of data analysis results.

Participants' characteristics

A total of 665 participants completed the final survey, with an average age of 19.86 ± 1.19 years. Table 1 shows the basic demographic characteristics of participants.

Descriptive analysis and correlations between overall variables

Means, standard deviations (SD), and Pearson correlations of each variable were shown in Table 2. The average score of MP was (2.893 ± 0.591), resilience was (2.775 ± 0.494), AP was (2.549 ± 0.604), PCS was (2.547 ± 0.433) and NCS was (2.720 ± 0.546). As can be seen from the range of item scores, the scores of the five variables were basically at the medium level.

MP was significantly correlated with resilience ($r = -0.105$, $p < 0.01$), AP ($r = 0.215$, $p < 0.01$), PCS ($r = -0.083$, $p < 0.05$) and NCS ($r = 0.181$, $p < 0.01$). Moreover, resilience was significantly correlated with AP ($r = -0.290$, $p < 0.01$) and PCS ($r = 0.584$, $p < 0.01$). Finally, PCS and NCS are significantly correlated with AP, respectively, (PCS: $r = -0.261$, $p < 0.01$; NPS: $r = 0.286$, $p < 0.01$).

Mediating effect with moderating analysis

In the first place, multiple linear regression analysis showed that gender and age had a significant influence on AP. As a result, they were included as covariates in the moderated mediation analysis.

In the second place, PROCESS Macro model 4 was used to analyze the mediating role of resilience. MP significantly positively predicts AP after controlling for age and gender ($c = 0.210$, $t = 5.492$, $p < 0.001$). The H1 is verified. When MP and resilience entered the regression equation together, the predictive effect of MP on AP is still significant ($c' = 0.177$, $t = 4.799$, $p < 0.001$). MP has a significant negative predictive effect on resilience ($a = -0.114$, $t = -2.984$, $p < 0.001$), and resilience has a significant negative predictive effect on AP ($b = -0.288$, $t = -7.441$, $p < 0.001$). This manifested that resilience partially mediates the relationship between MP and AP. The H2 and H3 are supported. Bootstrap method test with percentile bias correction indicated that

TABLE 2 Descriptive statistics and correlations (N=665).

Variables	1	2	3	4	5	6	7	8	9	10	11	Range	M ± SD
1.MP	1											1–5	2.893 ± 0.591
2.CM	0.854**	1										1–5	2.386 ± 0.856
3.PE	0.669**	0.311**	1									1–5	3.214 ± 0.720
4.DA	0.692**	0.436**	0.0745**	1								1-5	3.258 ± 0.751
5.Resilience	−0.105**	−0.165**	−0.090*	−0.137**	1							0-4	2.775 ± 0.494
6.Tenacity	−0.096*	−0.150**	−0.099*	−0.147**	0.950**	1						0-4	3.374 ± 0.557
7.Strength	−0.103**	−0.162**	−0.062*	−0.101**	0.901**	0.756**	1					0-4	3.600 ± 0.535
8.Optimization	−0.072	−0.115**	−0.159**	−0.086*	0.725**	0.564**	0.617**	1				0-4	3.368 ± 0.560
9.AP	0.215**	0.223**	0.088*	0.181**	−0.290**	−0.262**	−0.316**	−0.149**	1			1-5	2.549 ± 0.604
10.PCS	−0.083*	−0.112**	−0.079*	−0.090*	0.584**	0.528**	0.560**	0.443**	−0.261**	1		1-4	2.547 ± 0.433
11.NCS	0.181**	0.186**	0.065	0.136**	−0.057	−0.063	−0.095*	0.072	0.286**	0.037	1	1-4	2.720 ± 0.546

MP, Maladaptive perfectionism; CM, Concern over Mistakes; PE, Parental Expectations; DA, Doubts about Actions; AP, Academic procrastination; PCS, Positive coping style; NCS, Negative coping style.
*p < 0.05; **p < 0.01.

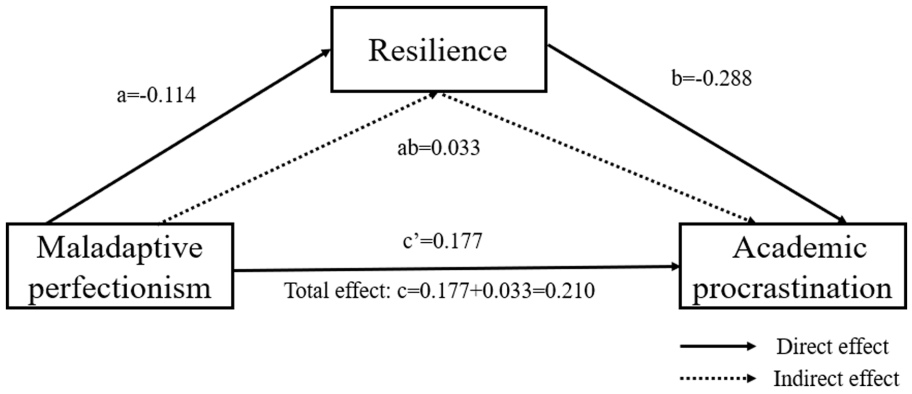

FIGURE 2
Mediating effect of resilience.

resilience has a significant mediating effect between MP and AP, ab = 0.033, Boot SE = 0.013 and 95%CI = (0.008, 0.060). The contribution rates of indirect effects in the total effect was ab/(ab + c'') = (0.033/0.210) = 15.70%. In other words, resilience is the mediating effect of 15.70% in the association between MP and AP (The H4 was supported). Figure 2 shows the direct, indirect, and total effects.

Finally, PROCESS Macro model 16 was used to analyze the moderating role of PCS and NCS. The predictive variables in the regression model are standardized, and age and gender are taken as control variables. If the model meets the following three conditions, there will be a mediating mechanism with moderating effect: (a) In Model 1, MP has a significant overall impact on AP; (b) in Model 2, MP is significantly negatively associated with resilience; (c) in Model 3, resilience has a significant main effect on AP, and the interaction term between resilience and PCS/NCS has a significant effect on AP. The results showed that the analysis of the moderating effect of PCS fully met the above conditions, that is to say, PCS moderated the association between resilience and AP, while the moderating role of NCS were not significant, which supports H5 and rejects H6.

Simple slope analysis was used to further visually investigated the moderating role of PCS. Whether PCS is at a high or low level, resilience had a significant effect on AP. The difference was that for nursing undergraduates with high PCS, the effect of resilience on AP showed an obvious trend of strengthening (β = −0.247, t = −4.589, p < 0.001); However, for nursing undergraduates with low PCS, the effect of resilience on AP was still significant but decreased (β = −0.115, t = −2.104, p < 0.05). Figure 3 has shown the moderating role of PCS between resilience and AP (Table 3).

Discussion

Our study aimed to explore the association between MP, resilience, PCS, NCS and AP among Chinese nursing undergraduates. First, results show that except for NCS, there was a significant correlation between each of the two variables

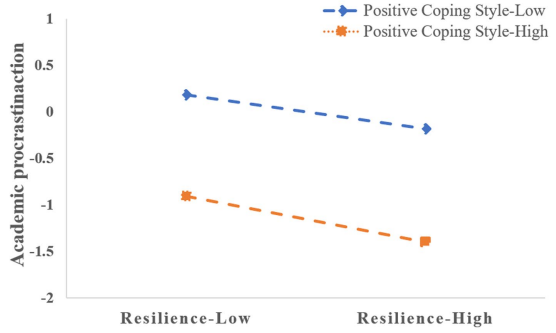

FIGURE 3
Moderating effect of positive coping style.

TABLE 3 The model of mediating effect with moderating.

Predictive variable	Model 1(criterion: AP)		Model 2(criterion: Resilience)		Model 3(criterion: AP)	
	β	*t*	*β*	*t*	*β*	*t*
Gender	0.100	1.982*	−0.113	−1.818	0.146	2.069*
Age	−0.110	−2.459**	0.101	1.943	−0.096	−1.135*
MP	0.210	5.491**	−0.114	−2.984*	0.134	3.763**
Resilience					−0.181	−4.008**
PCS					−0.151	0.001**
NCS					0.247	6.822**
Resilience × PCS					−0.066	−2.185*
Resilience × NCS					0.046	1.427
R^2	0.051		0.045		0.213	
F	5.934**		5.214**		16.023**	

MP, Maladaptive perfectionism; AP, Academic procrastination; PCS, Positive coping style; NCS, Negative coping style.
*$p < 0.05$; **$p < 0.001$.

among the remaining variables. Second, MP has a positive effect on AP, and resilience plays a partial mediating role in the relationship. In the end, our study confirms that PCS play a moderating effect in the mediating mechanism. To be specific, the resilience of nursing students with a high level of PCS has a higher predictive effect on AP than that of nursing students with a low level of PCS.

In this study, the MP of undergraduate nursing students were slightly higher than the results of Zheng (2011), which may be related to the fact that the participants of the latter were ordinary college students, while this study was nursing students. Due to the particularity of the nursing profession and the requirements of the future occupational environment, accurate performance is an underlying principle of nursing education (Si and Lee, 2022). Nursing students are usually expected to perform all tasks perfectly. Furthermore, since every nursing practice is closely related to the quality of nursing, nursing students may experience high levels of stress due to an excessive fear of making mistakes, leading to highly MP. The resilience is at a medium level, which is consistent with the precious result (Wang, 2016), indicating that the participants have certain positive psychological resources, but still need to be strengthened. In addition, the score on AP was lower than in previous study (Cho and Lee, 2022), a possible reason being that the majority of respondents in this study were female student. And studies have shown that female are less likely than male to procrastinate on academic tasks for fear of lower academic performance (Lu et al., 2021). Finally, compared to previous study (Cheng et al., 2021), PCS slightly scored lower and NCS scored higher, possibly because during the COVID-19 pandemic, fear of infection and death may predispose nursing students to adopt NCS (Ma et al., 2022).

Our study confirmed that MP is significantly positively associated with AP in nursing undergraduates, which is consistent with previous finding (Burns et al., 2000). Many studies have pointed out that the main reasons for individuals to delay tasks that should be completed, knowing that such delay will have adverse consequences are irrational beliefs, such as fear of failure and evaluation anxiety (Beck et al., 2000; Burka and Yuen, 2007). As mentioned in the introduction, maladaptive perfectionists insist on setting unrealistically high standards for themselves, believing that things are either perfect or fail. This requirement makes them often worry that they cannot complete the task, which leads to the fear of failure and indecision (Canter, 2008). These characteristics are consistent with the above-mentioned irrational beliefs that govern procrastination. People who are troubled by these irrational beliefs are more likely to have negative or even catastrophic interpretations of benign events, thereby irrationally delaying many things in life (Steel, 2007). Furthermore, according to the CBT (Knaus, 1973), individual cognition largely determines individual behavior. Therefore, only by helping nursing students develop correct cognitive beliefs can nursing students improve their behavioral performance, including reducing AP.

The results of this study confirmed that resilience was significantly negatively correlated with AP. This is consistent with previous finding (Ko and Chang, 2019). As a positive psychological resource, resilience has a protective effect on an individual's positive behavior (Richardson, 2002). The important reason why resilience can effectively reduce AP is that it can improve self-esteem and self-efficacy (Richardson, 2002; Warshawski, 2022), enhance psychological resistance to pressure and the temptation of short-term benefits (Rutter, 1999), so that more psychological resources can be devoted to learning, and thus reduce procrastination. Cleary et al. (2018) identified resilience as a necessary trait for nursing students to succeed in learning and practice. Therefore, for nursing educators, improving the resilience of nursing students may be one of the important strategies to reduce AP.

The findings demonstrate that MP is significantly negatively associated with resilience, which is consistent with previous finding (Burns et al., 2000). Maladaptive perfectionists tend to have higher stress levels due to fear of failure and evaluation anxiety. Consequently, there is inevitably a negative impact on

resilience (Canter, 2008). In addition, emotions may also be an important reason to explain the impact of MP on resilience. As a new concept in psychology, emotioncy is considered as the blend of emotion and frequency of senses (Miri and Pishghadam, 2021; Pishghadam et al., 2022). It means sense induced emotions can relativize cognition (Pishghadam et al., 2016). According to emotioncy, individuals can be exvolved (hearing and seeing sth) and involved (direct experience of Sth; Miri and Pishghadam, 2021). Individuals with high MP level may lack the sensory experiences of completing the task due to the fear of the task, which will affect their emotioncy level and then have an impact on resilience (Pishghadam et al., 2019). If nursing educators can guide nursing students to lower MP levels and incorporate multiple senses into their educational practice, nursing students tend to experience less stress, which in turn improves resilience.

This study prove that the MP of nursing students not only directly affected AP, but also indirectly affected AP through the partial mediating role of resilience. In the context of nursing education, nursing students are often expected to perform all tasks flawlessly, and they are told that any mistakes can be life-threatening for the patient (Si and Lee, 2022). As a result, nursing students may experience chronic stress due to fear of failure and higher expectations resulting in higher levels of MP (Si and Lee, 2022). Under the long-term effects of this stress, resilience is negatively affected. At the same time, when faced with academic tasks, they are more likely to choose to procrastinate to avoid the execution of tasks. In addition, the moderating effect analysis showed that the resilience of nursing undergraduates with high PCS had a higher predictive effect on AP than that of nursing students with low PCS. This is consistent with the promotion hypothesis of the "protective-protective model" of human development (Cohen et al., 2014). The interaction between the two protective factors enhances each other, and the impact on the outcome variable is a "icing on the cake" effect (Bao et al., 2013). Contrary to our hypothesis, NCS did not moderate the association. One possible explanation is that resilience as a positive coping resource has positive effects on psychology and behavior, whereas NCS is more likely to have negative effects. When the two positive and negative effects coexist, they may cancel each other out, resulting in an insignificant moderating effect of NCS (He et al., 2022).

In current study, on the one hand, we demonstrated 'how MP works. In other words, MP of nursing undergraduates not only directly affected AP, but also indirectly affected AP through the partial mediating role of resilience. On the other hand, we investigated the when the effect is greater. Namely, the latter half of the mediating path of resilience is moderated by PCS, and the resilience of nursing undergraduates with high PCS has a greater predictive effect on AP. Therefore, the findings of this study will have a certain guiding significance and practical value for nursing educators to improve nursing undergraduates' academic procrastination.

Implication for nursing education

The results of this study have important theoretical significance and practical value for improving the academic procrastination of undergraduate nursing students. To reduce the risk of academic procrastination, the following recommendations are made: First of all, for nursing students, it is necessary to develop good study habits and enhance the ability of time management. In the face of heavy learning tasks, nursing students should learn to scientifically disassemble the tasks, break the big tasks into a number of small tasks and complete them one by one. At the same time, through listening to music, physical exercise and other activities to properly adjust the mood, reduce the negative impact of stress. Second, for nursing educators, individual counseling or group counseling can be used to guide nursing students to overcome unreasonable cognitive ways in the process of nursing education practice, so that nursing students do not worry too much about mistakes and reduce the fear of failure. Moreover, from the perspective of positive psychology, nursing educators should pay more attention to the harmonious development of nursing students' mental health, encourage nursing students to actively cope with the setbacks and challenges in learning and life, so that they can obtain positive emotional experience from solving problems. Finally, for nursing education authorities, psychological experts can be invited to regularly carry out psychological training to help nursing students build a good level of resilience, and share tips to improve their self-control ability, so as to provide a good and warm learning environment for nursing students.

Limitations

Though there are some highlights, several limitations must be considered. First of all, this study is a cross-sectional study, so further longitudinal studies are needed to investigate the causal association. Secondly, the data used in current research were all self-reported by the participants, which may affect the results by recall bias. Although the deviation of common methods was not found in this study, we can still use a variety of data collection methods (such as the combination of self-report and others' report) in future studies to ensure the reliability of conclusions. Finally, the participants of this study are only from two undergraduate universities, which hinders the promotion of the conclusion to some extent. Future studies can expand sample sources and explore the differences of results under different cultural backgrounds and educational levels.

Conclusion

In the context of a global nursing shortage, measures to reduce nursing staff turnover and improve the quality of nursing, such as reducing academic procrastination among nursing undergraduates,

are an urgent task. This study found that maladaptive perfectionism, resilience, positive coping style and academic procrastination among nursing undergraduates were significantly correlated between every two variables; resilience partially mediates the association between maladaptive perfectionism and academic procrastination; in the meantime, positive coping style moderated the effect of resilience on academic procrastination. In view of these findings, it is necessary for nursing educators to develop an academic procrastination improvement strategy suitable for nursing undergraduates.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by Institutional Review Board of Henan Provincial Key Laboratory of Psychology and Behavior (reference: 20220107001). The patients/participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

HH and YD: writing—original draft preparation and investigation. YZ: software and data curation. QP: investigation and validation. YL and XW: supervision and writing—reviewing. CC: conceptualization, methodology, and writing—reviewing and editing. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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Association of individual resilience with organizational resilience, perceived social support, and job performance among healthcare professionals in township health centers of China during the COVID-19 pandemic

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Background: Primary healthcare professionals were overworked and psychologically overwhelmed during the COVID-19 pandemic. Resilience is an important shield for individuals to cope with psychological stress and improve performance in crises. This study aims to explore the association of individual resilience with organizational resilience, perceived social support and job performance among healthcare professionals in township health centers of China during the COVID-19 pandemic.

Methods: Data from 1,266 questionnaires were collected through a cross-sectional survey conducted in December 2021 in Shandong Province, China. Descriptive analysis of individual resilience, organizational resilience, perceived social support, and job performance was conducted. Pearson correlation analysis was used to examine the correlations among these variables, and structural equation modeling was performed to verify the relationships between these variables.

Results: The score of individual resilience was 101.67±14.29, ranging from 24 to 120. Organizational resilience (β=0.409, p<0.01) and perceived social support (β=0.410, p<0.01) had significant direct effects on individual resilience. Individual resilience (β=0.709, p<0.01) had a significant direct effect on job performance. Organizational resilience (β=0.290, p<0.01) and perceived social support (β=0.291, p<0.01) had significant indirect effects on job performance.

Conclusion: During the COVID-19 pandemic, the individual resilience of healthcare professionals in township health centers was at a moderate

level. Organizational resilience and perceived social support positively affected individual resilience, and individual resilience positively affected job performance. Furthermore, individual resilience mediated the effect of organizational resilience and perceived social support on job performance. It is recommended that multiple stakeholders work together to improve the individual resilience of primary healthcare professionals.

KEYWORDS

individual resilience, organizational resilience, social support, job performance, primary healthcare professionals

Introduction

Individual resilience is described as the ability to absorb, adapt, bounce back, and maintain a stable equilibrium that unfolds in a context of adversity, failure, uncertainty, or dramatic changes (Bonanno, 2004; Luthans and Youssef, 2004; Karoly and Ruehlman, 2006). It represents positive adaptation and successful coping with stressful events and challenges (Sonn and Fisher, 1998). Individuals with resilience have the following recognized characteristics: a firm acceptance of reality, a life of deep beliefs and values, and a strong ability to improvise and adapt to significant changes (Luthans and Youssef, 2004). Individual resilience is also considered to be one of the key elements of positive psychological capital (Luthans et al., 2004). Individuals with high resilience adopt a positive attitude toward finding solutions to problems, whereas those with low resilience are susceptible to negative emotions and avoid problems, makingit difficult for them to bounce back from adversity (Ho and Chan, 2022).

Coronavirus disease 2019 (COVID-19), a severe acute infectious respiratory disease, was first reported in December 2019 and declared a pandemic by the World Health Organization (WHO) in early March 2020 (Duncan, 2020). The COVID-19 pandemic has posed serious challenges to healthcare systems globally, and primary care has become increasingly critical in responding to the COVID-19 pandemic because of the surge of patients and the inadequacy of treatment services for the population in secondary and tertiary hospitals (Haldane et al., 2020). Accordingly, the workload, operating conditions, and task structure of primary healthcare professionals have changed significantly (de Sutter et al., 2020). In China, nearly 4 million primary healthcare professionals have taken on many tasks beyond their usual duties during the COVID-19 pandemic (Zhou et al., 2020). Besides the increased workload and extended working hours, the risk of COVID-19 infection, lack of personal protective equipment, updated COVID-19-related treatment protocols, and separation from family have also posed a threat to the mental and psychological well-being of Chinese primary healthcare professionals, with more than half of them reporting symptoms of depression and anxiety during the COVID-19 pandemic (Ou et al., 2021; Shi et al., 2022). Persistent psychological problems can affect individuals' overall health and lead to negative effects such as burnout and inefficiency at work, which can pose a threat to the integrity of the healthcare system and adequate care for patients (Fuchs et al., 2020; Wu et al., 2020). It was revealed that the psychological capital and job performance of healthcare professionals have become more vital than ever in these pandemic conditions (Pourteimour et al., 2021). Therefore, individual resilience, a protective factor in coping with stressful environments, alleviating negative emotions, preventing psychological disorders, and improving job performance cannot be overlooked (Luceño-Moreno et al., 2020).

Individual resilience is an important protective shield for healthcare professionals against psychological stress and mental breakdown during infectious disease outbreaks, and individuals who lack sufficient resilience are more vulnerable to negative psychological effects in a pandemic (De Brier et al., 2020). Moreover, individual resilience contributes to a strong psychological background for healthcare professionals to remain fully engaged in a pandemic, which has a positive impact on performance, and the adoption of resilience-enhancing strategies can improve the job performance of healthcare professionals (Handini et al., 2020; Jeong and Cho, 2020). Individual resilience in human resource management is stated as the ability to be competent for positions, emphasizing a stable psychological state and physiological function maintained by individuals in the context of adversity, which helps individuals to achieve good performance (Liang, 2013). Therefore, the matter of how to improve the individual resilience of primary healthcare professionals to cope with psychological stress and maintain satisfactory job performance during the COVID-19 pandemic is a widespread concern.

Existing studies have explored potential factors influencing individual resilience, such as demographic characteristics, personal attributes, personal skills and resources, and additional life stressors (Bonanno et al., 2007; Sousa et al., 2013; Huang et al., 2018). However, other potential factors (such as organizational resilience and social support) have rarely been explored. With little time for national healthcare systems to adequately prepare for the COVID-19 pandemic, organizational resilience is seen as

being essential (Duncan, 2020). Focusing on individual resilience rather than organizational resilience is a way of missing the forest for the trees (Riess, 2021), as organizational resilience is an important foundation that can contribute to individual resilience, and shaping individual resilience is the mutual responsibility of the organization and the individual (Riess, 2021; Udod et al., 2021). In addition, studies interpreting the concept of individual resilience have included social support as one of the key attributes (Cooper et al., 2020). Studies have confirmed that perceived support from family, friends, and significant others during the COVID-19 pandemic, which makes individuals feel concerned and develop a sense of belonging, is regarded as an important protective factor to effectively handle and cope with various stressors in the working circumstances, and has a direct impact on individual resilience (Cooper et al., 2020; Labrague and De Los Santos, 2020; Shi et al., 2022). Thus, organizational resilience and perceived social support can be deemed to be important factors influencing the resilience of primary healthcare professionals during the COVID-19 pandemic.

Township health centers are an important part of the Chinese primary healthcare system, and also the hub of the Chinese three-tier healthcare system in rural areas (the rural three-tier healthcare system consists of county hospitals, township health centers and village health offices; Chen et al., 2021). By the end of 2020, China had 35.76 thousand township health centers, accounting for 3.69% of the total number of Chinese primary healthcare institutions (Website of the National Health Commission, 2021). Township health centers provide basic medical and public health services for rural residents, and are the "first line of defense" in guarding their health, as well as being an important cornerstone of the Chinese healthcare system (Sheng, 2018). Township health centers have taken on lots of the front-line work and public health responsibilities during the COVID-19 pandemic, including pre-screening and referral of fever cases, taking nucleic acid samples, performing health surveillance of high-risk groups, improving hospital infection control and personal protection, conducting vaccination, disinfecting the public environment, and educating the public on prevention of the pandemic (Zhou et al., 2022). In China, given the small number of healthcare professionals in township health centers and their limited experience in pandemic prevention and control, they have faced enormous psychological stress and performed unsatisfactorily during the COVID-19 pandemic (Meng et al., 2012; Ge, 2020; Yi et al., 2022). In this context, maintaining the resilience of rural primary healthcare professionals deserves great attention (Lei and Li, 2021).

Therefore, this study took healthcare professionals in township health centers as subjects, collected data on their resilience during the COVID-19 pandemic, and analyzed the relationships between individual resilience, organizational resilience, perceived social support, and job performance. We put forward the following hypotheses: (1) Organizational resilience and perceived social support are positively associated with the individual resilience of healthcare professionals in township health centers during the COVID-19 pandemic; (2) individual resilience is positively associated with job performance; (3) the relationship between organizational resilience and job performance, and the relationship between perceived social support and job performance are both mediated by individual resilience.

Materials and methods

Study design and sampling

The subjects of this study were healthcare professionals working in township health centers of China during the COVID-19 pandemic, and each of them read a statement describing the purpose of the survey and consented to engage in this survey. Before the formal survey, we conducted a pilot test in Weifang, Shandong Province, in September 2021 using simple random sampling. In total, 200 questionnaires were distributed and 186 valid questionnaires were collected, with a valid response rate of 93.00%. In the pilot test, the mean age of healthcare professionals in township health centers was 38.43 years old, 51.08% were women, and the Cronbach's Alpha of the questionnaire was 0.977. In addition, the data collected from the pilot test were analyzed by Exploratory Factor Analysis (EFA), and four common factors were extracted (consistent with our prespecified four factors of individual resilience, organizational resilience, perceived social support, and job performance), the cumulative variance contribution was 67.555%, the factors loading ranged from 0.502 to 0.870, and the structural validity of the questionnaire was good. A formal cross-sectional survey with the stratified random sampling method to collect data on subjects was conducted in December 2021 in Shandong Province, which is an economically developed region in eastern China, and has 16 prefecture-level cities (a prefecture-level city is an administrative level below a province and above a county). First, three prefecture-level cities were selected in Shandong Province to represent economically developed cities, economically moderate cities, and economically underdeveloped cities. Then, three counties were randomly selected in each prefecture-level city, and four to six townships were selected in each county depending on the population size. Generally, there is one township health center in a township, and we sampled around 30 healthcare professionals for the anonymous self-administered questionnaire survey in each township health center. After removing invalid questionnaires with missing data that could not be supplemented and logical errors that could not be corrected, a total of 1,266 valid questionnaires were collected, with a valid response rate of 97.38%.

Measurement instruments

Demographic characteristics

Demographic information collected in the questionnaire included gender, age, marriage, educational background, annual income, working tenure, average weekly working hours, etc.

Individual resilience

Referring to the resilience scale for rescuers in emergencies designed by Liang (2013), and following our thorough discussion and revision, the individual resilience scale in this study included 24 items. Each item required participants to rate it from 1 (strongly disagree) to 5 (strongly agree), and the scores of all items were summed to obtain a total individual resilience score (ranging from 24 to 120). The score on a five-point Likert item could be categorized into three levels: low (1.00–2.99), moderate (3.00–4.30), and high (4.31–5.00; Labrague and De Los Santos, 2020). We took this criterion and multiplied it by the number of items on variables, with scores for individual resilience of 24–71.99 indicating a low level, 72.00–103.20 indicating a moderate level, and 103.21–120 indicating a high level. These items of individual resilience were divided into four dimensions: rational coping including 6 items (describing the individual's ability to remain sober and calm without being affected by emotions, and to analyze problems rationally and objectively when dealing with the COVID-19 pandemic and related events); hardiness including 5 items (describing the individual's ability to keep faith and work hard to complete tasks in response to the COVID-19 pandemic and related events); self-efficacy including 7 items (description of individuals during the COVID-19 pandemic with successful experiences, being confident in their ability to handle emergencies effectively); and flexible adaption, with 6 items (describing the individual's ability to accept adversity and be flexible and constructive in dealing with the COVID-19 pandemic and related events). The Cronbach's Alpha for our sample in this scale was 0.967. The results of the Confirmatory Factor Analysis (CFA) found an acceptable fit for the model of this scale [Standardized Root Mean Square Residual (SRMR) = 0.038, Root Mean Square Error of Approximation (RMSEA) = 0.055, Adjusted Goodness of Fit Index (AGFI) = 0.912, Comparative Fit Index (CFI) = 0.970, and Tucker-Lewis Index (TLI) = 0.962; Deng et al., 2018; Heiss et al., 2020].

Organizational resilience

Organizational resilience was measured using the scale developed by Yan (2018), including two subscales: static resilience with 6 items (demonstrating the organizational risk prevention capabilities, flexibility, and collaboration capabilities) and dynamic resilience with 6 items (manifesting as capabilities of organizations to respond to, recover from, and gain experience and growth from the COVID-19 pandemic and related events). All items in this scale were rated on a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree), and the total score for organizational resilience was from 12 to 60. According to the above criterion (Labrague and De Los Santos, 2020), scores of organizational resilience ranging from 12 to 35.99, 36 to 51.60, and 51.61 to 60 indicated low, moderate, and high levels, respectively. The Cronbach's Alpha for the present sample in this scale was 0.954. The results of the CFA found an acceptable fit for the model of this scale (SRMR = 0.019, RMSEA = 0.049, AGFI = 0.961, CFI = 0.992, and TLI = 0.987; Deng et al., 2018; Heiss et al., 2020).

Perceived social support

Perceived social support was measured with a twelve-item scale developed by Blumenthal et al. (1987). The scale was divided into three dimensions: perceived support from a significant other (4 items), perceived support from family (4 items), and perceived support from friends (4 items) during the COVID-19 pandemic. All items were rated on a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree), and the total score for perceived social support was from 12 to 60. According to the above criterion (Labrague and De Los Santos, 2020), scores of perceived social support ranging from 12 to 35.99, 36 to 51.60, and 51.61 to 60 indicated low, moderate, and high levels, respectively. The Cronbach's Alpha for the present sample in this scale was 0.949. The results of the CFA found an acceptable fit for the model of this scale (SRMR = 0.021, RMSEA = 0.054, AGFI = 0.952, CFI = 0.989, and TLI = 0.980; Deng et al., 2018; Heiss et al., 2020).

Job performance

Motowidlo and Van Scotter (1994) divided job performance into task performance and contextual performance, and contextual performance was further divided into interpersonal facilitation and job dedication (Motowidlo and Van Scotter, 1994; Van Scotter and Motowidlo, 1996; Borman and Motowidlo, 1997). Referring to the scale developed by Motowidlo and Van Scotter (1994); Chen et al. (2021) designed a nine-item job performance scale tailored to the Chinese context (Chen, 2006), which was borrowed to measure the job performance of primary healthcare professionals in this study. This scale was divided into 3 dimensions with 3 items each: task performance (reflecting the direct contribution to organizational goals and core tasks, and measured mainly by the quantity and quality of the completed tasks during the COVID-19 pandemic), interpersonal facilitation (the performance in collaborating with, communicating with, or helping colleagues during the COVID-19 pandemic), and job dedication (taking the initiative to perform tasks outside the scope of their work and overcoming work difficulties during the COVID-19 pandemic, including self-discipline, proactive behavior, and hard work in support of organizational goals). Each item used a five-point Likert scale from 1 (strongly disagree) to 5 (strongly agree), with the total score for job performance ranging from 9 to 45. According to the above criterion (Labrague and De Los Santos, 2020), scores of job performance ranging from 9 to 26.99, 27 to 38.70, and 38.71 to 45 indicated low, moderate, and high levels, respectively. The Cronbach's Alpha for the present sample in this scale was 0.911. The results of the CFA found an acceptable fit for the model of this scale (SRMR = 0.022, RMSEA = 0.056, AGFI = 0.962, CFI = 0.990, and TLI = 0.979; Deng et al., 2018; Heiss et al., 2020).

Statistical analysis

First, descriptive analysis with frequencies and percentages was performed to describe the demographic characteristics of participants in this survey. Then, student's *t*-test (*t*-test) and

analysis of variance (ANOVA) were used to examine statistical differences across subgroups of demographic characteristics in scores on individual resilience, organizational resilience, perceived social support, and job performance. Pearson correlation analysis was conducted to estimate the correlations among these variables. IBM SPSS Statistics 21.0 was used for the above analyses. Finally, hypothesized relationships among individual resilience, organizational resilience, perceived social support, and job performance were validated with Structural Equation Modeling (SEM) on AMOS 21.0, using a bias-corrected bootstrap 95% confidence interval (CI) to further evaluate the significance of total, direct, and indirect effects (not including 0, significant). Additionally, fit indices of SRMR, RMSEA, AGFI, CFI, and TLI were proposed to assess model adequacy. We determined an acceptable fit using the conventional cut-off criteria of SRMR < 0.08, RMSEA < 0.08, AGFI > 0.90, CFI > 0.90, and TLI > 0.90 (Deng et al., 2018; Heiss et al., 2020). The significance level for all tests was determined as $p < 0.05$.

Quality control

To control the data quality, the following steps were taken. In the study design stage, a formal questionnaire was formed by interpreting the relevant literature and using a pilot test. In the field research stage, the investigators were trained before the formal survey to ensure that they had a thorough understanding of the aim and content of the study. In the process of the formal survey, we assigned three to five specially trained investigators to each survey site. At least one investigator reviewed the quality of each questionnaire after it was completed. The investigators manually checked each item of the completed questionnaire to avoid omissions, mistakes, and logical errors. For example, if a healthcare professional's age was 25 years old and his/her working tenure was written as 20 years, the investigator would re-interview the participant and ask him/her to correct it on the spot if there was a filling error, or if the same value was selected for all answers to the measured variables in the questionnaire, the investigator would ask the participant to reconfirm the accuracy of the answers. In the data collation and analysis stage, the questionnaires checked and passed were coded uniformly, and there was double-entry of data to control the quality.

Results

Demographic characteristics

Among the 1,266 healthcare professionals in township health centers who participated in this survey, most were females (70.62%) and married (83.33%). The mean age of these participants was 37.20 ± 9.20 years (ranging from 20 to 73 years old), and the majority of participants were in the age groups of 31–40 years (33.33%) and 41–50 years (34.52%). Most participants had a bachelor's degree or higher (57.66%) and earned CNY 20,001–60,000 per year (64.61%). Nearly one-third (32.86%) of the participants have been working for more than 20 years. The majority of participants (58.29%) reported having worked 48 h or less per week. The specific information on demographic characteristics was shown in Table 1.

Score differences across subgroups

The means of total scores for individual resilience, organizational resilience, perceived social support, and job

TABLE 1 Demographic characteristics of healthcare professionals in township health centers in this survey (*N*=1,266).

Variables	*N* (%)	Variables	*N* (%)
Gender		Annual income (CNY)	
Male	372 (29.38)	≤20,000	93 (7.35)
Female	894 (70.62)	20,001–40,000	377 (29.78)
Age (years)		40,001–60,000	441 (34.83)
≤30	318 (25.12)	60,001–80,000	256 (20.22)
31–40	422 (33.33)	>80,000	99 (7.82)
41–50	437 (34.52)	Working tenure (years)	
>50	89 (7.03)	≤5	271 (21.41)
Marital status		6–10	239 (18.88)
Married	1,055 (83.33)	11–15	186 (14.69)
Unmarried/divorced/widowed	211 (16.67)	16–20	154 (12.16)
Educational background		>20	416 (32.86)
High school or below	150 (11.85)	Average weekly working hours (h)	
Associate's degree	386 (30.49)	≤48	738 (58.29)
Bachelor's degree or above	730 (57.66)	49–72	464 (36.65)
		>72	64 (5.06)

performance among the 1,266 participants in this study were 101.67 ± 14.29, 51.29 ± 7.88, 49.10 ± 8.37, and 37.97 ± 5.22, respectively. The means of total scores for each dimension of the variables were detailed in Table 2.

Participants in different age groups, marital statuses and weekly working hours reported different scores for individual resilience and perceived social support. Participants who were older, married, and had shorter weekly working hours had higher scores for individual resilience and perceived social support. Meanwhile, those with moderate annual incomes had a higher organizational resilience score. Participants who were older, married, held bachelor's degrees or above, had high annual incomes, and have been working over 20 years had a higher score for job performance. The different scores across subgroups of demographic characteristics were shown in Table 3.

Bivariate correlations

Individual resilience, organizational resilience, perceived social support, and job performance were correlated bilaterally. Individual resilience was positively related to organizational resilience ($r = 0.619$, $p < 0.001$), perceived social support ($r = 0.634$, $p < 0.001$), and job performance ($r = 0.633$, $p < 0.001$). Organizational resilience was positively related to perceived social support ($r = 0.588$, $p < 0.001$), and job performance ($r = 0.438$, $p < 0.001$). Perceived social support was positively related to job performance ($r = 0.451$, $p < 0.001$). More detailed correlation coefficients among the variables were presented in Table 4.

TABLE 2 Means of total scores for individual resilience, organizational resilience, perceived social support, and job performance among the 1,266 participants in this survey (N=1,266).

Variables	Mean	SD
Individual resilience		
Rational coping	23.61	4.51
Hardiness	22.14	3.14
Self-efficacy	30.56	4.27
Flexible adaption	25.38	4.08
Organizational resilience		
Static resilience	26.01	4.06
Dynamic resilience	25.28	4.23
Perceived social support		
Significant other support	16.07	3.08
Family support	16.74	2.94
Friends support	16.28	3.03
Job performance		
Task performance	12.29	1.98
Interpersonal facilitation	12.89	1.86
Job dedication	12.78	1.99

SD, Standard deviation.

Synthesized relationships verification by SEM

Figure 1 demonstrated the standardized path coefficients of the synthesized relationships among variables validated by SEM. The model shown in Figure 1 had a good fit (SRMR = 0.029, RMSEA = 0.074, AGFI = 0.922, CFI = 0.971, and TLI = 0.962). Table 5 with a bias-corrected bootstrap 95% CI presented the significance of the total, direct, and indirect effects. The path coefficients for all effects were significant. Organizational resilience [$\beta = 0.409$, 95% CI = (0.304, 0.495)] and perceived social support [$\beta = 0.410$, 95% CI = (0.323, 0.507)] had significant direct effects on individual resilience. Organizational resilience [$\beta = 0.290$, 95% CI = (0.222, 0.359)] and perceived social support [$\beta = 0.291$, 95% CI = (0.229, 0.371)] had significant indirect effects on job performance. Meanwhile, individual resilience [$\beta = 0.709$, 95% CI = (0.647, 0.759)] had significant direct effect on job performance.

Discussion

Summary of main findings

This study was designed to explore the level of individual resilience of healthcare professionals in township health centers during the COVID-19 pandemic, and to analyze the relationships between individual resilience, organizational resilience, perceived social support, and job performance.

The score of the individual resilience for our collected sample was 101.67, showing a moderate level of resilience among healthcare professionals in township health centers during the COVID-19 pandemic, which was higher than the level of resilience reported in a study for primary care workers in Spain (Aragonès et al., 2022). Additionally, organizational resilience and perceived social support were positively associated with individual resilience, and individual resilience was positively associated with job performance, in line with the findings of previous studies (Hou et al., 2020; Riess, 2021; Shi et al., 2022). Moreover, the relationship between organizational resilience and job performance, and the relationship between perceived social support and job performance were both mediated by individual resilience.

The effect of organizational resilience on individual resilience

Organizational resilience is related to the inherent and adaptive capabilities that enable organizations to detect threats, cope with disturbances, adapt and adjust to environmental changes, reduce organizational vulnerabilities to systemic risk environments, recover from adverse events, and even grow from them (Burnard and Bhamra, 2011; Jalil et al., 2021; Khalili et al.,

TABLE 3 Score differences in individual resilience, organizational resilience, perceived social support, and job performance across different demographic characteristics groups in this survey (N=1,266).

Variables	Individual resilience		Organizational resilience		Perceived social support		Job performance	
	Total scores	*t/F*	Total scores	*t/F*	Total scores	*t/F*	Total scores	*t/F*
Gender								
Male	102.55 ± 13.74	1.413	51.10 ± 7.94	−0.555	49.39 ± 8.25	0.792	38.15 ± 5.39	0.801
Female	101.31 ± 14.51		51.37 ± 7.85		48.98 ± 8.43		37.89 ± 5.15	
Age (years)								
≤30	99.92 ± 14.95	3.040*	51.11 ± 8.26	0.295	47.91 ± 9.20	3.060*	37.17 ± 5.24	4.381**
31–40	101.53 ± 13.55		51.50 ± 7.75		49.55 ± 7.91		37.92 ± 4.90	
41–50	102.61 ± 14.30		51.13 ± 7.69		49.34 ± 8.04		38.43 ± 5.19	
>50	104.02 ± 14.80		51.72 ± 8.08		50.02 ± 8.70		38.80 ± 6.31	
Marital status								
Married	102.05 ± 14.11	2.078*	51.21 ± 7.87	−0.812	49.45 ± 8.07	2.960**	38.19 ± 5.22	3.402**
Unmarried/divorced/widowed	99.81 ± 15.05		51.69 ± 7.88		47.36 ± 9.58		36.86 ± 5.06	
Educational background								
High school or below	102.17 ± 15.88	0.104	52.11 ± 7.17	1.789	50.15 ± 8.37	1.432	38.03 ± 6.07	4.216*
Associate's degree	101.56 ± 14.81		51.60 ± 7.90		49.09 ± 8.75		37.34 ± 5.51	
Bachelor's degree or above	101.63 ± 13.68		50.95 ± 7.99		48.88 ± 8.16		38.29 ± 4.83	
Annual income (RMB)								
≤20,000	97.55 ± 15.92	2.211	49.55 ± 9.45	3.017*	47.47 ± 8.65	1.018	36.55 ± 4.88	2.965*
20,001–40,000	102.17 ± 13.95		52.16 ± 7.50		49.34 ± 8.10		37.70 ± 5.29	
40,001–60,000	101.80 ± 14.57		51.26 ± 7.76		49.15 ± 8.72		38.22 ± 5.30	
60,001–80,000	102.33 ± 13.64		51.20 ± 7.90		49.31 ± 8.07		38.52 ± 4.83	
>80,000	101.42 ± 13.97		49.97 ± 7.77		48.90 ± 8.33		37.81 ± 5.59	
Working tenure (years)								
≤5	100.70 ± 14.21	2.100	51.70 ± 7.83	0.359	48.82 ± 8.68	0.662	37.08 ± 5.19	4.687**
6–10	100.67 ± 15.74		51.36 ± 8.16		48.58 ± 8.98		38.06 ± 5.59	
11–15	101.63 ± 13.72		51.20 ± 7.49		48.96 ± 7.90		37.70 ± 5.04	
16–20	100.69 ± 13.64		50.79 ± 8.21		49.29 ± 8.27		37.60 ± 4.67	
>20	103.27 ± 13.88		51.21 ± 7.81		49.57 ± 8.06		38.75 ± 5.18	
Average weekly working hours (h)								
≤48	102.29 ± 13.91	4.157*	51.53 ± 7.85	1.794	49.59 ± 8.09	4.424*	38.14 ± 5.06	1.161
49–72	101.34 ± 14.90		51.14 ± 7.90		48.64 ± 8.84		37.77 ± 5.48	
>72	97.06 ± 13.42		49.66 ± 7.91		46.78 ± 7.64		37.38 ± 5.00	

*$p < 0.05$. **$p < 0.01$.

2021). It can be understood from both static and dynamic perspectives, encompassing not only the capacity of organizations to proactively prevent risks, but also their capacity to cope with crises, bounce back from adversity, and survive in the long term (Zhang and Qi, 2021), which also has important implications for shaping individual resilience. The organizational resilience of the township health centers during the COVID-19 pandemic was at a moderate level, with a score of 51.29, and had a positive effect on individual resilience, which can be explained in the following ways.

First, resilient organizations are more likely to be taking steps before, during, and after crises to alleviate the psychological stress of healthcare professionals and enhance individual resilience (Young et al., 2021). Township health centers have been taking multiple steps during the COVID-19 pandemic to promote individual resilience by understanding the psychological status of primary healthcare professionals, monitoring individual stress responses, developing new support services and resources, rationalizing the working hours and rest times, and prioritizing individuals with special needs. Second, the organizational culture of resilience in township health centers can underpin the development of individual resilience among primary healthcare professionals. The features of leadership, effective communication, efficient policy implementation, empowerment, solidarity and cooperation, and altruism available in healthcare organizations during the COVID-19 pandemic have been noted to be associated with a culture of resilience at the organizational level, contributing to the resilience of individuals (Wu et al., 2020; Brown et al., 2021; Fleuren et al., 2021). Third, township health centers with resilience pay more attention to improving the work environment, such as through the provision of appropriate personal protective equipment and disinfection of hospital communal facilities, which alleviates anxiety about COVID-19 infection among primary

TABLE 4 Correlation coefficients of individual resilience, organizational resilience, perceived social support, and job performance in this survey (N=1,266).

Variables	1	2	3	4	5	6	7	8	9	10	11	12
Individual resilience												
1. Rational coping	1											
2. Hardiness	0.646***	1										
3. Self-efficacy	0.658***	0.827***	1									
4. Flexible adaption	0.731***	0.713***	0.810***	1								
Organizational resilience												
5. Static resilience	0.503***	0.571***	0.555***	0.485***	1							
6. Dynamic resilience	0.528***	0.547***	0.533***	0.494***	0.804***	1						
Perceived social support												
7. Significant other support	0.535***	0.506***	0.521***	0.496***	0.531***	0.559***	1					
8. Family support	0.510***	0.560***	0.550***	0.514***	0.497***	0.515***	0.771***	1				
9. Friends support	0.547***	0.515***	0.526***	0.504***	0.481***	0.514***	0.792***	0.786***	1			
Job performance												
10. Task performance	0.443***	0.453***	0.529***	0.501***	0.346***	0.360***	0.352***	0.371***	0.362***	1		
11. Interpersonal facilitation	0.466***	0.546***	0.568***	0.532***	0.406***	0.365***	0.389***	0.434***	0.398***	0.668***	1	
12. Job dedication	0.447***	0.519***	0.560***	0.529***	0.402***	0.359***	0.346***	0.365***	0.354***	0.687***	0.751***	1

***$p < 0.001$.

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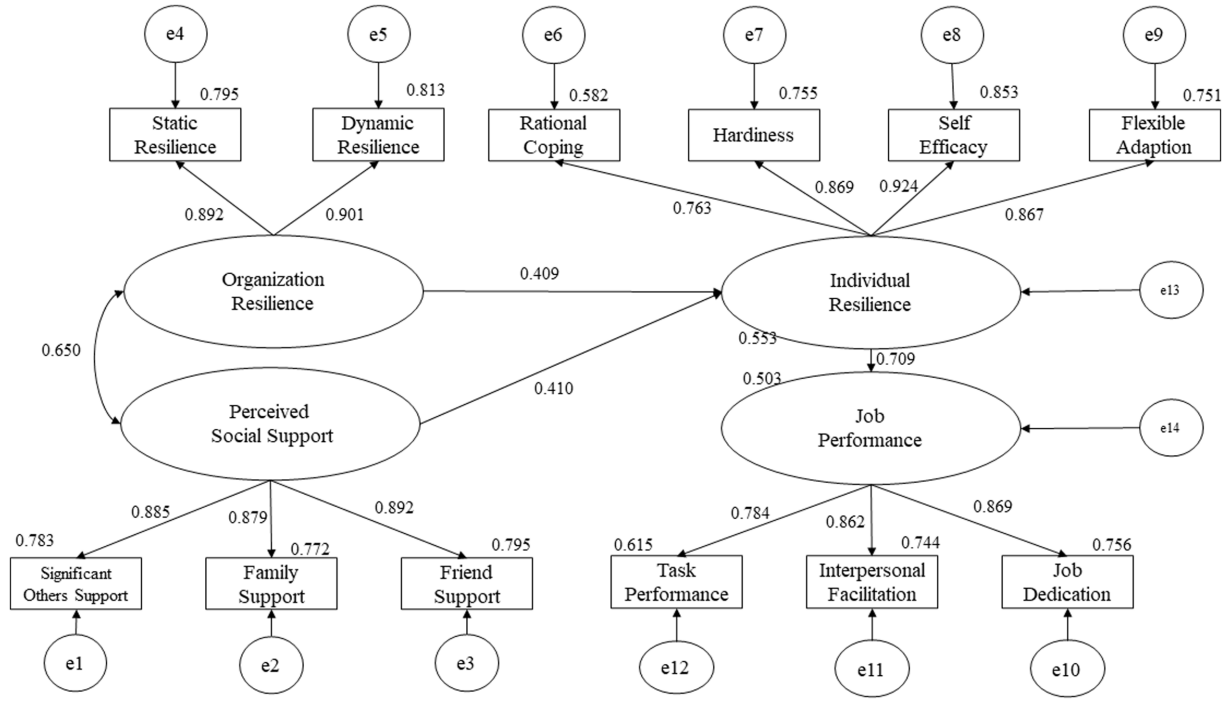

FIGURE 1
Model diagram of the synthesized relationships among individual resilience, organizational resilience, perceived social support, and job performance in this survey.

TABLE 5 Total, direct and indirect effects among individual resilience, organizational resilience, perceived social support, and job performance in this survey (N=1,266).

Paths	Total effects	95% CI	Direct effects	95% CI	Indirect effects	95% CI
Organizational resilience → Individual resilience	0.409**	[0.304, 0.495]	0.409**	[0.304, 0.495]	–	–
Organizational resilience → Individual resilience → Job performance	0.290**	[0.222, 0.359]	–	–	0.290**	[0.222, 0.359]
Perceived social support → Individual resilience	0.410**	[0.323, 0.507]	0.410**	[0.323, 0.507]	–	–
Perceived social support → Individual resilience → Job performance	0.291**	[0.229, 0.371]	–	–	0.291**	[0.229, 0.371]
Individual resilience → Job performance	0.709**	[0.647, 0.759]	0.709**	[0.647, 0.759]	–	–

**$p < 0.01$.

healthcare professionals. The association between low anxiety levels and high resilience scores among healthcare professionals has been shown to be strong (Sakr et al., 2022).

The effect of perceived social support on individual resilience

Perceived social support is a subjective perception and assessment of the degree of support received from one's external surroundings, such as family, friends, and significant others (Zimet et al., 1990). It allows for solving problems or regulating emotions arising from stressful events by providing tangible assistance (such as medical assistance, financial support, and useful information) or emotional values (such as empathy and belonging; Mo et al., 2020; Hofman et al., 2021). The perceived social support of healthcare professionals in township health centers during the COVID-19 pandemic was at a moderate level, with a score of 49.10, and perceived social support positively affected individual resilience, further explaining previous studies that found social support to be an important resource for healthcare professionals improving their ability to cope with stress during the COVID-19 pandemic (Aughterson et al., 2021).

Some studies reported that healthcare professionals were not fully prepared for emergencies, including the COVID-19 pandemic (Labrague et al., 2018; Labrague and De Los, 2021). Inadequate preparation can make it difficult for healthcare professionals to take on the physical and psychological stresses of a pandemic in a short period, showing vulnerability. Instrumental and informational support from significant others (such as leaders and experienced colleagues) in terms of emergency response methods, risk communication skills, and critical information findings can

bridge gaps in crises preparedness for healthcare professionals and promote rational coping with and flexible adaptation to the COVID-19 pandemic and related events, which would enhance individual resilience among healthcare professionals in township health centers. Furthermore, given the fast spreading nature of COVID-19, healthcare professionals in township health centers have been forced to isolate themselves from family, friends and society, which left them feeling anxious and depressed. Emotional support from family and friends can promote positive emotions, increase confidence, alleviate anxiety and depression, and enhance hardiness and self-efficacy with individual resilience for them (Ortiz-Calvo et al., 2022; Shi et al., 2022). Additionally, work-life balance is an essential attribute of resilience (Cooper et al., 2020). Healthcare professionals in township health centers have put lots of effort into their work during the COVID-19 pandemic, with limited time allocated for family life. Family members can support healthcare professionals in achieving a work-life balance by sharing more family responsibilities, enabling primary healthcare professionals to improve their resilience.

The effect of individual resilience on job performance

Job performance of healthcare professionals, a key objective of organizational management, refers to their behavioral presentations and outcomes in healthcare work and is profoundly associated with individual resilience (Liu et al., 2019; Hoşgör and Yaman, 2022). The job performance of healthcare professionals in township health centers during the COVID-19 pandemic was at a moderate level, with a score of 37.97, and was affected by individual resilience.

Resilience protects individuals against various negative emotions and prevents poor psychological states such as stress, depression, and anxiety, thereby improving the professional skills and job engagement of primary healthcare professionals with a positive effect on job performance (Ojo et al., 2021; Yörük and Güler, 2021; Hoşgör and Yaman, 2022). Studies have also shown that resilient individuals are able to take control of themselves, thus avoiding transgressions in the workplace and contributing to increased productivity (Song, 2012). These viewpoints can serve to explain the positive relationship between the individual resilience and job performance of healthcare professionals in township health centers during the COVID-19 pandemic. Moreover, resilience is regarded as being related to a sense of coherence, which was defined as individuals having a dynamic feeling of confidence in being able to cope with stressful challenges (Streb et al., 2014). A strong sense of coherence enables individuals to mobilize the available resources for effective coping with stress and avoiding burnout (Levert et al., 2000), which plays a positive role in improving the job performance of healthcare professionals in township health centers. We also found that individual resilience mediated both the relationship between organizational resilience and job performance, and the relationship between perceived social support and job performance.

Implications for practice

The individual resilience of healthcare professionals in township health centers requires long-term investment and sustained attention, rather than no longer valued as crises abate, and it should involve the joint efforts of individuals, organizations, health authorities, and society. Primary healthcare professionals have been required to acquire increased specialized knowledge and emergency management skills to adapt rapidly and cope rationally with the COVID-19 pandemic and related crisis events, and to learn from experiences in practice to improve their individual confidence and self-efficacy. Meanwhile, healthcare professionals are encouraged to relieve negative emotions through reflective journaling, thoughts sharing, and mindfulness training, to develop hardiness and promote individual resilience by accepting their limitations, finding meaningful objects in life, and learning to grow in life experiences (Bonanno, 2004).

Building organizational resilience and fostering the individual resilience of primary healthcare professionals should be a priority for healthcare organizations. Firstly, organizations should take the COVID-19 pandemic as an opportunity to improve the capacity to monitor and predict risks, develop emergency plans and conduct simulation exercises, and strengthen organizational teamwork, with the aim of crisis prevention and preparedness. Secondly, organizations are expected to bounce back rapidly from crises and achieve a new development stage. Thirdly, during a pandemic, organizations should develop the individual resilience of primary healthcare professionals at the organizational level by monitoring their health status, providing technical guidance, offering targeted support programs and creating an optimal working environment. Additionally, in the early stages of a pandemic, organizations need to redeploy staffing structures, form a flexible shift schedule, optimize the workflow, and guarantee adequate rest time for primary healthcare professionals (Johal et al., 2021), with a view to improving individual adaptation to the stressful environment, attending to their the mental state and enhancing resilience. What's more, it is recommended that health authorities and society provide instrumental and emotional support for healthcare professionals during the pandemic to enhance resilience in terms of sharing information, stocking, providing adequate emergency supplies, and offering medical support and emotional value when necessary.

Limitations and future research

Although this study provides an important reference for enhancing the individual resilience of primary healthcare professionals during the COVID-19 pandemic, some limitations were noted. Firstly, the data in this study were from one province in eastern China, rather than being representative of the national situation, so we will consider taking one province in central China and one province in western China in a future study, to obtain a more comprehensive understanding of the resilience of healthcare

professionals in township health centers during the COVID-19 pandemic. Secondly, several limitations were imposed by the nature of the study design. The cross-sectional survey meant that causal relationships between variables could not be proven, and the adoption of self-reported methods for collecting data implied that social desirability effects due to observation bias were unavoidable. In future studies, we will incorporate a combined qualitative and quantitative approach for the study design and the collection of sample data from multiple subjects. Finally, we expect to include more individual factors (such as demographic information, personal characteristics, and resources available to the individual) in the analysis of factors influencing individual resilience.

Conclusion

This study focused on exploring the individual resilience of healthcare professionals in township health centers during the COVID-19 pandemic, and found that individual resilience was at a moderate level. Moreover, organizational resilience and perceived social support were positively associated with individual resilience, and individual resilience was positively associated with job performance; furthermore, individual resilience mediated the relationship between organizational resilience and job performance, and the relationship between perceived social support and job performance. Synthesizing the findings of this study, it is recommended that enhancing resilience from various perspectives, including individual professional skills and psychological quality improvement, organizational resilience enhancement, material security and emotional support, which involves the joint efforts of primary healthcare professionals, healthcare organizations, health authorities and society.

Data availability statement

The original contributions presented in the study are included in the article, further inquiries can be directed to the corresponding authors.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent from the patients/participants or patients/participants legal guardian/next of kin was not required to participate in this study in accordance with the national legislation and the institutional requirements.

Author contributions

A-QW, C-HT, JS, C-XF, and W-CW were responsible for the conception and design, drafting the manuscript, reviewing, and editing the paper. A-QW and C-HT were responsible for evaluating and analyzing data. Z-MC and W-QY critically reviewed and commented on the draft paper. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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Development of a nurse-manager dualistic intervention program to alleviate burnout among nurses based on the appreciative inquiry

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Aims: To develop a feasible and effective nurse-manager dualistic intervention program to support nurses coping with burnout symptoms.

Background: Person-organization combined interventions were recommended as the most effective approach for reducing burnout symptoms. However, few interventions have been developed in the nursing field.

Methods: The Medical Research Council, United Kingdom (MRC UK), Framework for Development and Evaluation of Complex Interventions, was employed for nurse-manager dualistic intervention program development. The following three steps were followed for developing the dualistic intervention program: (1) identifying the evidence base by conducting extensive reviews of the relevant literature and a mixed study; (2) identifying/developing a theory by selecting the job demands-resources model and proposing the theoretical framework for intervention development; and (3) modifying the process and outcomes of the nurse-manager dualistic intervention program.

Results: The intervention program consists of six group sessions over 9 weeks. Researchers/managers are supposed to deliver the program. The main contents of the intervention are (1) inception (session 1); (2) discovery (session 2); (3) dream (session 3); (4) design (session 4); (5) destiny (session 5); and (6) keep (session 6). The emphasis of the intervention is on helping nurses dealing with burnout symptoms.

Conclusion: Following the guidance of the MRC framework, a feasible and potentially effective nurse-manager dualistic intervention program was developed for nurses coping with burnout. Future studies are needed to model the intervention and assess the effects and replicability of the intervention.

KEYWORDS

appreciative inquiry, burnout, formative intervention development, nurse, qualitative research, quantitative research

Introduction

Burnout is a psychological response to chronic work-related stress that is characterized by emotional exhaustion, cynicism, and reduced professional accomplishment. According to Leiter and Maslach (2004), a chronic mismatch between a person and an organization plays a key role in burnout development. The severe conflict between personal and organizational values negatively influences job involvement, decision-making participation, and organizational identification, which, in turn, leads to burnout (Leiter and Maslach, 2004). As one of the most important psychological occupational hazards, burnout develops progressively and negatively affects work attitude and behavior, which causes damages at a personal (e.g., poor work performance, turnover intention, and absence) and organizational level (e.g., low organizational commitment, poor peer supports, and substantial financial costs) (Fish et al., 2022; Li et al., 2022; Shapiro et al., 2022). A growing body of empirical evidence shows that burnout prevalence is high in healthcare professions, especially in the nursing group, with 20%−80% of nurses acknowledging severe burnout symptoms worldwide (Matsuishi et al., 2021; Membrive-Jimenez et al., 2022; Wei et al., 2022). Therefore, it is urgent to develop effective intervention strategies to alleviate nurse burnout, which ultimately contributes to high levels of work passion, work performance, psychological wellbeing, and organizational commitment.

Background

Since the 1980s, numerous studies have been conducted to figure out effective intervention approaches that prevent and alleviate burnout symptoms. According to types, purposes, and target populations of the interventions, researchers normally classify the burnout interventions into one of the following three broad categories: (1) person-directed interventions aim to reduce individuals' burnout experience, usually through promoting their coping skills, acquiring supports from family and organization, or changing negative cognition and behaviors (Dreison et al., 2018); (2) organization-directed interventions concentrate on modifying the organization and job characteristics related to burnout, such as negative work environment, inadequate organizational resources, injustice, and work overload (Edu-Valsania et al., 2022); (3) person-organization combined interventions focus on promoting coping strategies of individuals and employee-driven organizational change *via* interaction of individuals with organizations and aspects of their job (Awa et al., 2010).

Typical person-directed interventions mainly include classic cognitive-behavioral therapies (e.g., emotional self-regulation, cognitive restructuring, and relaxation), mindfulness training, and physical exercise. Most of the interventions, presented in a workshop or online software, were initiated and determined by the employees themselves, to strengthen their psychological and behavioral states, which were completely outside the organizational problems (Schaufeli and Enzmann, 1998). For example, Bagheri et al. (2019) employed a stress-coping strategy and group cognitive-behavioral therapy on clinical nurses and found that the intervention significantly reduced nurse burnout and the effectiveness lasted after a month. Duarte and Pinto-Gouveia (2016) provided a mindfulness-based intervention on oncology nurses and found a significant decrease in burnout, compassion fatigue, and stress and a significant increase in life satisfaction and self-compassion, with medium to large effect sizes. Semerci et al. (2021) used progressive muscle relaxation exercises on burnout and compassion of nurse managers and found that the intervention significantly alleviates burnout and compassion fatigue of managers.

A further narrative review identified several studies that showed no effect of person-directed interventions on nurse burnout. The nurse-led cognitive-behavioral therapy analyses by Partlak Gunusen et al. (2021) and mindfulness analyses by Wong et al. (2021) did not show any positive effects on nurse burnout. Taken together, since burnout develops idiosyncratically due to person and organization mismatch, the negative effects of organizational conditions on burnout have not been involved in person-directed interventions. Moreover, the effectiveness of person-directed interventions on nurse burnout reduction needs further evidence to be proven. In addition, concerns about the limited long-term effects of person-directed interventions have been raised by researchers and managers (Jensen et al., 2006; Westermann et al., 2014).

Organization-directed interventions involve developing welcoming programs, using rewards and incentives, implementing work-family balance plans and humanizing work schedules, improving job characteristics and leadership of managers, training and coaching employees, and creating supportive environments (Shanafelt and Noseworthy, 2017; DeChant et al., 2019). Kersten et al. (2019) used a dialysis-specific training program (including healthy behavior management, promotion of work characteristics, and organizational resource identification and enhancement) to reduce nurse burnout and found that burnout had improved after the intervention, although the effects were not stable over time and the effect sizes were small. Wei et al. (2017) developed an active intervention, including communication skills, conflict coping strategies, efficacy elevation, working skills, and emotion management, and conducted a randomized control trial on burnout nurses. They found significant decreases in emotional exhaustion and depersonalization in nurses. Kelly et al. (2012) explored the effect of creating a positive organizational culture *via* Magnet hospital on burnout and found that nurses from Magnet hospital reported lower burnout symptoms than nurses from the non-Magnet hospital. Despite several organization-directed intervention studies reporting positive findings, these

interventions do not target specific personal issues, which might lack feasibility for individuals and hardly motivate their subjectivity (Tsutsumi et al., 2009). Furthermore, difficulties in repetitive verification and challenges in the popularization and application of the interventions make it hard to conclude (Dreison et al., 2018).

Person-organization combined interventions are multifaceted, initiated, and determined by both employees and managers. The typical interventions often use stress management with organizational environment improvement (e.g., stress coping strategies with organizational support and psychotherapy with job crafting and time management). A previous systematic review showed that combined intervention approaches were completely different in terms of content, form, duration, and frequency (Pijpker et al., 2019). Adams et al. (2019) used a 2-month cultural change toolkit, including meaningful recognition, shared decision-making, and increased leadership involvement and support, to promote nurse burnout and found a significant burnout reduction after the implementation. Liu et al. (2022) provided a 1-year rational emotional intervention combined with hierarchical management to burnout nurses and found that nurses experienced lower levels of burnout after the intervention. Given the comprehensiveness of combined interventions, it is recommended as the most effective intervention type. However, most of the combined interventions focus on stress reduction and work condition promotion, which hardly tackles the burnout root of the person and organization mismatch issue. In addition, few interventions simultaneously motivate personal strengths and organizational resources to cope with burnout adversity, which impacts the positive attributes and organizational involvement of nurses.

Appreciative inquiry (AI), developed by Cooperrider (1986), is based on a relational constructionist view that places a strong emphasis on human perceptions, social collaboration, and appreciative systems. As a new organizational development intervention, AI seeks innovative ideas from employees and searches for success for employees and their organizations *via* affirmation, appreciation, and dialogue (Koster and Lemelin, 2009). AI advocates a positive slant of inquiry based on future possibilities instead of problem-based short-term solutions and focuses on positive changes arising from the interaction between employees' language, relationships, and functioning in an organization (Cooperrider and Whitney, 2000, 2005). There are four phases of inquiry cycles that form the process of AI: (1) discovery uses emotional touchpoints and photoelicitation to discover what is working well and appreciate what is the best of what has been; (2) dream envisions what would be the ideal dream for the future; (3) design co-constructs a vision for the ideal future; and (4) destiny plans the work strategies toward the desired vision. Through this 4D (discovery, dream, design, and destiny) cyclical process, AI provides a flexible framework for discovering and utilizing personal strengths and organizational resources to achieve organizational goals. AI has been widely employed in several fields, such as education (Stulz et al., 2021), organization management (Martyn et al., 2019), and healthcare promotion (Shrivastava et al., 2020), and is proven to be an effective method in generating personal growth (Sturm et al., 2020), leadership promotion (Bleich and Hessler, 2016), environment change (Ebert et al., 2020), capacity building (Magnussen et al., 2019), and organizational development (Hilde et al., 2010).

Therefore, taking the intrinsic causes of burnout and the benefits of person-organization combined interventions into account, this study aimed to employ the 4D cycle of AI to develop an AI-based nurse-manager dualistic intervention program to support burnout nurses, guided by the MRC framework for developing and evaluating complex interventions.

Methods

This was an interventional development study. The framework for the development and evaluation of complex interventions developed by MRC, UK, was employed as a stepwise guideline for developing the nurse-manager dualistic intervention program. There are four stages of the MRC framework, namely, development, feasibility/piloting, evaluation, and implementation. In this study, we just reported the development stage of the AI-based nurse-manager dualistic intervention (NMDI) program. The following three steps of the development stage were followed: identifying the evidence base, identifying/developing theory, and modifying processes and outcomes. Table 1 shows the activities we undertook for developing an AI-based NMDI program following the guidelines of the MRC. This study was approved by the Human Research Ethics Committee of the School of Nursing and Rehabilitation, Shandong University (NO. 2020-R-030). Approvals were gained from the two tertiary hospitals in Baoding where the study was carried out.

Results

The identified evidence base

According to the framework of the MRC, we first identified the evidence base *via* a systematic review and a mixed study.

Review of interventions to alleviate burnout

A systematic review and meta-analysis of burnout interventions identified 29 studies (Dreison et al., 2018). Of these studies, 21 were organizational-directed interventions, with the subtypes of job training and education, coworker support groups, and clinical supervision; six were personal-directed

TABLE 1 Activities for developing NMDI program following the guidelines of the MRC.

Steps for developing a complex intervention following the MRC framework	Activities taken to develop NMDI program
Identifying the evidence base	(i) Identifying existing reviews of burnout interventions (ii) Conducting extensive reviews of studies related to appreciative inquiry interventions in nursing group (iii) Primary research: a mixed study were conducted to evaluate the attitudes and suggestions of nurses and nurse managers toward burnout intervention
Identifying/developing theory	(i) Literature review and team discussions to choose an appropriate theory and intervention strategies
Modifying process and outcomes	(i) Developing the contents of the NMDI program. As to optimize the intervention, an iterative process was employed with involvement of nursing experts, management experts, nurse managers and nurses

interventions, and the most common subtype was a stress management workshop; and only two were personal-organizational combined interventions, with the subtypes of a stress management workshop, ongoing workgroups, and organizational consultation. Studies indicated that combined interventions, targeting both personal and organizational factors, were the most effective strategies for decreasing burnout symptoms (Awa et al., 2010; Morse et al., 2012).

Review of appreciative inquiry interventions in the nursing group

To increase our understanding of AI interventions, we conducted extensive reviews related to AI interventions aimed to improve the emotions, behavior, and performance of nurses. These reviews focused on the contents, implementation methods, participants, duration, and outcome measures of interventions. The findings of the review showed that most AI interventions followed the four core components (discover, dream, design, and destiny) to develop the interventions; a group-based method was commonly used to implement the interventions, and nurses were the main participants, with several studies involving managers, doctors, and other health-related professions. The duration of the interventions varied, ranging from 2 days to 2 years. Semi-structured interviews, self-rating questionnaires, work summaries, and work diaries were used as measures to evaluate the work attitude, emotion, behavior, and performance of nurses.

These literature reviews provided some important suggestions on the development of interventions targeting burnout reduction and AI application in nurses: person-organization combined interventions should be developed for alleviating nurse burnout; nurses and nurse managers should be involved in the intervention as a group; four core components of AI should be followed for developing the content of NMDI program; a comprehensive theoretical framework will be needed to guide the development of this multifaceted intervention and evaluate possible change processes.

A mixed study evaluating attitudes and suggestions from nurses and nurse managers toward burnout intervention

A semi-structured face-to-face interview was conducted among nurses and nurse managers to obtain a better understanding of nurses and managers coping with burnout and to evaluate their experiences and suggestions. After a conventional content analysis, three themes and six subthemes were identified. The three themes were as follows: needing help to cope with burnout, burnout intervention measures, and intervention environment.

A quantitative study was conducted to investigate the preference of nurses for burnout intervention. A total of 274 nurses were recruited from two tertiary hospitals. The results showed that over half of the nurses selected a group-based (53.6%) or online-to-offline model of intervention (67.9%), and the roles of managers were advisors and supervisors in the intervention (74.5%). Notably, 38.3% of nurses liked to take burnout interventions in hospitals, 46.0% preferred one time per week of the intervention, and 56.6% of nurses suggested that the length of each section for the intervention should be from 1 to 3 h.

Based on the findings, we drew up a primary conclusion on nurses' experiences of coping and living with burnout and made suggestions for developing effective intervention programs to support burnout nurses. This mixed study showed that nurses struggled with chronic burnout symptoms, that few resources can be used to deal with burnout, and that they had strong preferences in burnout intervention models and implementing forms. These findings not only emphasized the need for burnout interventions in a collaborative nurse-manager combined style but also provided us with valuable information that should be considered in the development of burnout interventions.

Identifying/developing theory

Numerous personal factors (e.g., self-efficacy and self-esteem) and organizational factors (e.g., peer support and job control) are involved in coping with stress and changing existing psychological burnout. Appropriate theories provide an overarching framework for personal and organizational factors that explain why burnout should be targeted by the intervention. Therefore, after a systematic review and a series of team discussions, we chose the job demand-resources model (JD-R) as the theoretical basis for developing our conceptual framework (Demerouti and Bakker, 2011). The model has been shown to predict work-related psychological and behavioral issues in employees (Garcia-Sierra et al., 2016; Hussein, 2018), and it has been used to develop interventions to alleviate stress and promote work engagement (Richard et al., 2012; Makowska-Tiomak et al., 2022).

Bakker and Demerouti (2007) classified two general categories of stress-related factors (job demands and job resources) in JD-R. Job demands are considered the physical, psychological, organizational, and social aspects of the job that require physical and psychological knowledge, skills, and efforts of employees and, therefore, lead to certain physical and psychological costs. Several kinds of job demands have been listed, such as work overload, irregular work arrangements, and an unfavorable working environment. Job resources refer to the physical, psychological, organizational, and social aspects of the job that could be contributing factors for work achievement, job demand reduction, and personal growth. The job resources may be from organizations (e.g., career opportunities, professional training, and salary), the interpersonal relationship (e.g., supervisor, support, and trust), the job position (e.g., role clarity, responsibility, and right), and the task (e.g., task identity, significance, and autonomy). Xanthopoulou et al. (2007) extended the JD-R model by including personal resources (e.g., self-efficacy, organizational-based self-esteem, and optimism) as predictors for exhaustion and work performance. The job demands and resources negatively interact with each other and then affect the development of job-related health impairments and motivation.

In the development of motivation and reduced health/energy, two different underlying psychological processes were found. First, long-term, chronic job demands lead to massive consumption of mental and physical resources by employees and therefore result in health problems (e.g., physical pain and sleep disorders) and energy exhaustion (e.g., burnout). Second, job and personal resources are referred to as motivational factors, which could promote work engagement and work performance of employees, and eliminate cynicism. Studies demonstrated that job and personal resources played intrinsic and extrinsic motivational roles in satisfying the basic needs of employees, such as autonomy, relatedness, competence, and professional development, and ultimately led to positive work attitude and high work engagement (Fullemann et al., 2016; Trepanier et al., 2020; Kato et al., 2021). The JD-R model provides a conceptual basis for the NMDI program with regard to the process of improving job and personal resources and includes seven domains of performance, namely, feedback, job control, supervision and guidance, peer support, self-efficacy, self-esteem, and optimism. Hence, we proposed a theoretical framework for an AI-based NMDI program targeting burnout reduction (Figure 1).

According to the theoretical framework for an AI-based NMDI program, the literature review, and the mixed study, the AI-based NMDI program for nurses coping with burnout was developed. The essential components of the NMDI program were discovery (inquire the meaning of the nursing profession, discover an existing job and personal resources of nurses, and help nurses to excavate potential resources that goes unnoticed before), dream (create a nursing dream to change the current status and arouse energy and enthusiasm of nurses), design (construct compelling strategies for turning "dreams" into "reality" and essential elements for resources promotion must be in place), and destiny (practice strategies in normal clinical work with organizational support and share the best practical experience). The detailed contents for the AI-based NMDI programs are listed in Table 2.

The proposed AI-based NMDI program is an online and offline mixed burnout intervention program with five weekly sessions and one 4-week session (destiny). Each weekly session lasts for 120–180 min. While, for the 4-week destiny, each week hold a 60–90 min online meeting. Group intervention was employed in all of the sessions. Each group consists of six–eight participants. Managers (e.g., head nurse, vice director, and director of the nursing department) need to participate in each session of the program.

Outcome measures

All of the outcome measures were selected based on the theoretical framework of the AI-based NMDI program and were intended to be measured at baseline, after the NMDI program intervention, and 3 and 6 months after the intervention. The outcome measures assess the following variables: performance feedback, job control, supervision and guidance, peer support, self-efficacy, self-esteem, optimism, and burnout. All of the measures employed in the study are established scales with good reliability and validity.

The performance feedback, job control, supervision, and guidance of participants are assessed using the work resources subscales of the job demand and work resources scale (Li et al., 2014). The Colleague Support Scale for the nursing group, developed by Ma and Ye (2007), is employed to evaluate the peer support of participants. The 10-item General Self-Efficacy Scale, developed by Schwarzer et al. (1999), is used to evaluate the self-efficacy status of participants. The 3-item subscale of

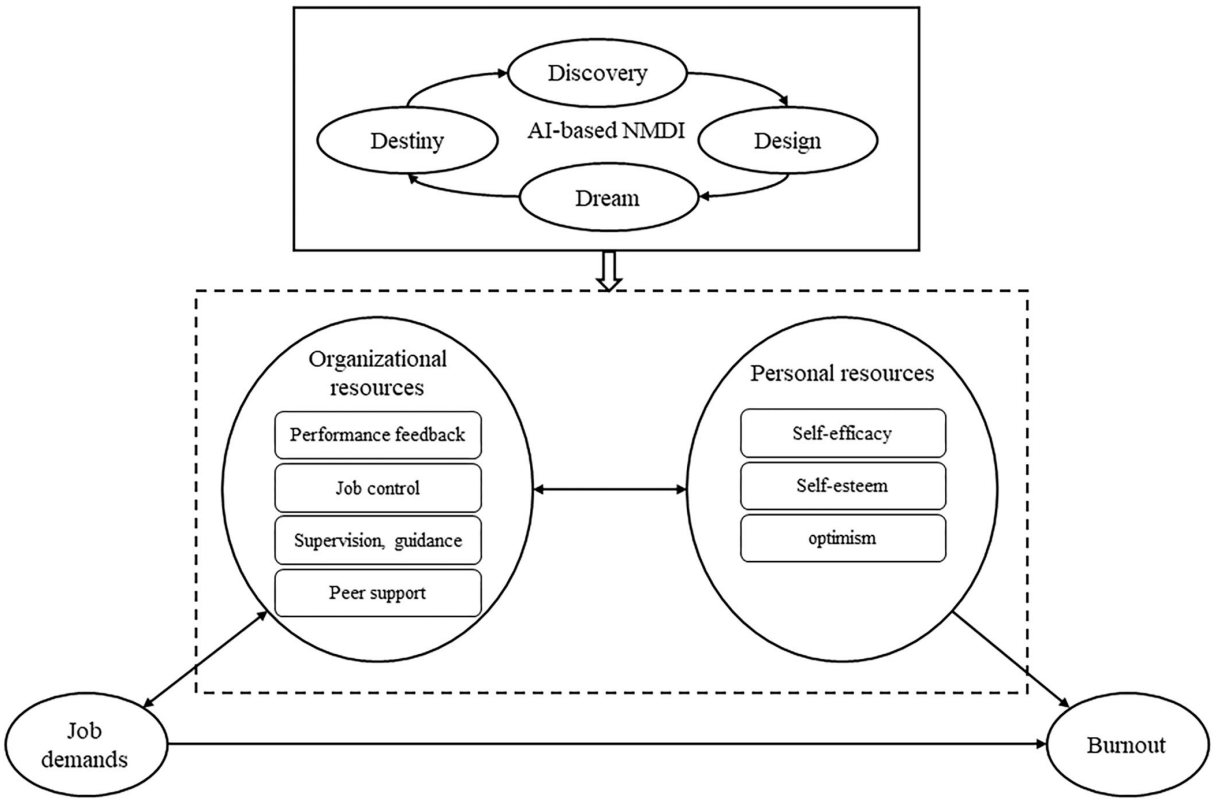

FIGURE 1
Theoritical framework for AI-based NMDI program targeting in burnout reduction.

the Psychological Capital Questionnaire (Luthans et al., 2007) is used to measure the optimism of participants. The 10-item Rosenberg Self-Esteem Scale (Vispoel et al., 2001) is used to measure the self-esteem of participants. The Maslach Burnout Inventory-General Survey (Maslach and Jackson, 1981) is used to measure burnout symptoms experienced by participants.

General information on the sociodemographics and characteristics of both participants and hospitals are collected at baseline. The records written by participants and intervenors are collected after the intervention to support the analysis of intervention effects.

Discussion

This study was used to develop an AI-based nurse-manager dualistic intervention program to reduce burnout symptoms among nurses. Following the MRC framework for developing and evaluating complex interventions (Moore et al., 2015; Medical Research Council, 2022), a systematic and iterative procedure used for intervention development was described, which involved three steps identifying the evidence base, identifying/developing theory, and modifying process and outcomes. These were done by gathering extensive existing evidence from reviews of the literature, investigations, and interviews with nurses and nurse managers, and applying the job demand-resources model as a theoretical basis to strengthen the design for the intervention. This AI-based nurse-manager dualistic intervention program should be a feasible and effective intervention.

Our study is the first to address nurse burnout by organizing nurses and nurse managers as a whole to discover and utilize the personal strengths of nurses and hospital resources. Compared with current combined interventions (Rodrigues et al., 2018; Kersten et al., 2019), our study focused more on enhancing the value match between nurses and hospitals. There are six sessions for the AI-based nurse-manager dualistic intervention program, and all sessions are very closely interdependent. For instance, the discovery session, which aims to find out personal strengths and organizational resources, acts interdependently with the dream session to build a positive career dream toward work-related burnout symptoms. According to the 4D cycles of AI (Sandars and Murdoch-Eaton, 2017; AI Commons, 2018), the six sessions (inception, discovery, dream, design, destiny, and keep) have direct interrelationships that advance the process of

TABLE 2 Titles, aims and contents of the AI-based NMDI program sessions.

Session titles	Aims	Contents
1. Inception	- To form an intervention group - To introduce the aims and contents of the program - To construct affirmative themes	- Organize the first meeting and conduct several ice-breaking games to help nurses know each other - Provide intervention manual and introduce the concepts, theory of AI, the process and consideration of the intervention - Form affirmative themes revolving around overall changing agenda *via* "brain storm"
2. Discovery	- To discover personal resources through self-exploration and peer support - To discover organizational resources through managers and peer support	- State of peak experience and explore positive characteristics of nurses - Explore personal strengths *via* character-strengths survey - Communicate with managers and colleagues to list organizational resources that can be used to deal with job-related issues
3. Dream	- To develop self-confidence and a positive self-image - To build positive career dreams	- Gain new insights through reviewing old material, and enhance participants' strengths - Build a career dream using personal strengths and organizational resources and record the dream by mails or painting - Share dreams with group members and construct declarations for the dreams Note: manager participate this process and give suggestion about the dreams
4. Design	- To design the work plan to strengthen job control - To collaborate with colleagues and managers to get organizational resources	- Review the dreams built by participants - Order the goals, personal strengths and organizational resources by importance and figure out work plan to achieve the primary goal with suggestions from managers - Break the work plan into several phases and set short-term goals for each phases. Participants are suggested to record the process of realizing their dreams
5. Destiny	- To form a support team to promote participants' work performance - To organize group meetings to share positive experiences and get supports from managers and colleagues	- Support teams consist of intervenors and managers. Participants can contact with support team to get suggestions. Meanwhile, support teams need to supervise participants to guarantee their performance followed the work plan - Organize online meetings for participants to share their best experiences and discuss with support team and colleagues to cope with difficulties and frustration - Each participant needs to summarize their gains and give out positive concluding statements
6. Keep	- To strengthen personal and organizational resources *via* performance feedback - To create a positive work environment *via* personal competence improvement and good relationships with colleagues and managers - To continue set goals and work plan	- Celebrate the achievements with group members and work out new goals - Explore new personal strengths by sharing successful experiences - Colleagues and managers summarize participants' positive changes and give out positive feedback and expectations - Intervenors review the intervention process and encourage participants and managers to employ AI-based NMDI into their clinical work in future

appreciating, envisioning, and creating a "best" future for nurses and reduce their burnout symptoms.

A pilot study and randomized controlled trial (RCT) are recognized as necessary advancements for developing and assessing a complex intervention. A pilot study of the nurse-manager dualistic intervention program needs to be conducted to test the adequacy of the planned methods and procedures, the fidelity of implementation, and the retention of nurse participants, identify potential confounding factors, and evaluate the underlying mechanism for the intervention. The RCT study is highly recommended to measure the effects, safety, cost-effectiveness, and long-term impacts of the dualistic intervention. In addition, a mixed study incorporating both qualitative and quantitative methods could be adopted for evaluating objective outcomes and subjective attitudes of the participants.

The AI-based nurse-manager dualistic intervention program, developed in accordance with the JD-R model, is intended to eliminate the mismatch between nurses and hospitals *via* utilizing the personal strengths of nurses and

hospital resources, which, in turn, prevent or alleviate nurse burnout. Thus, performance feedback, job control, supervision and guidance, peer support, self-efficacy, self-esteem, optimism, and burnout of nurses were chosen as the key outcomes. The strength of the relationships among the observed variables and a potential mechanism of the intervention are recommended to be analyzed in RCT studies.

Limitations

Using theory to design effective personal-organizational dualistic interventions posed a number of challenges, the biggest being the process of blending personal and organizational-oriented interventions. Moreover, another challenge was promoting the feasibility of the intervention to nurse participants and nurse managers. Future studies are suggested to explore the experiences, concerns, and needs of nurses and nurse managers coping with burnout, which could be used to develop these complex interventions. This study focused on the development of this AI-based NMDI program and the recruitment strategies of participants; the effects and generalizability of the program remain uncertain. Further pilot studies and single-center and multicenter studies are recommended to implement and evaluate this complex intervention.

Conclusion

Following the MRC framework for the development and evaluation of complex interventions, a potentially feasible and effective nurse-manager dualistic intervention program for burnout nurses was developed. Literature reviews, a qualitative and quantitative mixed study, and the job demand-resources model provided the evidence base for intervention development. Future pilot studies and randomized controlled trials need to be employed to evaluate the feasibility, effects, and mechanism of these nurse-manager dualistic intervention programs. Nurses and nurse managers are encouraged to use this dualistic intervention for alleviating burnout after advanced evidence on the effect of the intervention is reported by further studies.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

Human Research Ethical Approval (No. 2020-R-030) was obtained from the Human Research Ethics Committee of School of Nursing and Rehabilitation, Shandong University. The patients/participants provided their written informed consent to participate in this study.

Author contributions

Y-FG contributed to the study design, the literature review, data analysis, and writing and revising. X-XW contributed to the literature review, data collection, data analysis, and writing. F-YY and F-YS contributed to data analysis, writing, and revising. MD and Y-NJ contributed to the writing and revising. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Effects of psychological capital and social support availability on anxiety and depression among Chinese emergency physicians: Testing moderated mediation model

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Introduction: Anxiety often precedes depression, and the pathway from anxiety to depression may be affected by multiple exposures. Our research aims to explore the mediating effect of the social support availability (SSA) between anxiety and depression and how it is moderated by psychological capital.

Methods: A cross-sectional study was conducted among Chinese emergency physicians at the top-level general hospitals in eastern China. Data were collected via the questionnaire including anxiety and depression subscales of Symptom Checklist-90, Psychological Capital Questionnaire as well as Social Support Rating Scale. The PROCESS v3.4 macro was employed to assess the mediating role of SSA and a moderating role of psychological capital.

Results: A total of 536 valid samples were filtered. Anxiety, depression, SSA, and psychological capital were significant correlated. Anxiety was positively associated with depression ($\beta = 0.82$, $p < 0.001$), and the SSA mediated the relationship between anxiety and depression (indirect effect = 0.013, 95%BootCI [0.005, 0.023]). Psychological capital (specifically, self-efficacy, hope and resilience) further played a moderating role in the relationship between SSA and depression ($\beta = 0.06$, $p < 0.01$).

Conclusion: The mental health of emergency physicians should be concerned. In order to decrease anxiety and depression, SSA and psychological capital should be increased as the interventions for emergency physicians.

KEYWORDS

depression, anxiety, psychological capital, social support availability, emergency physician, moderated mediation model

Introduction

Depression is common in medical practitioners across all stages of their careers (Center et al., 2003; Bailey et al., 2018), even occurs much more frequently than in the general population (Eckleberry-Hunt and Lick, 2015). Medical staffs always have poorer mental health than the general population (Rajasekar and Krishnan, 2021). The morbidity of depression among medical staff was estimated between 12.3 and 45.5% (Paiva et al., 2018; de Wit, 2020; Elhadi et al., 2020). In addition, anxiety is also the common mental health problem for medical staff (Medisauskaite and Kamau, 2019). A Brazilian survey showed that the positive rate of anxiety was 56.6% among 1,419 doctors (de Mélo Silva Júnior et al., 2022). Because of the special nature of the work, emergency physicians (EPs) need to be ready to provide medical services for emergency cases and suffer from huge occupational stress (Basu et al., 2020; Janicki et al., 2020; Pujo et al., 2021). A longitudinal study found the anxiety level of medical residents among EPs were higher than other department doctors (González-Cabrera et al., 2018), and a study at east Africa's largest public hospital displayed that 40.6% of EPs had the moderate to severe range of depression disorders (Iheanacho et al., 2022). There are lots of factors that affect the mental health of EPs and work environment is one of the factors (Rasmussen et al., 2014). In China, large population leads to a crowded and noisy emergency environment, which is not only bad for the work of EPs, but also reduces patients' satisfaction (Lin et al., 2013). The recent research discovered that a total of 35.6% of EPs suffered from depression among 15,243 Chinese samples (Chen et al., 2022).

The relationship between anxiety and depression

Anxiety disorders refer to a group of mental disorders in which patients experience excessive worry and constant fear, and depression is a common psychiatric disorder characterized by sadness, loss of interest or pleasure, feelings of tiredness and poor concentration (World Health Organization, 2017). Because of similarity in symptoms, anxiety and depression often go together (Groen et al., 2020) as the most common comorbidity in psychiatry, while the mechanism of the comorbidity is still unclear (Ter Meulen et al., 2021). Previous study discovered that the overlapping symptoms act as a bridge linking the anxiety and depression (Groen et al., 2020). Nevertheless, either anxiety or depression has a respective component to differentiate both, for anxiety is characterized by psychological hyperarousal and depression is characterized by anhedonia (Joiner, 1993), and anxiety precedes depression in the temporal order of onset of most cases (Moscati et al., 2016; Demyttenaere and Heirman, 2020). Starr et al. (2014) found that anxiety may develop into depression if limiting interpersonal interaction, because the decrease or loss of social relationships is harmful to mental health (Chu, 2017). In conclusion, anxiety and depression are highly correlated and anxiety may be a precursor to depression. Thus, we proposed the hypothesis.

> Hypothesis 1: anxiety is highly related to depression among EPs in China.

The mediating role of social support availability

Social support, as a crucial social factor beneficial to human health, has long been recognized and well-documented for several decades (Cobb, 1976; Ditzen and Heinrichs, 2014), but the concrete definition of social support is not uniform (Cohen, 1988). In general, social support is defined as the material, information and emotional support that an individual receives in a network of social relationships (Cohen and Wills, 1985; Cohen, 1988; Ditzen and Heinrichs, 2014). That means, the individual's social support concerns two parties: actual received social support and subjective perceived social support. The social support availability (SSA) is defined as the extent to which individuals utilize the social support that available to them, which belongs to subjective perceived social support (Xiao, 1994). Compared with actual received social support, the SSA should be most effective in altering subjective cognitive appraisals if the counter the specific needs elicited by the stressful event (Cohen and McKay, 2020). In term of the relationship between stress or negative emotions and perceived social support, Barrera proposed the social support deterioration model that stress or negative emotions can deteriorate the perceived availability or effectiveness of social support (Barrera, 1986). Hindmarch (1998) found that anxious individuals will have cognitive biases and cannot perceive things correctly, which verified the deterioration model. Existing empirical research found that perceived social support can mediate the relationship between anxiety and life satisfaction (Yu et al., 2020), quality of life (Kugbey et al., 2020; Yang and Lu, 2022), and depression (Dour et al., 2014). However, less research has been done on the relationship between SSA (as a component of social support) and anxiety or depression. A study found that anxiety was negatively associated with perceived availability of social support (Den Oudsten et al., 2010). And a recent survey found social support including the dimension of SSA mediated the relationship between the psychological capital and depression among EPs in China (Xu et al., 2022a). Furthermore, low levels of perceived social support may lead to hopelessness and helplessness, which in turn can trigger depression (Johnson et al., 2001). Nonetheless, the role of SSA in the relationship between anxiety and depression was still

unclear. Thus, based on the deterioration model, we proposed this hypothesis.

> Hypothesis 2: SSA paly a mediating role in the relationship between anxiety and depression among EPs in China.

The moderating role of psychological capital

Psychological capital (PsyCap), as an emerging positive psychological resource, is defined as 'a positive state of mind exhibited during the growth and development of an individual,' comprising four core components: self-efficacy, optimism, hope, resilience (Luthans et al., 2007b). PsyCap has been proven to be effective in improving individual performance and relieving negative emotions. Empirical research showed that PsyCap was negatively associated with psychological symptoms, such as anxiety (Minglu et al., 2020) and depression (Shen et al., 2014), and could improve nurses' care competencies (Guo et al., 2021) and quality of life of cancer patients (Guo et al., 2022). And PsyCap also played a mediating role in the relationship between anxiety or depression and other related variables (Rahimnia et al., 2013; Jiang, 2021; Zhao et al., 2021). What's more, PsyCap could moderate the relationship between perceived stress and negative emotions (Wang et al., 2021b) or anxiety (Yang and Yang, 2022). The study of Xu et al. (2022b) found that college freshmen with high level of PsyCap reduced the more effect of interpersonal sensitivity on depression than that with low PsyCap. However, there was little exploration about the moderating effect of PsyCap in the relationship between anxiety, SSA and depression. Hence, we proposed the following hypothesis.

> Hypothesis 3: PsyCap has the moderating effect on one or more paths of the mediating model.

In summary, based on the appraisal perspective of buffering effect of social support and the dynamic effect model of PsyCap, the present study constructed the moderated mediation model (**Figure 1**). The aim of our study was to explore the mediating (SSA) and moderating (PsyCap) mechanisms in the relationship between anxiety and depression among EPs in China.

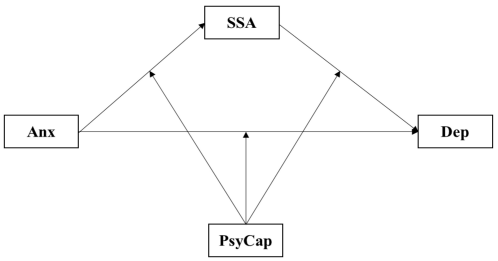

FIGURE 1
The hypothetical moderated mediation model. Dep, depression; Anx, anxiety; SSA, social support availability; PsyCap, psychological capital.

Materials and methods

Participants and procedure

This study was performed from July to August 2017 by a cross-sectional survey in Jiangsu Province in eastern China. The dataset was constructed from 33 tertiary grade-A (top-level) general hospitals in 13 prefecture-level cities of the province. Before the formal investigation, researchers first contacted the relevant staffs of hospitals to introduce the purpose and details in order to achieve approval. The researchers recruited college students to train as investigators. After completing the training, the investigators went to the target hospitals that achieved approval with the paper questionnaire to collect data. With the cooperation of the emergency department director, the EPs were called together for on-site questionnaire distribution, filling and retrieval. Before filling out, the investigator told the purpose and guidance of the study. EPs who filled out and submitted questionnaire were considered as contenting to participate in this study.

The inclusion criteria for respondents included: (1) those who volunteered to participate in our survey and followed the principle of informed consent, and (2) who understood the interview questions. The exclusion criteria were: (1) those who refused to sign the informed consent, and (2) the uncompleted answers.

Measures

An anonymous self-reported questionnaire in Chinese was distributed to all the selected EPs. The questionnaire contained two parts: the first part had the social demographic and other relevant features of the EPs that act as control variables in the model, including gender, age, working-years, education background and professional post; in the second part, we used the following maturity scales as the measuring tool: anxiety and depression subscales of Symptom Checklist 90 (SCL-90), Psychological Capital Questionnaire 24 (PCQ-24), and Social Support Rating Scale (SSRS). All scales that in Chinese, were standardized and suited to the Chinese population (see below for details).

Symptom checklist-90

The Symptom Checklist-90-Revised (SCL-90-R) is a 90-item self-report symptom inventory developed by Derogatis

et al. (1976) in the mid-1970s and widely exploited to measure psychological status or screen for mental disorders. The SCL-90 consists of nine subscales with a total of 90 items: somatization, obsessive-compulsive, interpersonal sensitivity, hostility, phobic anxiety, paranoid ideation, psychoticism, anxiety, and depression. Each item is scored by Likert 5-point scale ranging from 1 (no symptoms), 2 (mild), 3 (moderate), 4 (serious), to 5 (severe), with a higher score representing a more evident degree of psychological distress symptoms. The SCL-90 has been proved to have acceptable psychometric properties for the screening of anxiety and depression among Chinese doctors (Dai et al., 2015). In addition, the standard (the mean of the sample plus a standard deviation) recommended by Dang et al. (2020) was acted as the positive threshold of anxiety and depression. In our study, the Cronbach's α for depression and anxiety subscale was 0.89 and 0.88, respectively.

Psychological capital questionnaire

PsyCap was measured via the Psychological Capital Questionnaire (PCQ-24), which was developed by Luthans et al. (2007a) and the Chinese version has shown good reliability among Chinese physicians (Tian et al., 2020). The PCQ-24 consists of four dimensions (i.e., self-efficacy, hope, optimism, and resilience), with each dimension including six items. Each of the items is scored on a Likert 6-point scale, with 1 indicating potent disagreement and 6 indicating strong agreement. A higher score generally indicates a higher level of PsyCap and better mental health. In our study, the Cronbach's α was 0.93 for the total scale, with 0.74, 0.88, 0.88, and 0.83 for the subscales of self-efficacy, hope, resilience, and optimism, respectively.

Social support rating scale

Social support rate scale (SSRS), compiled by Xiao, was adopted to measure individuals' social support, including three dimensions: objective social support, subjective social support, and the availability of social support (Xiao, 1994). The SSA subscale contained three items, such as "How often you participate in activities organized by groups (party member organizations, trade unions, student unions, etc.)." Each item scoring 1–4 points, with a higher score representing better SSA. It has been demonstrated to be a reliable and valid measure for assessing SSA among Chinese physicians (Song et al., 2021). In our study, the Cronbach's α was 0.64 for the subscale of SSA.

Ethics approval

The study was reviewed and approved by the ethics committee at Xuzhou Medical University. All research methods were performed in accordance with relevant guidelines of Declaration of Helsinki. Completion of the surveys was deemed as an indication of participant consent.

Statistical analysis

Descriptive analysis was used to describe and compare the socio-demographic data (e.g., gender, age, and working-years). For continuous variables, mean and standard deviation (SD) were used; and for discrete variables, rate (or proportion) was used. Pearson's correlation analyses of the four variables (PsyCap, SSA, anxiety and depressive symptoms) were performed using SPSS version 21.0. AMOS 24.0 was employed to test the validity of scales. G*power 3.1.9.2 was used to calculate the sample size. To test the significance of the moderated mediation model in this study, we adopted model 4 and 59 of PROCESS v3.4 macro for SPSS provided by Hayes and Rockwood (2019). This approach is based on ordinary least-squares regression and the bootstrap method. A simple slope test was used to initially probe the moderating effect. The bootstrapped conditional effect was used to show the interactions and the Johnson–Neyman (J–N) technique was applied for probing interactions more specifically (Hayes, 2018). The J–N technique can identify regions in the range of the moderator variable where the effect of the antecedent variable on the outcome variable is statistically significant or not significant. The number of bootstrap confidence intervals was 5,000.

Results

Sample size

We adopted the G*power 3.1.9.2 to calculate the sample size. A total of 536 of 593 EPs submitted valid questionnaires, with the response rate of 90.4%. *Post hoc* analysis in G*power was employed to compute the achieved power (1-β) of the simple size of our study. Because the process macro was based on the multiple regression model, fixed model of linear multiple regression was set as the statistical test. The calculated parameters were as follows: effect size f^2 was inputted as 0.15, α was 0.05, the total sample was 536, and the number of final predictors was 10. The result showed that a statistical power of 100% was achieved in the regression model, indicated that 536 EPs reached the necessary sample size.

Common method bias

Harman's single-factor test was used to probe common method bias. The result found that nine factors had eigenvalues greater than 1, and the first factor of the amount of variation explained was 29.38%, less than 40% of the critical criterion. Therefore, the common method bias in our study was not strong.

Validity and reliability

To test the construct validity, we assessed for discriminant validity and convergent validity. The discriminant validity was measured by comparing the AVE square root of the scales with the correlation coefficient between the scale variable and other variables. If the AVE square root > the absolute value of correlation coefficient, it showed that the constructs had adequate discriminant validity (Fornell and Larcker, 1981). As shown in **Table 1**, the AVE square root of four scales were between 0.63 and 0.79, which higher than the absolute value of correlation coefficient except for the coefficient between anxiety and depression. Previous researches had demonstrated that anxiety and depression subscales of SCL-90 have greatly discriminant validity (Morgan et al., 1998; Bech et al., 2014). In general, the constructs had adequate discriminant validity in our study.

The convergent validity was evaluated the magnitude of the standardized factor loadings (SFL) and composite reliability (CR). The SFL values of the measurement model of scales were between 0.572 and 0.913 except for only three items (0.446, 0.464, and 0.467), which were above the threshold of 0.5 in general (Hair et al., 2010). Furthermore, the CR values of four constructs ranged from 0.65 to 0.89, which all exceeded the convergent validity threshold of 0.6 (Hair et al., 2010). Hence, the convergent validity of scales was appropriate.

For reliability, we additionally reported the CR values besides the Cronbach's α coefficient. The CR values for the scales ranged from 0.65 to 0.89, which agreed with Fornell–Larcker criteria of 0.6 (Fornell and Larcker, 1981). Therefore, the scales used in our study had acceptable reliability.

Preliminary analyses

A total of 593 emergency physicians were recruited in this study, and 536 valid data were screened out according to the exclusion criteria (the effective response rate = 90.4%), including 330 (61.6%) males and 206 (38.4%) females. 54.9% of emergency physicians were between the ages of 26 and 35. 67.4% of samples have been working for less than 10 years. See **Table 2** for more details.

TABLE 1 Descriptive statistics and bivariate correlations.

	M ± SD	1	2	3	4
(1) Dep	1.56 ± 0.54	0.63			
(2) Anx	1.52 ± 0.54	0.88***	0.67		
(3) SSA	8.01 ± 2.00	−0.22***	−0.17***	0.63	
(4) PsyCap	100.44 ± 16.58	−0.43***	−0.39***	0.20***	0.79

M, mean; SD, standard deviation; Dep, depression; Anx, anxiety; SSA, social support availability; PsyCap, psychological capital. The diagonal is the AVE square root of the corresponding scale. Two-tailed test, ***$p < 0.001$.

According to the standard recommended by Dang, we used 2.1 (1.52/1.56 + 0.54) as the positive threshold for anxiety and depression subscales in the present study. We found that 16.6% (89/536) of EPs had reach the threshold of anxiety, and 16% (86/536) of EPs could been considered had depression. In addition, the proportion of the comorbidity of anxiety and depression among EPs is 12.13% (65/536) in the present study.

Correlation analysis

Pearson's correlation analysis revealed that significant correlations existed between these variables. Specifically, depression was negatively related to SSA and PsyCap ($r = –0.22$ and –0.43, $p < 0.001$, respectively). Anxiety was also negatively associated with SSA and PsyCap ($r = –0.17$ and –0.39, $p < 0.001$, respectively). In addition, a positive correlation between PsyCap and SSA was identified ($r = 0.20$, $p < 0.001$). Moreover, the four components of PsyCap are all negatively related to anxiety and depression (**Table 1**).

Mediation analyses

As shown in **Table 3**, anxiety had a negative impact on SSA (β = –0.17, $p < 0.001$). With the statistically significant effect of SSA on depression (β = –0.08, $p < 0.001$), it appears that anxiety had a positive direct effect (β = 0.86, $p < 0.001$), and further had an indirect effect on depression via the partially mediating role of SSA (indirect effect = 0.013, BootSE = 0.005, 95%BootCI [0.005, 0.023]) (**Table 4**). Hence, hypothesis 1 and 2 was supported.

Moderated mediation analyses

In the moderation analysis, the interaction of PsyCap and anxiety was insignificant (β = –0.01, $p = –0.115$), which displayed that PsyCap had no moderating effect in the relationship between anxiety and depression. Meanwhile, the interact term of anxiety and SSA was also insignificant (β = –0.02, $p = 0.569$), whereas the interaction of SSA and PsyCap was statistically significant (β = 0.06, $p = 0.004$) (**Table 3**). This indicated that PsyCap played a moderating role in the link between SSA and depression.

In term of probing the moderation, when PsyCap was divided into high and low groups by M ± 1 SD, the simple slope test indicated that compared with EPs in high groups, the effect of SSA on depression was more pronounced among the low group (**Figure 2**). The analysis of conditional indirect effect also confirmed that the indirect effect was not significant when PsyCap was in the high group (**Table 5**). Furthermore, the J–N technique indicated that the standardized score of 0.386 on

TABLE 2 Descriptive statistics of emergency physicians.

Category	*N* (%)
Total	536 (100%)
Gender	
Male	330 (61.6%)
Female	206 (38.4%)
Age	
≤25	46 (8.6%)
26–35	294 (54.9%)
36–45	142 (26.5%)
≥46	54 (10.0%)
Work-yrs	
≤10	361 (67.4%)
11–20	114 (21.3%)
21–30	52 (9.7%)
≥31	9 (1.6%)
Edu-bac	
≤Associate degree	10 (1.9%)
Bachelor's degree	219 (40.9%)
≥Master's degree	307 (57.2%)
Pro-pos	
Resident or intern	254 (47.4%)
Attending physician	163 (30.4%)
Deputy chief physician	75 (14.0%)
Chief physician	44 (8.2%)

SD, standard deviation; Work-yrs, working-years; Edu-bac, educational background; Pro-pos, professional post.

the PsyCap can be regarded as a point of transition between the statistically significant effect and the non-significant effect of SSA on depression (**Figure 3**). In addition, we also explored the moderating role of four components of PsyCap in the model. Results showed that self-efficacy (β = 0.07, p = 0.004), hope (β = 0.06, p = 0.010), and resiliency (β = 0.05, p = 0.015) had significant moderating effect in the link from SSA to depression except for optimism (β = 0.03, p = 0.143, **Table 6**). In all, hypothesis 3 was partially supported.

Discussion

This cross-sectional survey was conducted to find the psychological symptoms (anxiety and depressive symptoms), SSA and PsyCap level of EPs in China. And to date, this investigation was the first study to explore the moderation mediation mechanism of SSA and PsyCap in the link from anxiety to depression (SSA as the mediating variable and PsyCap as the moderating variable). Interestingly, in our study the positive rates for anxiety and depression were almost the same (16%) and the proportion that met the positive criteria for both symptoms was 12.13%. The regression model also showed anxiety had a strong positive association with depression. This result reaffirmed the high comorbidity of anxiety and depression at the cross-sectional level, which was consent with the conclusion of large cohort study (Lamers et al., 2011).

Central to our research findings is the examination in which SSA and PsyCap are postulated as intervening variables in the relationship between anxiety and depression in a model. Our findings demonstrated that the mediation effect of SSA in the pathway from anxiety to depression and the moderating role of PsyCap in the link between SSA and depression were both significant. The findings also provided new insights into the detail of how PsyCap can play a significant moderating role. Specifically, it was found that the moderating effect PsyCap on the link between SSA and depression was significant only when PsyCap was at the low level.

In our study, SSA played a mediating role in the link from anxiety to depression, which verified the subjective cognitive appraisal of social support (Cohen and McKay, 2020). When an individual's evaluation of an event tends to be negative, the negative belief about self will occur, which is central to the development of depression (Otani et al., 2018). High level of SSA can make individuals have less negative appraisal of stressful events (Lakey and Cohen, 2000). The specificity of the occupation requests the EPs to be fully prepared for unpredictable emergency incidents, which brings them frequently negative emotions or behaviors by the patients from different types of families, especially those who are drunk, irritable, aggressive or even violent (Liu et al., 2015). These factors have been proven to be risk factors for depression among EPs in China (Chen et al., 2022). When EPs are confronted with these stressful anxiety events, the appraisal system is activated. If they are proactive and have resources available for support that are sufficient to deal with these things, that is, high levels of SSA, then the level of depression will be reduced and. Relatively, if EPs don't seek support from friends and family in a timely and active manner, that is, the level of SSA is low, they wrongly believe subjectively that no one helps them, amplifying the negative appraisals of stressful events and deteriorating the anxiety symptoms into depression (Hart and Hittner, 1991; Starr et al., 2014).

Through the moderation analysis, we found that the significant dynamic effect of PsyCap in the relationship between SSA and depression. Compared to EPs with high PsyCap, the alleviating effect of SSA on depression was more significant. Specifically, when the amount of PsyCap was below a certain value (varied according to the sample specific value), the effect of SSA on alleviating depression became more pronounced with the adding PsyCap score. But when the PsyCap score reached a critical value, the moderating effect was non-significant. The possible interpretation for this may be twofold. First, people with low level of PsyCap are not very good at perceiving and utilizing social support. They cannot make good use of the resources of social support around when suffering from stress. Second, high PsyCap is associated with low depression (Bakker et al., 2017), and the promoting interaction between PsyCap and social support (Liu et al., 2013) makes individuals

TABLE 3 Model characteristics for moderated mediation analysis.

	Model 1 (Y = SSA)	Model 2 (Y = Depression)	Model 3 (Y = SSA)	Model 4 (Y = Depression)
Gender	0.20*	0.07	0.18*	0.07
Age	−0.20*	−0.02	−0.25*	−0.01
Work-yrs	0.03	0.02	0.06	0.01
Edu-bac	0.29***	−0.01	0.32***	−0.03
Pro-pos	0.08	−0.01	0.59	0.01
Anxiety (X)	−0.17***	0.86***	−0.11*	0.82***
SSA (M)		−0.08***		−0.07**
PsyCap (Z)			0.18***	−0.10***
X × Z			−0.02	−0.01
M × Z				0.06**
R^2	0.07	0.77	0.10	0.78
F	6.50***	256.09***	7.05***	190.12***

SSA, social support availability; PsyCap, psychological capital; Work-yrs, working-years; Edu-bac, educational background; Pro-pos, professional post; X, independent variable; M, mediating variable; Z, moderating variable; Y, outcome variable. X, M, Z, and Y were all standardized. Two-tailed test, *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

with high psychological capital have no great improvement in the utilization of social support. Therefore, for EPs with high PsyCap, if depression symptoms occur, they need to find other psychological resources for relief.

Based on the moderation analysis of overall PsyCap, we further conducted the same model to explore the moderating effect of four components of PsyCap. The results indicated that self-efficacy, hope and resiliency exerted the identical dynamic effect as PsyCap, that was these traits could enhance SSA in alleviating depressive symptoms. This corroborated previous research and further explored the interaction between SSA and these psychological traits. Holahan and Holahan (1987) found self-efficacy could function indirectly through its effect on social support in preventing depression by a longitudinal study. A recent study also showed that self-efficacy and social support could alleviate depression and improve psychological well-being among Chinese nurses (Xie et al., 2020). The growth of low level of self-efficacy can make individuals better use of the social support around them and believe in their ability to regard demands as challenges rather than treats (Weber et al., 2013). Similarly, a study (Tao et al., 2022) found that hope protected individuals from depression by enhancing social support (including the SSA dimension). Another study (Zhao et al., 2018) showed that resiliency moderated the relationship between social support and depressive symptoms. These traits can help EPs discover the positive connotation behind stressful events and fully tap their supports to cope with these difficulties (Feng and Yin, 2021). Unexpectedly, optimism did not have the moderating effect in our study. We inferred that this may be due to the cultural differences in optimism. The effect of optimism on individuals' behavior differed by nationality and

TABLE 4 Bootstrapped direct and indirect effects of mediation analysis.

X	Effect	BootSE	95%BootCI	
			LL	UL
Direct	0.861	0.021	0.819	0.902
Indirect	0.013	0.005	0.005	0.023

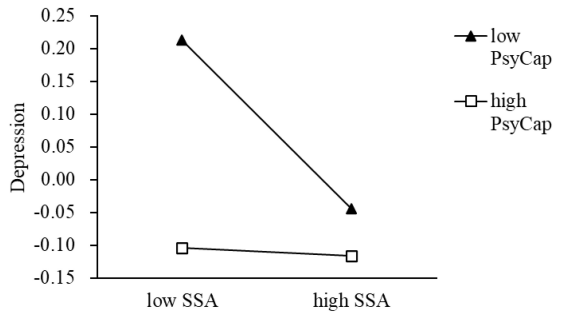

FIGURE 2
The simple slope test of the moderating effect of PsyCap on the relationship between SSA and depression. SSA, social support availability; PsyCap, psychological capital.

TABLE 5 Bootstrapped conditional direct and indirect effects.

Anxiety	PsyCap	Effect	BootSE	95%BootCI	
				LL	UL
Direct	Low	0.821	0.024	0.774	0.869
	High	0.817	0.037	0.744	0.890
Indirect	Low	0.012	0.006	0.001	0.025
	High	0.001	0.003	−0.007	0.008

The outcome variable: depression. The values of moderator: low = −1, high = 1.

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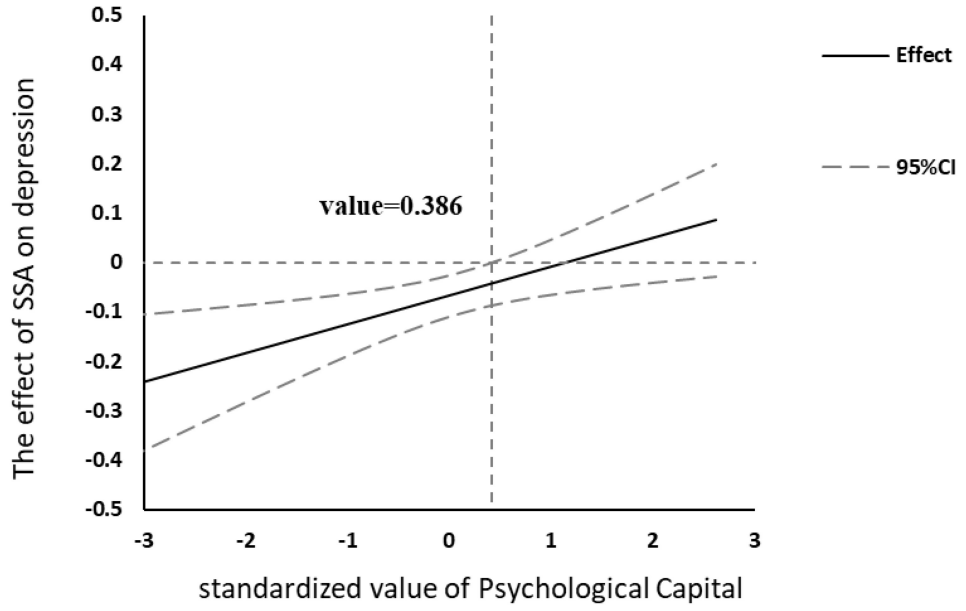

FIGURE 3
Effect of social support availability (SSA) on depression at different levels of psychological capital (PsyCap). The moderating effect of PsyCap was existed when the value of PsyCap ≤ 0.386.

TABLE 6 Model coefficients for moderated mediation analysis of components of PsyCap.

Predictors	Moderator = Self-efficacy		Moderator = Hope		Moderator = Resiliency	
	Model 1 (Y = SSA)	Model 2 (Y = Depression)	Model 3 (Y = SSA)	Model 4 (Y = Depression)	Model 5 (Y = SSA)	Model 6 (Y = Depression)
Gender	0.17	0.07	0.18	0.07	0.18	0.07
Age	−0.12	−0.04	−0.13	−0.03	−0.13	−0.04
Work-yrs	0.05	−0.01	0.05	0.01	0.05	−0.01
Edu-bac	0.24***	−0.01	0.23**	0.01	0.23**	0.02
Pro-pos	0.01	0.01	0.01	0.01	0.01	0.01
Anxiety (X)	−0.15**	0.87***	−0.14**	0.83***	−0.16**	0.82***
SSA (M)		−0.08***		−0.08***		−0.08***
Moderator (Z)	0.10*	−0.01	0.11*	−0.07**	0.08	−0.07**
X × Z	−0.01	0.07**	−0.02	−0.01	−0.03	−0.01
M × Z		0.07**		0.06*		0.05*
R^2	0.07	0.78	0.07	0.78	0.07	0.78
F	4.50***	168.70***	4.62***	169.40***	4.29***	169.16***

SSA, social support availability; Work-yrs, working-years; Edu-bac, educational background; Pro-pos, professional post; X, independent variable; M, mediating variable; Z, moderating variable; Y, outcome variable. X, M, Z, and Y were all standardized. Insignificant results were not shown. Two-tailed test, *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

culture (Wang et al., 2021a). In general, due to the influence of Confucian culture, Chinese had lower level of optimism than western group (Moyer et al., 2009). Coupled with overwhelming workload, optimism may have little effect on SSA of EPs.

Our study is not free from limitations. First, due to the cross-sectional observational nature of our study, the time causality between these factors cannot be robustly determined and established. We can only try to explore the underlying mechanisms. Second, we did not examine the precedence of anxiety and depression and the bidirectional causal relationship between anxiety and depression may be more complicated. Confounding factors are not the only ones included in our study, such as genetic, socio-environmental stressors, etc. Third, the subscale that was used to assess SSA was not custom-designed. It is necessary to develop a specialized measurement scale in the further researches. Fourth, our sample only focus

on the EPs of the top-level hospital in Jiangsu province. There is a need for further studies to authenticate whether our conclusion can be generalized to other medical practitioners in other grade hospitals or other Chinese provinces with different profiles.

Theoretical and practical implications

The value of the present study was to verify the subjective cognitive appraisal theory of SSA and the dynamic effect of PsyCap in relieving symptoms of anxiety and depression among EPs in China. First, our study demonstrated the high co-existence of anxiety and depression at the data level. In clinical diagnosis, the two are generally not diagnosed separately (Ter Meulen et al., 2021). Therefore, mental health needs close attention among EPs, especially for anxiety and depressive symptoms. Second, the present study found that SSA mediated the conduction pathway from anxiety to depression, which verified the appraisal mechanism of social support for individual mental health protection. Specifically, SSA could reduce the effect of anxiety in depression among EPs. This reminds EPs that when they experience psychological symptoms, such as anxiety, they need to actively seek support around them in time and improve SSA to buffer the negative impact of psychological stress. Third, our study displayed that PsyCap played a moderating role in the link between SSA and depression. More importantly, we found that the moderating effect of PsyCap only works in the low level. Therefore, psychological capital intervention can be applied to enhance SSA to further alleviate anxiety and depressive symptoms. Hospitals should organize activities to improve PsyCap of EPs with low PsyCap, which focus on self-efficacy, hope and resiliency. EPs with high PsyCap need to keep the *status quo*, make their anxiety and depression at a low level, and ensure their mental health. According to the 'Healthy China 2030' program, EPs should be more likely to have priority over others to be screened for depression to prevent mental health problems. With their mental health improved, they can provide better medical care services.

Conclusion

Our study explored the mediating role of SSA and the moderation effect of PsyCap in the relationship between anxiety and depression. The results found that anxiety had a strong association with depression and SSA mediated the pathway between the two. Furthermore, PsyCap moderated the second half of the mediated pathway (the link from SSA to depression). More specifically, the alleviating effect of PsyCap was more pronounced at low level of PsyCap.

Data availability statement

The original contributions presented in this study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

XL and HX developed the rationale for the study. HX and LP analyzed and interpreted data as well as wrote up the initial draft of the manuscript. HX and ZW revised subsequent manuscripts. All authors read and approved the final manuscript.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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The effect of emotion regulation on happiness and resilience of university students: The chain mediating role of learning motivation and target positioning

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Objective: To investigate the effect andmechanism among emotion regulation, relationship,happiness, learning motivation, target positioning, and resilience of university students.

Method: A total of 904 university students in China were included in this cross-sectional survey from April to May this year. The self-administered questionnaires, including the adapted Mental Health Scale with a Healthy Personality Orientation for College Students, were used to construct structural equations to test the chain mediating effects of learning motivation and target positioning based on a multi-stage whole group sample of university students.

Result: Emotion regulation indirectly affected happiness through the mediating effect of interpersonal relationship (Med=−0.387, p=0.001). Learning motivation and target positioning play the chain mediating role in the effect of emotion regulation on happiness (Med=−0.307, p=0.001) and resilience (Med=−0.275, p=0.001).

Conclusion: Emotion regulation indirectly affected happiness and resilience through the chain mediating effect of learning motivation and target positioning.

KEYWORDS

emotion regulation, interpersonal relationship, learning motivation, target positioning, happiness, resilience, structural equation model, chain mediating role

Introduction

Happiness, popularly referred to well-being or subjective well-being (SWB), is the research area of philosophy and religion (Diener et al., 2018). Its definition refers to the overall evaluation of an individual's quality of life according to their internal standards, including life satisfaction and positive and negative emotions (Diener et al., 2018). Resilience, also a popular research area, is defined as an ability to adapt well when individuals

encounter stressful events in life, such as adversity (Biao et al., 2022). Happiness and resilience are closely related to individual physical and mental health. Their contributing factors, internal mechanisms, and interventions are essential to positive psychology.

Much research has been conducted to study what aspects would influence happiness and resilience, and emotion regulation is one of important aspects. In terms of happiness, emotion regulation, as an essential component of social and emotional ability (Zhi et al., 2021), is a basic capability to maintain physical and mental well-being (Martin et al., 2017; Haijuan et al., 2022). Emotion regulation can improve happiness by enhancing positive emotions (Quoidbach et al., 2015) as emotion is significant to happiness from the definition (Li et al., 2007). Many studies have proved that emotion regulation correlated with well-being (OECD, 2015; Strickhouser et al., 2017). Besides, emotional regulation significantly predicts happiness (Zhi et al., 2021). Cognitive emotion regulation has a positive effect on happiness (Kohn et al., 2014). Moreover, cognitive appraisal, one emotion regulation strategy, also affects individual happiness (Li et al., 2007).

Resilience also highly correlates with emotion regulation (Gross, 1998; Juzhe et al., 2013). Previous studies have found that people with high resilience adopt positive emotion regulation and implement good emotional regulation strategies to deal with negative emotions. Emotional regulation also well reflects resilience (Bonanno and Diminich, 2013; Caina et al., 2016). Individuals with a high level of emotion regulation utilize positive emotion regulation strategies, which can be used as a protective factor to stimulate internal resources to stabilize emotional state, develop positive factors, and improve the level of psychological resilience in challenges and adversity (Tugade and Fredrickson, 2007). Regulatory emotion Self-efficacy of Emotional Regulation not only directly affects psychological resilience (Yong and Zhenhong, 2013; Wenjiang et al., 2020), but also plays a mediating role in family harmony and psychological resilience (Qisheng and Dan, 2017). For early gastric cancer patients, strengthening the intervention of emotional regulation ability can improve psychological resilience (Lili, 2019). Additionally, cognitive appraisal, one of the emotion regulation strategies, predicts psychological resilience (Guolai et al., 2017; Sukui and Yue, 2022).

However, what is the internal mechanism of the effect of emotional regulation on happiness and resilience? Are there other factors that might mediate the influence of emotional regulation on happiness and resilience? What roles do interpersonal relationships, learning motivation, and target positioning play in the impact of emotional regulation on happiness and resilience? In this article, we built a structural equation model to explore the relationship of emotion regulation, learning motivation, target positioning, interpersonal relationship, happiness, and resilience on the basis of previous empirical research.

Hypothesis development

Since the 1980s, researchers have paid more attention to the influence of targets on happiness (Brunstein, 1993; Kasser and Ryan, 1996). Emmons pointed out that having the meaningful purposes in life and moving toward them is a prerequisite for well-being. Diener proposed in the Telic Theory that, as an important reference standard of affective system, target can affect the level of happiness and predict well-being. It is found that the internal goals orientation is highly related to positive emotions, higher satisfaction, and well-being (Vansteenkiste et al., 2006), which also positively predict happiness (Jiejie et al., 2021). Besides, Individuals with a heightened sense of life purpose tend to have more robust subjective well-being (Hooker et al., 2017).

Although there were relatively few studies on the impact of target positioning on resilience, some studies proved that target positioning significantly predicts resilience (Sagone and Caroli, 2014; Biao et al., 2022). Purpose in life is a good protective factor for resilience, which is conducive to resilience reorganization (Biao et al., 2022). Existential psychology believes that individuals who experience the purpose and meaning of life are more likely to take a certain personal attitude toward incidents in the face of suffering, and are less likely to be stroke down (Schulenberg et al., 2008).

Learning motivation and target positioning, which are of great importance to university students, affect the learning outcomes and future planning. As a complex system, learning motivation contains a series of subsystems. Target positioning, belonging to the subsystem of learning motivation as one of the motivation variables, is closely correlated to learning motivation (Ling and Dejun, 2003).

Learning motivation is affected significantly by emotional regulation. As an active and indispensable variable in the structure of learning motivation, emotion is a necessary basis for forming and realizing learning motivation (Jianzhong and Xingyun, 1995). Thus, emotion plays an important role in learning motivation (Shilu and Youzhi, 2005). Therefore, emotion regulation can mobilize students' inner will and improve learning motivation by regulating positive emotions (Barrett et al., 2001). Emotion regulation strategies can also enhance the level of learning motivation (Macher et al., 2013). In Ling's study, during the COVID-19 period, emotions and emotion regulation significantly predicted online learning motivation due to the impact of the pandemic environment (Ling and Kuiliang, 2021). Hence, based on the previous arguments, this article proposed the following hypothesis:

> *Hypothesis 1*: Learning motivation and target positioning played a chain mediating role in the effect of emotion regulation on happiness.
>
> *Hypothesis 2*: Learning motivation and target positioning played a chain mediating role in the effect of emotion regulation on resilience.

Interpersonal relationship plays a critical role in university students' mental health (Jiyuan and Zhongzeng, 2012). There are many factors that affect interpersonal relationships, one of which is emotion regulation. Some studies proved that emotion, which is important to interpersonal relationship (Garner, 2010), affects how

individuals deal with interpersonal communication. Thus, how to manage emotions affects the state of interpersonal relationships. Campos (Campos and Camras, 2004) proposed that the rational emotion expression and the control of emotional experience played an essential role in forming interpersonal relationships.

In addition, interpersonal relationships affect well-being. Previous research has shown that interpersonal relationships reflect happiness (Ling et al., 2007; Feng and Man, 2012). In China, interpersonal relationships have been a stronger indicator of happiness (Hong and Siping, 2012). Few studies directly explored the relationship between emotional regulation and interpersonal relationship (Lisong et al., 2012). Interpersonal relationship is often used as the mediating variable in the research on the influencing factors and mechanism of happiness (Tse and Yip, 2009; Ling et al., 2013; Yangjun et al., 2017). Moreover, it is found that interpersonal relationship plays a mediating role in the effect of emotional regulation on happiness among college students (Ling et al., 2013). Hence, based on the abovementioned arguments, we proposed the following hypothesis:

> *Hypothesis 3*: Interpersonal relationship mediating the influence of emotion regulation on happiness.

In sum, most previous studies only considered the direct impact of emotional regulation on happiness and resilience, or other factors that mediate the relationship between emotional regulation, happiness, and resilience. They paid little attention to the relationship between learning motivation, goal positioning, emotion regulation, interpersonal relationship, happiness, and resilience. Therefore, this study makes the following hypotheses: (1) Learning motivation and target positioning play a chain mediating role in the influence of emotional regulation on happiness; (2) Learning motivation and target positioning play a chain mediating role in the influence of emotional regulation on psychological resilience; and (3) Interpersonal relationship plays a mediating role in the influence of emotional regulation on happiness among university students.

Materials and methods

Sampling method and participants

This cross-sectional study used data among university students from April 2022 to May 2022, the aim of which was to investigate the influence of emotion regulation on happiness and resilience. Cluster sampling and simple random sampling were used in the data collection. A total of 904 valid questionnaires were returned with 1,000 questionnaires being distributed, and the effective response rate was 90.4%. SPSS25.0 software was used for descriptive statistics analysis and structural equation models were constructed and tested using AMOS23.0 software. The bias-corrected non-parametric percentile confidence interval Bootstrap method was used to examine the chain mediating effect of learning motivation and target positioning between emotion regulation and happiness, and resilience using 2000 replicate samples (Rui et al., 2013).

Research tools

The self-administered questionnaire

The questionnaire was a self-designed questionnaire containing demographic variables.

The mental health scale with a healthy personality orientation for college students

The Mental Health Scale with a Healthy Personality Orientation for College Students developed by Cheng Ke was selected and adapted for studying better. The adapted scale is mainly used to measure the mental health of college students at the level of healthy personality orientation and consists of 27 questions divided into six dimensions: emotion regulation, interpersonal relationship, happiness, learning motivation, target positioning, and resilience. Interpersonal relationship mainly involves the problems of getting along with the opposite sex, dealing with interpersonal problems, communicating with strangers, and being respected by others. Emotion regulation includes the problems of emotion, external influence, and emotion control. Happiness involves the problem of satisfaction with the present situation, meaning of life, fulfillment in life, and the sense of control in life. Resilience involves the problem of the desire of challenge, recovering from setbacks, and coping with challenging. Learning motivation involves the problem of self-discipline, lack of motivation, procrastination, concentration, and perseverance. Target positioning includes the problem of graduation plans, future plans, and a sense of meaning in life. The higher the score on the dimension of emotion regulation and resilience, the higher the level of mental health. The higher the score on the dimension of interpersonal relationship, happiness, learning motivation, and target positioning, the lower the level of mental health. The scale has internal consistency reliability of 0.887. In this study, the Cronbach's alpha measured by the adapted scale was 0.626.

Statistical analysis

SPSS (Version 25, IBM, 2020) was used to conduct descriptive analysis, Lambda Correlation, Spearman's Correlation, and Pearson's Correlation. Amos Graphics (IBM, 2021) was used to test the hypothetic structural equation model.

Model construction and variable design

Principles of structural equation modeling

Structural equation model is a statistical method which uses linear equations to explain multiple statistic relationships between

TABLE 1 The relationship between latent variables and observed variables.

Latent variable	Observed variable	Code
Happiness	Life satisfaction	HAP1
		HAP4
	Sense of meaning in life	HAP2
		HAP5
	Life fulfillment	HAP3
Interpersonal Relationship	Opposite-sex interaction	REL1
		REL2
	Communication skills	REL3
		REL4
	Interpersonal trust	REL5
Learning Motivation	Lack of motivation	MOT1
	Possessiveness	MOT2
	Procrastination	MOT3
	Attention	MOT4
	Perseverance	MOT5
Emotion Regulation	Emotion stability	EMO1
		EMO3
	Susceptibility	EMO2
	Emotional control efficacy	EMO4
Target positioning	Oriented life after graduation	TAR1
		TAR2
	Long-term plan for future	TAR3
	Value of life	TAR4
Resilience	Attitude toward challenges	RES1
	Frustrated recovery	RES2
	Emotion toward challenges	RES3
	Coping with challenges	RES4

variables simultaneously based on the covariance matrix of variables. It contains two parts: the measurement model and the structural model. The matrix equation is:

$$X = \Lambda x\xi + \delta \quad (1)$$

$$Y = \Lambda y\eta + \varepsilon \quad (2)$$

$$\eta = \beta\eta + \Gamma\xi + \zeta \quad (3)$$

(1) The formula is the measurement equation and (2) the formula is the structural equation. X is a vector composed of exogenous indicators, Y is a vector composed of endogenous indicators, ξ is a vector of exogenous latent variables, η is a vector of endogenous latent variables, Λx is a coefficient matrix that reflects the strength of the relationship between exogenous observation variables and exogenous latent variables; Λy is a coefficient matrix reflecting the strength of the relationship between endogenous observed variables and endogenous latent variables, δ represents the measurement error of exogenous variables, ε represents the measurement error of the endogenous variable, β represents the coefficient matrix of the endogenous latent variable, Γ represents the coefficient matrix of the exogenous latent variable, and ζ represents the error of the structural equation.

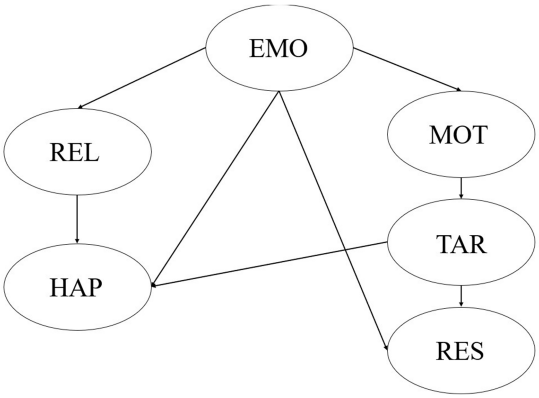

FIGURE 1
Structural relational model.

Structural equation model and index design

This paper intends to construct a structural equation index system composed of five basic dimensional latent variables and 27 observation variables. The relationship between latent variables and observed variables has been shown in Table 1. The basic dimensions of emotion regulation include four observed variables: EMO1, EMO2, EMO3, and EMO4. The basic dimensions of interpersonal relationship include five observed variables: REL1, REL2, REL3, REL4, and REL5. The basic dimensions of happiness consist of five observed variables: HAP1, HAP2, HAP3, HAP4, and HAP5. The basic dimensions of learning motivation consist of five observed variables: MOT1, MOT2, MOT3, MOT4, and MOT5. The basic dimensions of target positioning are composed of four observed variables: TAR1, TAR2, TAR3, and TAR4. The basic dimensions of resilience are composed of four observed variables: RES1, RES2, RES3, and RES4. The theory and former studies assume a direct relationship between emotion regulation, interpersonal relationship, happiness, learning motivation, target positioning, and resilience. The structural relationship model is displayed in Figure 1.

Results

Description statistics and correlations

The description statistics and correlation coefficients among the study are shown in Tables 2, 3. Sixty-eight percent were female ($n = 621$) and 31% were male ($n = 283$) in the available data. The

TABLE 2 Description statistics.

Variables	Maximum	Minimum	Median	Quartile	
				Lower quartile	Upper quartile
Gender (1 = male)	2	1	2	1	2
Origin (1 = urban areas)	2	1	2	1	2
Left-behind	2	1	2	1	2
Experience (1 = with left-behind experience)					
Interpersonal relationship	25	5	12	9	14
Emotion regulation	20	4	11	8	13
Happiness	25	5	19	16	21
Resilience	20	4	14	12	16
Learning motivation	25	5	14	11	16
Target positioning	20	4	11	9	13

TABLE 3 Description statistics and correlations.

Variables	Mean	SD	1	2	3	4	5	6	7	8	9
1. Gender (1 = male)	1.69	0.464	1								
2. Origin (1 = urban areas)	1.5	0.5	0.089**	1							
3. Left-behind experience	1.64	0.48	−0.03	−0.344**	1						
(1 = with left-behind experience)											
4. Interpersonal	11.79	4.019	0.012	0.153**	−0.167**	1					
Relationship											
5. Emotion Regulation	10.8	3.431	0.056	0.035	−0.110**	0.529**	1				
6. Happiness	18.52	3.623	0.026	−0.098**	0.098**	−0.556**	−0.422**	1			
7. Resilience	14.26	2.693	−0.087**	−0.149**	0.084*	−0.566**	−0.521**	0.601**	1		
8. Learning Motivation	13.69	4.224	−0.03	0.091**	−0.098**	0.502**	0.535**	−0.519**	−0.503**	1	
9. Target	11.18	3.167	−0.016	0.119**	−0.109**	0.480**	0.410**	−0.556**	−0.570**	0.579**	1
Positioning											

Significance level: *$p < 0.05$; **$p < 0.001$.

origin from urban areas was about 49% ($n = 448$), while the origin from rural areas was 51% ($n = 456$). There are 326 participants with childhood left-behind experience.

Lambda correlations showed that gender positively correlated with origin ($r = 0.089$, $p < 0.001$). Phi correlations showed that left-behind experience negatively correlated with gender and origin.

Spearman's correlations displayed that Gender negatively correlated with resilience ($r = -0.087$, $p < 0.01$). Origin positively correlated with interpersonal relationship ($r = 0.153$, $p < 0.001$), target positioning ($r = 0.119$, $p < 0.001$), and learning motivation ($r = 0.091$, $p < 0.001$), but negatively correlated with happiness ($r = -0.098$, $p < 0.001$) and resilience ($r = -0.149$, $p < 0.001$). Left-behind experience negatively correlated with interpersonal relationship ($r = -0.167$, $p < 0.001$), learning motivation ($r = -0.098$, $p < 0.001$), emotion regulation ($r = -0.110$, $p < 0.001$), and target positioning ($r = -0.109$, $p < 0.001$), but positively correlated with resilience ($r = 0.084$, $p < 0.05$) and happiness ($r = 0.098$, $p < 0.001$).

Pearson's correlations showed that interpersonal relationship positively correlated with emotion regulation ($r = 0.529$, $p < 0.001$), learning motivation ($r = 0.502$, $p < 0.001$), and target positioning ($r = 0.480$, $p < 0.001$), but negatively correlated with happiness ($r = -0.556$, $p < 0.001$) and resilience ($r = -0.566$, $p < 0.001$).

Emotion regulation positively correlated with learning motivation ($r = 0.535$, $p < 0.001$) and target positioning ($r = 0.410$, $p < 0.001$), but negatively correlated with happiness ($r = -0.422$, $p < 0.001$) and resilience ($r = -0.521$, $p < 0.001$).

Happiness positively correlated with resilience ($r = 0.601$, $p < 0.001$), but negatively correlated with learning motivation ($r = -0.519$, $p < 0.001$) and target positioning ($r = -0.556$, $p < 0.001$). Resilience negatively correlated with learning motivation ($r = -0.503$, $p < 0.001$) and target positioning ($r = -0.570$, $p < 0.001$). There was a significant positive correlation between Learning motivation and target positioning ($r = 0.579$, $p < 0.001$).

Reliability and validity test

The scale was examined for reliability and validity by using SPSS 25.0 software. The Cronbach's α value of each dimension fluctuates between 0.656 and 0.835, indicating that

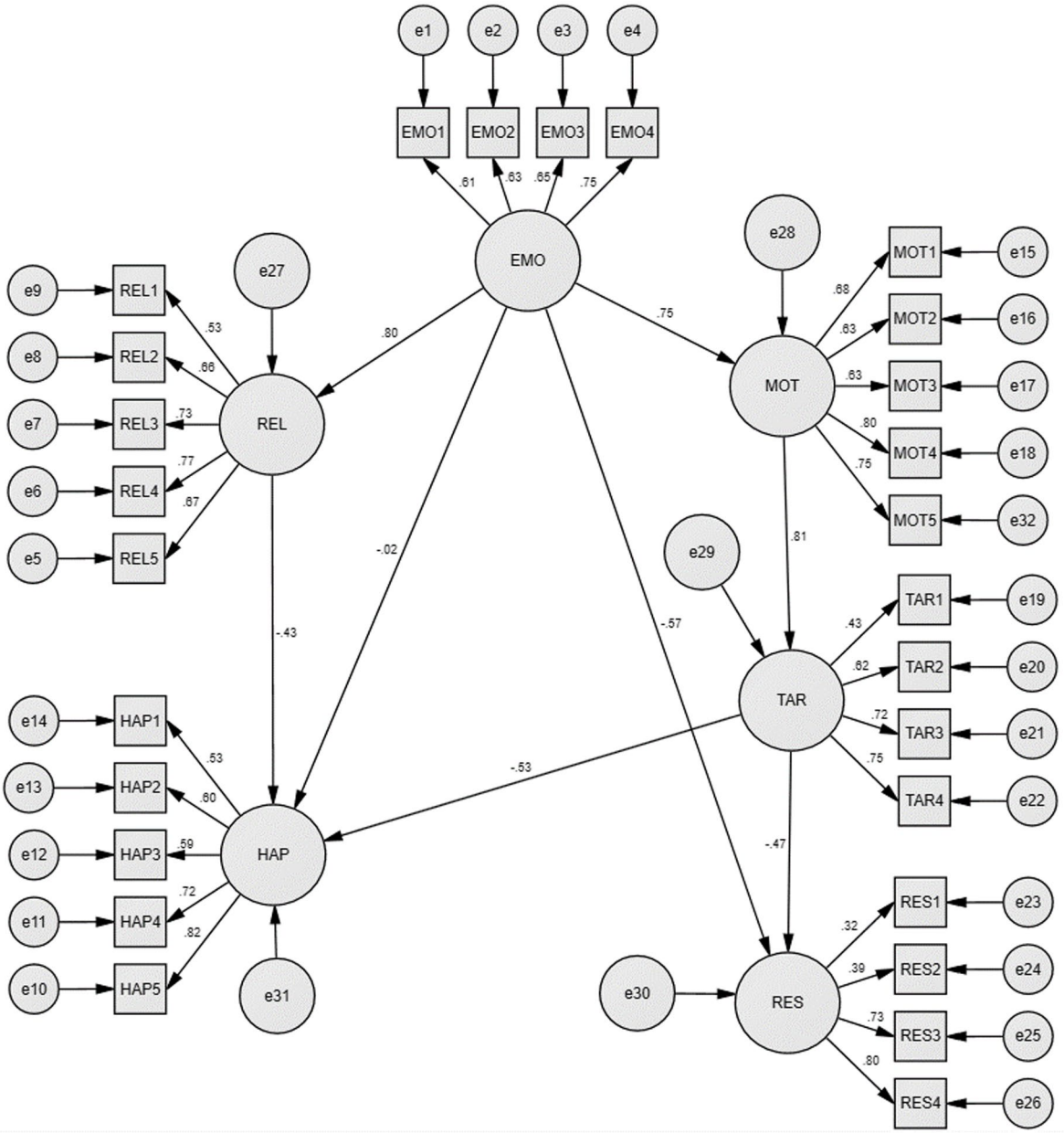

FIGURE 2
The initial structural equation model.

the reliability of the scale performed relatively well. Besides, the KMO value and Barlett's sphere test were relatively good as the KMO value of each dimension fluctuated between 0.636 and 0.847, which were all better than 0.6, and the *t*-test values were significant at the 0.05 level which indicated the structural model of performance's validity was good.

Model fit test and correlation

The structural equation model was built by operating AMOS 22.0 software and was estimated by using the maximum likelihood method to explore the relationship and action path of the happiness and resilience of university students.

After simulating the initial model, the correction index MI value among the five latent variables of emotion regulation, interpersonal relationship, happiness, learning motivation, and target positioning was relatively very large. [e8−e9], [15−e16] equal residual paths were added to modify the model. The fitting index is relatively good. Besides, the value of *p* of each path except the path of emotion regulation to happiness after the correction was statistically significant at the level of 0.05. The initial model and the final model are displayed in Figures 2, 3, respectively. The model fit index is shown in Table 4.

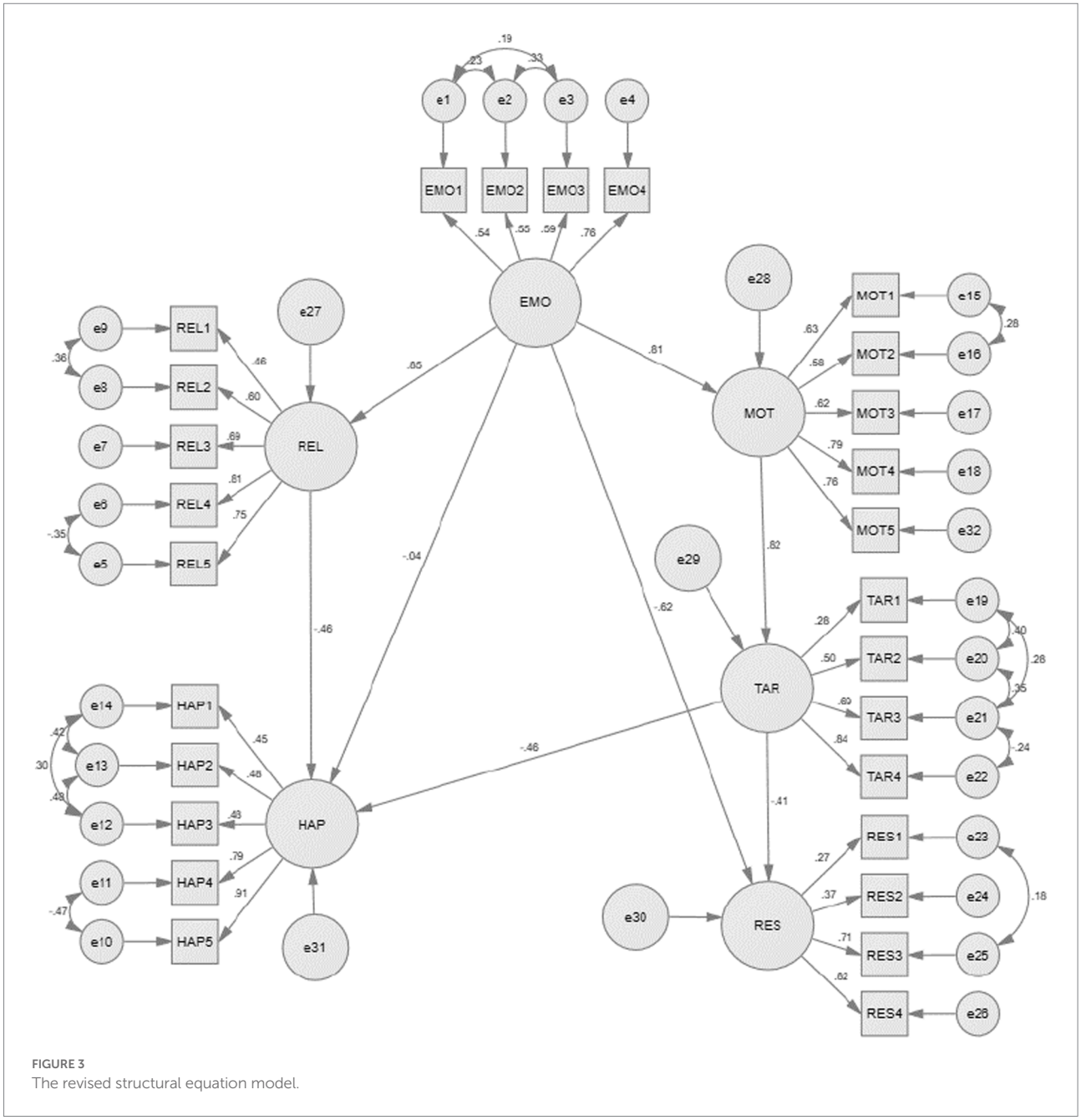

FIGURE 3
The revised structural equation model.

Path analysis of the revised model

Direct effect

Learned from Table 5, emotion regulation has a positive effect on learning motivation and interpersonal relationship, and each standard path estimate was 0.845 ($p < 0.001$) and 0.915 ($p < 0.001$). But emotion regulation negatively affects resilience with the −0.420 standard path estimate ($p < 0.001$). Learning motivation had a positive effect on target positioning, and the standard path estimate was 0.809 ($p < 0.001$). Interpersonal relationship had a negative effect on happiness, and the standard path estimate was −0.343 ($p < 0.001$). Target positioning had a negative effect on resilience and happiness, and the standard path estimate was −0.612 ($p < 0.001$) and − 0.600 ($p < 0.001$). Emotion regulation had a negative effect on happiness, and the standard path estimate was −0.041, which was not significant ($p = 0.640$).

Meditation effect

In this study, the Bootstrap method of deviation-corrected non-parametric percent position confidence interval was used to examine the chain mediating effect and simple mediating effect. The number of repeated random sampling was set to 2,000, and the significance was tested based on whether the 95% CI contained 0.

TABLE 4 Model fit index.

Fitting index		Initial model	Revised model
Absolute fit index	CMIN/DF	7.86	5.173
	GFI	0.8	0.877
	RMSEA	0.087	0.068
	AGFI	0.761	0.845
Value-added fitting	NFI	0.786	0.866
index	CFI	0.807	0.888
	IFI	0.808	0.889
Simplified fitting	AIC	2607.62	1710.94
index	CAIC	2967.64	2158.06

TABLE 5 The effect relationship between the factors in the fitted model.

Variable			Standard path estimate	C.R.	p
Learning Motivation	←	Emotion Regulation	0.811	12.8	***
Interpersonal Relationship	←	Emotion Regulation	0.846	14.174	***
Target Positioning	←	Learning Motivation	0.824	7.305	***
Happiness	←	Interpersonal Relationship	−0.457	−6.547	***
Happiness	←	Emotion Regulation	−0.041	−0.468	0.64
Resilience	←	Target Positioning	−0.411	−4.783	***
Resilience	←	Emotion Regulation	−0.621	−6.404	***
Happiness	←	Target Positioning	−0.459	−6.251	***

Significance level: ***$p < 0.001$.

As shown in the Table 6, emotion regulation had a negative effect on happiness through interpersonal relationship, and the mediating effect was −0.264 ($p = 0.001$). Emotion regulation negatively affected happiness and resilience through learning motivation and target positioning, and the chain mediating effects were − 0.384 ($p = 0.001$) and − 0.391 ($p = 0.001$).

Discussion

This is the first study using a questionnaire to explore the relationship and internal mechanism of emotion regulation, interpersonal relationship, learning motivation, target positioning, happiness, and resilience among 904 students from a university in Sichuan Province. The result showed that learning motivation and target positioning played a chain mediating role in the influence of emotion regulation on happiness and resilience. Besides, interpersonal relationship played an intermediary role in the effect between emotion regulation and happiness. This research helps to further understand the factors that influence happiness and resilience among university students and their internal connections with happiness and resilience. It also gives suggestions to improve happiness and resilience. The specific analysis was as follows.

Learning motivation and target positioning played a chain mediating role in the influence of emotion regulation on happiness and resilience, which is consistent with the hypothesis of this research. Emotion regulation can indirectly predict happiness and resilience by affecting learning motivation and target positioning. Under positive emotions, students are able to understand the learning content from multiple levels and angles, organize and summarize knowledge in an orderly way, and change from mechanistic passive learning to meaningful learning. Whereas negative emotions are the opposite. Individuals with a high level of emotion regulation can adopt adaptive emotion regulation strategies to reduce the influence of negative emotions and generate positive emotions, so as to stimulate higher learning motivation. Motivation can lead to goal-directed behavior. The high level of learning motivation is closely correlated to a high level of learning self-control, a high standard of learning engagement, and high academic achievement, which all contribute to the orientation of university students in their graduation goals and life targets. Individuals who have clear targets are more likely to persist in challenges and difficulties (Schulenberg et al., 2008), and experience more happiness.

Interpersonal relationship played an intermediating role in the influence of emotion regulation on happiness, which is consistent with the hypothesis of this study, and verified the results of the previous study (Ling et al., 2013). Emotion regulation is closely related to interpersonal communication situations. Individuals with high emotion regulation ability can express reasonable emotions and control inappropriate emotional experiences in different interpersonal communication environments, so as to cultivate a good interpersonal atmosphere and form a good interpersonal relationship. A good interpersonal relationship is a key to improving satisfaction and happiness (Okada et al., 2010). Interpersonal resources are an essential source to obtain instrumental assistance and affective support. In the context of Chinese collectivism, interpersonal relationship plays an important role. Good interpersonal relationship predicts the experience of happiness, while bad interpersonal relationship makes university students face greater psychological pressure, thus affecting their happiness.

This study reveals the internal mechanism of emotion regulation on happiness and resilience, and answers how emotion regulation affects happiness and resilience. Additionally, the two chain mediation models displayed in this study have certain implications for improving happiness and resilience: the cultivation of emotion regulation ability is important for the formation of good interpersonal relationships, the promotion of learning motivation, the specific positioning of goals, and the improvement of happiness and resilience. For students, it is necessary to encourage positive learning and open courses on graduation career planning, but more attention should be paid to

TABLE 6 Analysis of the mediating effect between relationship, emotion regulation, happiness, resilience, and learning motivation.

Intermediary path	Meditation effect	95%CI		Significance
		Lower limit	Upper limit	
Emotion Regulation → Interpersonal Relationship → Happiness	−0.387	−0.517	−0.282	0.001
Emotion Regulation → Learning Motivation → Target positioning → Happiness	−0.307	−0.39	−0.233	0.001
Emotion Regulation → Learning Motivation → Target positioning → Resilience	−0.275	−0.346	−0.207	0.001

emotional experience and expression, to improve happiness and psychological resilience. Subsequent research can continue to explore whether (1) different emotion regulation strategies in the same chain-mediated model still significantly predict happiness and resilience, (2) different goal orientations, such as internal and external goals, are still influenced by learning motivation in the same chain-mediated model, and (3) different target positioning plays a mediating role in the relationship between emotional regulation and well-being and resilience. Moreover, longitudinal studies can be designed to test the chain mediating model proposed in this study.

Conclusion

The cross-sectional study that used data collected between April 2022 and May 2022 examined the chain mediating role of learning motivation and target positioning in the influence of emotion regulation on happiness and resilience, and the mediating role of interpersonal relationship in the effect of emotion regulation on happiness and resilience. The results show that learning motivation and target positioning played a complete chain mediating role in the relationship between emotion regulation and happiness, but played a partially mediating role in the relationship between emotion regulation and resilience. Interpersonal relationship played a dominating mediating role in the influence of emotion regulation on happiness.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by the local legislation and institutional requirements. The patients/participants provided their written informed consent to participate in this study.

Author contributions

WL and XC conceived and designed the study, and drafted the method section. XC drafted the rest of the manuscript and contributed equally to this work. ZH extensively instructed and revised the manuscript. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2022.1029655/full#supplementary-material

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The correlation between posttraumatic growth and social support in people with breast cancer: A meta-analysis

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Posttraumatic growth (PTG) is consistently reported to be associated with social support among people with breast cancer. But so far there is no consensus on the size and direction to which social support are related to PTG in people with breast cancer. Thus, a meta-analysis was performed by us to quantitatively synthesize the previous results. This meta-analysis followed the PRISMA 2020 guidelines. We searched PubMed, PsycINFO, Web of Science, Embase, Chongqing VIP Information Co., Ltd. (VIP), China National Knowledge Infrastructure (CNKI), and WANFANG DATA databases prior to 1 June 2022. A random effects model of Stata software (version 17.0) was employed to compute the pooled association coefficient and examine a series of moderating factors: economic level, publication type, region, year of publication, participants' age, and social support measurement tools. Ultimately, 31 studies including 6,380 breast cancer patients were identified. This meta-analysis offers evidence of a highly positive correlation between PTG and social support among people with breast cancer (r=0.425). Economic level, region, and social support measurement tools moderated the link between PTG and social support among people with breast cancer. Whether variables such as disease stage, time since diagnosis, and disease treatment moderate the link between PTG and social support among people with breast cancer can be further investigated in the future.

KEYWORDS

breast cancer, posttraumatic growth, social support, meta-analysis, review

Introduction

Breast cancer is one of the most common cancers affecting women worldwide (Xu et al., 2022). Based on global cancer statistics, breast cancer exceeded lung cancer to become the most common cancer in 2020, with approximately 2.26 million new cases and 680,000 deaths (Sung et al., 2021). Although the global five-year survival rate of people with breast cancer after diagnosis is >70% (Maajani et al., 2019), the diagnosis and treatment of breast cancer still have a strong negative impact on people's mental health and trigger various negative psychological responses, such as depression (Denieffe et al., 2014), anxiety

(Schmid-Büchi et al., 2011), fear of recurrence (Soriano et al., 2021), and posttraumatic stress disorder (Koutrouli et al., 2012), etc. However, some studies have found that as their cancer progresses, cancer patients often experience positive psychological changes, which are called to posttraumatic growth (PTG; Liu, 2020; Baník et al., 2022).

The definition of PTG is the positive psychological changes that an individual perceives in his or her fight against a traumatic incident (Tedeschi and Calhoun, 2004). Scholars found that differing from reactions to slight or daily pressure and the process of people growth and development, PTG refers to personal efforts to manage the influence of trauma on his or her life and try to deal with their experiences and ramifications (Linley and Joseph, 2004; Tedeschi and Calhoun, 2004; Chen et al., 2021). It is usually evaluated with the Posttraumatic Growth Inventory (PTGI) complied by Tedeschi and Calhoun (1996). The PTGI involves five dimensions: personal strength, relating to others, appreciation of life, new possibilities, and spiritual change and consists of 21 items scored by the Likert. 6-point scoring method, with high scores suggesting positive growth. Studies have found that numerous people with breast cancer have experienced PTG (İnan and Üstün, 2014; Paredes and Pereira, 2018; Li et al., 2019; Karimzadeh et al., 2021), and the study result of Bourdon et al. (2019) found that the PTG level of people with breast cancer was higher than that of healthy people.

In the past few years, scholars worldwide have actively explored the factors that influence PTG in breast cancer patients and found that social support is one of the psychosocial elements that is beneficial to the experience of PTG (Casellas-Grau et al., 2016; Hasson-Ohayon et al., 2016; Shen et al., 2016; Li, 2017). Although there is no single definition of social support, it usually refers to the support behaviors that individuals obtain from other individuals and social networks (Heller et al., 1986). The diverse choices of social support assessment tools are caused by differences in research perspectives, But there are several commonly used social support measurement tools. From the perspective of individual subjective feelings, Zimet et al. (1988) compiled the Multidimensional Scale of Perceived Social Support (MSPSS), which gauges perception of friends, family, and significant others' support and includes 12 items scored on a Likert 7-point scale. The higher score, the stronger the sense of social support. Jiang (1999) translated and revised the MSPSS into the Chinese version of Perceived Social Support (PSSS). Xiao (1994) regarded social support as a combination of subjective sense and objective means and he developed the Social Support Rating Scale (SSRS), which is composed of 10 items and includes the three dimensions of subjective support, objective support, and social support utilization.

Many scholars have checked up the link between PTG and social support among breast cancer patients; however, the results are mixed. Some researchers have found a highly positive connection between PTG and social support ($r = 0.470$, 0.736, 0.574; Ma, 2014; Hasson-Ohayon et al., 2016; Li, 2018), some research have discovered a moderate connection between PTG and social support ($r = 0.349$, 0.360, 0.370; Tong et al., 2013; Aflakseir et al., 2018; He et al., 2018), while some study results have shown a weak relation between PTG and social support ($r = 0.210$, 0.123; Cohen and Numa, 2011; Liu, 2019). Some researchers have even found no significant connection between PTG and social support (Cordova et al., 2001; Kroemeke et al., 2017; Zhang et al., 2017). Thus, the first purpose of the study was to integrate previous empirical studies on the correlation between PTG and social support to assess the direction and size of the correlation between the two factors and provide evidence for whether social support is related to PTG.

We checked if the link between PTG and social support among people with breast cancer in previous studies might be due to the influence of potential moderators such as economic level, region, year of publication, participants' age, publication type, and social support measurement tools. First, Bozo et al. (2009) and Wang (2014) found a strong link between PTG and social support among breast cancer patients in developing countries ($r = 0.420$, 0.631), while Cohen and Numa (2011) and Romeo et al. (2019) found a weak connection between PTG and social support among breast cancer patients in in developed countries ($r = 0.210$, 0.244). Thus, the connection between PTG and social support may vary depending on the economic level. Second, compared to other countries, China has a unique system and cultural background. Therefore, the connection between PTG and social support may vary according to the region. Third, the incidence and mortality of breast cancer are rising yearly, and breast cancer has become the most common cancer in the world (Sung et al., 2021). Hence, the link between PTG and social support among people with breast cancer may also change over time. Fourth, the research results of Karlsen et al. (2016) and Yeo et al. (2020) both showed that compared with older breast cancer survivors, young survivors are more affected by cancer, have greater emotional distress and worse psychological adjustment. Therefore, the connection between PTG and social support among people with breast cancer may differ. Fifth, Sterne et al. (2000) found that in general, research with significant results is easier to publish, leading some scholars to overstate the true relationship between variables. Hence, this study involved the dissertations which were not formally published in journals. The articles were divided by us into journals and dissertations according to publication type. At the same time, we tested whether publication type would adjust the connection between PTG and social support. Finally, considering the measurement of social support, the characteristics of some measurement tools are different. For example, the SSRS centers on the measurement of objective support and the extent of support use (Xiao, 1994), while the MSPSS and the PSSS emphasize the initiative of individuals in social support (Zimet et al., 1988; Jiang, 1999). The PSSS is the MSPSS after sinicization. Hence, social support measurement instruments may moderate the correlation between PTG and social support among people with breast cancer.

In summary, this study carried on a meta-analysis of the connection between PTG and social support among people with breast cancer, investigated the direction and size to which social

support has a bearing on PTG among people with breast cancer, and checked whether the connection between social support and PTG is adjusted by (a) economic level, (b) region, (c) publication type, (d) year of publication, (e) participants' age, and (f) social support measurement tools.

Materials and methods

We registered the protocol of this meta-analysis in PROSPERO CRD42022311520. The meta-analysis abided by the PRISMA 2020 guidelines (Page et al., 2021), for searching articles, extracting results and describing the systematic processes.

Literature search

The following seven databases were searched by us for research on the link between PTG and social support among people with breast cancer published from inception to 1 June 2022: PsycINFO, PubMed, Web of Science, Embase, Chongqing VIP Information Co., Ltd. (VIP), China National Knowledge Infrastructure (CNKI), and WANFANG DATA. For the Chinese databases, the search terms included "breast cancer" OR "breast tumor" AND "posttraumatic growth" OR "benefit finding" OR "stress-related growth" AND "social support." For the English databases, See PubMed's detailed search strategy for Supplementary material. We also manually checked the reference list of retrieved articles to find potential relevant research.

Study selection criteria

The literature records were independently screened by two reviewers for possibly eligible articles. The inclusion criteria of articles were as followed: (1) patients were diagnosed with breast cancer by histopathology; (2) the PTGI or a revised PTGI scale were used to measure PTG; (3) there was no restriction on the social support scale; (4) the Pearson's association coefficient r or t and β values that could be changed to r values were reported in articles; (5) when the data from dissertations, conference papers and journal articles came from the same dataset, we used the one published in the journal. However, if the journal article did not involve the complete dataset, we used the original dissertation with an analysis of the full dataset.

The exclusion criteria were (1) conference reports; (2) low-quality research; (3) articles not written in Chinese or English; and (4) research with obvious data mistakes.

Quality assessment

Two reviewers independently used the 9-item Joanna Briggs Institution Critical Appraisal Checklist to assess the quality of methods used in all studies (Munn et al., 2015; see Supplementary material for detailed items). The answer options for every item were "Yes," "no," "not applicable," and "unclear." 1 point for "Yes," 0 point for "no," "unclear," and "not applicable." The higher the score, the higher the quality of the article. We solved the questions or disagreements arising from the article quality evaluation process by concentrated discussion or seeking advice from third-party specialists. As the final article quality scores were ≥6 (Table 1), we believed that the quality of the research included is good.

Data extraction

Two researchers independently used a purpose-designed form to extract data, and disagreements arising from the extraction process were addressed by discussion. The collected research is encoded by us with the following traits: study information, country, publication year, participant characteristics, publication type, sample size, correlation coefficients between PTG and social support, and social support measurement tools. If the research did not inform the correlation coefficient r, but informed t and β values, it should be changed to r value according to the following corresponding formula: $r = \sqrt{\frac{t^2}{t^2 + df}}$, $r = \beta \times 0.98 - 0.05$ $(\beta < 0)$ $[-0.5 < \beta < 0.5]$ $r = \beta \times 0.98 + 0.05$ $(\beta \geq 0)$(Card, 2012). Furthermore, if multiple effect sizes of PTG and social support obtained in identical samples, we only selected the overall effect size.

Statistical analysis

We used the inverse variance method to calculate the pooled association coefficients and their corresponding 95% confidence intervals (CIs) between PTG and social support (Moles, 2009). Specifically, we used Fisher transform to convert r value to corresponding Fisher Z value, weighted according to the sample size with 95% CIs: $Z = 0.5*\ln[(1+r)/(1-r)]$. Meanwhile, $V_Z = 1/n-3$ is the variance of Z, and $SE_Z = \sqrt{(1/n-3)}$ is the standard deviation of Z. According to the suggestions by Lipsey and Wilson (2001), low, moderate, and high correlations correspond to effect size r values of 0.10, 0.25, and 0.40, respectively. A random effect model was used by us to conduct data analysis. Compared with the fixed effect model, the random effect model more suits for the current meta-analysis because the size of the common potential effects of all research in this meta-analysis are not assumed (Borenstein et al., 2021; Huang et al., 2022). Moreover, we used Cochran's Q and I^2 statistics to appraise the heterogeneity across studies (Higgins et al., 2003). Heterogeneity between studies had statistical significance when $p < 0.05$ or $I^2 > 75\%$.

Potential moderation effects were suggested by a large level of heterogeneity. Meta-regression analysis was employed by us to check whether the result of the continuous moderating

TABLE 1 Characteristics of the 31 studies involved in this meta-analysis.

Study author (year)	Country	Publication type	Age/rank[a]	*r*	N	Social support measurement	JBI score
			mean ± SD				
Cordova et al. (2001)	United States	Journal	54.7 ± 12.1	0.130	70	DUKE-SSQ	7
Bozo et al. (2009)	Turkey	Journal	46.28 ± 9.23	0.420	104	MSPSS	7
Cohen and Numa (2011)	Israel	Journal	59.26 ± 10.01	0.210	124	MSPSS	7
Tong et al. (2013)	China	Journal	45.19 ± 2.54	0.349	169	PSSS[b]	9
Lu (2014)	China	Journal	50.47 ± 9.51	0.239	159	PSSS[c]	8
Ma (2014)	China	Dissertation	49.87 ± 10.03	0.736	300	PSSS[c]	8
Wang (2014)	China	Journal	N/A	0.631	138	PSSS[c]	7
Dou et al. (2016)	China	Journal	N/A	0.736	280	PSSS[c]	7
Hasson-Ohayon et al. (2016)	Israel	Journal	53.24 ± 9.24	0.470	80	CPASS	7
Shen et al. (2016)	China	Journal	49.87 ± 10.03	0.736	300	PSSS[c]	7
Chen et al. (2017)	China	Journal	42.98 ± 4.29	0.399	224	SSRS	8
Gao and Shi (2017)	China	Journal	50.88 ± 9.2	0.318	102	PSSS[c]	7
Kroemeke et al. (2017)	Poland	Journal	62.27 ± 8.38	0.060	84	SSE-Q	6
Li (2017)	China	Journal	52.24 ± 8.17	0.491	295	PSSS[c]	8
Qiu and Zhou (2017)	China	Journal	43.70 ± 7.94	0.269	83	MSPSS	6
Tomita et al. (2017)	Japan	Journal	59.08 ± 10.06	0.290	157	JMS-SSS	6
Zhang et al. (2017)	China	Journal	52 ± N/A	0.056	210	PSSS[b]	8
Aflakseir et al. (2018)	Iran	Journal	52 ± 12.32	0.370	196	MSPSS	9
He et al. (2018)	China	Journal	48.86 ± 10.06	0.360	160	SSRS	9
Li (2018)	China	Dissertation	N/A	0.574	424	MSPSS	7
Liu (2018)	China	Dissertation	48.78 ± 7.56	0.504	325	PSSS[c]	7
Mao (2018)	China	Dissertation	49.07 ± 7.67	0.515	193	PSSS[c]	8
Yeung and Lu (2018)	United States	Journal	54.7 ± 8.61	0.440	118	MOS-SS	7
Liu (2019)	China	Dissertation	46.88 ± 13.09	0.123	612	FBNRI	8
Romeo et al. (2019)	Italy	Journal	54.3 ± 8.0	0.244	123	MSPSS	7
Yan et al. (2019)	China	Journal	49.91 ± 11.73	0.569	180	SSRS	9
Liu et al. (2020)	China	Dissertation	28–68	0.453	112	SSRS	8
Liu et al. (2021)	China	Journal	48.21 ± 3.16	0.284	174	SSRS	8
Zhang (2021)	China	Dissertation	47 ± 0.95	0.481	236	SSRS	9
Zhou (2021)	China	Journal	N/A	0.668	358	PSSS[c]	8
Du et al. (2022)	China	Journal	20–40	0.294	290	SSRS	8

[a]N/A, Not reported.
[b]PSSS compiled by Blumenthal.
[c]The Chinese version of PSSS revised by Jiang.
DUKE-SSQ, Duke—UNC Functional Social Support Questionnaire; MSPSS, Multidimensional Scale of Perceived Social Support; PSSS, Perceived Social Support Scale; CPASS, Cancer Perceived Agents of Social Support; SSRS, Social Support Rating Scale; SSE-Q, Social Support Effectiveness Questionnaire; JMS-SSS, Jichi Medical School Social Support Scale; MOS-SS, Medical Outcomes Study Social Support Survey; FBNRI, Furman and Buhrmester Net-work of Relationships Inventory.

variable was significant. Subgroup analysis was used by us to examine whether the result of categorical moderating variable was significant. Furthermore, to appraise the effect of single study on the summary association coefficients and to examine the steadiness of the correlation between PTG and social support, we conducted a sensitivity analysis. Funnel plots were applied to detect potential publication bias. In addition, we performed Egger's linear regression test to assess publication bias (Egger, 1997). We used Stata software (version 17.0) to conduct all statistical analyses.

Results

Study characteristics

528 studies without duplicates were identified by our search strategy (see Figure 1 for the flow chart of the research selection process). We conducted a qualification examination on the full text of 59 articles after reading the titles and abstracts. Among them, we excluded 28 studies since they were conference reports ($n = 5$), were in other languages ($n = 8$), duplicate samples ($n = 5$),

or had no interesting result data ($n = 10$). Ultimately, 31 studies were included and the total sample size is 6,380 patients, all from articles published after 2001. Table 1 summarizes the features of the included studies. The survey sample size ranged from 70 to 612 participants. Among the 31 studies, two were from the United States and Israel each, 22 were from China, and five were from Turkey, Poland, Japan, Iran, and Italy each.

Pooled analyses

As demonstrated in Figure 2 and Table 2, the random-effects model indicated a highly positive link of 0.429 (95% CI [0.342, 0.501]) between PTG and social support. The association between PTG and social support was steady, as demonstrated by the Z value of 9.166 and $p < 0.001$. Furthermore, the homogeneity examination for 31 single samples revealed significant heterogeneity in the selected studies ($Q = 447.63$; $p < 0.001$; $I^2 = 93.3\%$) and potential moderating effects.

Publication bias

First, we employed funnel plot to test whether there was publication deviations in the meta-analysis. The findings showed that the effect sizes of the correlation between PTG and social support of breast cancer patients were generally uniform distribution on two sides of the whole effect sizes (Figure 3), which meaned that there were few publication deviations. Egger's linear regression was employed by us to test and verify this further. Egger's linear regression test also demonstrated few significant bias ($p = 0.229$). Hence, the research population in this field could be systematically and wholly represented by the articles included in the study.

Sensitivity analysis

We evaluate the robustness of our results by moving individual studies each time and recalculating the aggregate correlation coefficients. The sensitivity analysis results demonstrated that there had very small changes in the summary correlation coefficients between PTG and social support, indicating that our findings were steady (see Supplementary material).

Moderating effect test

A meta-analysis of variance (Meta-ANOVA) was performed by us to examine the regulatory effect of the following target categorical variables: economic level, region, publication type, and measurement instrument for social support. In addition, a

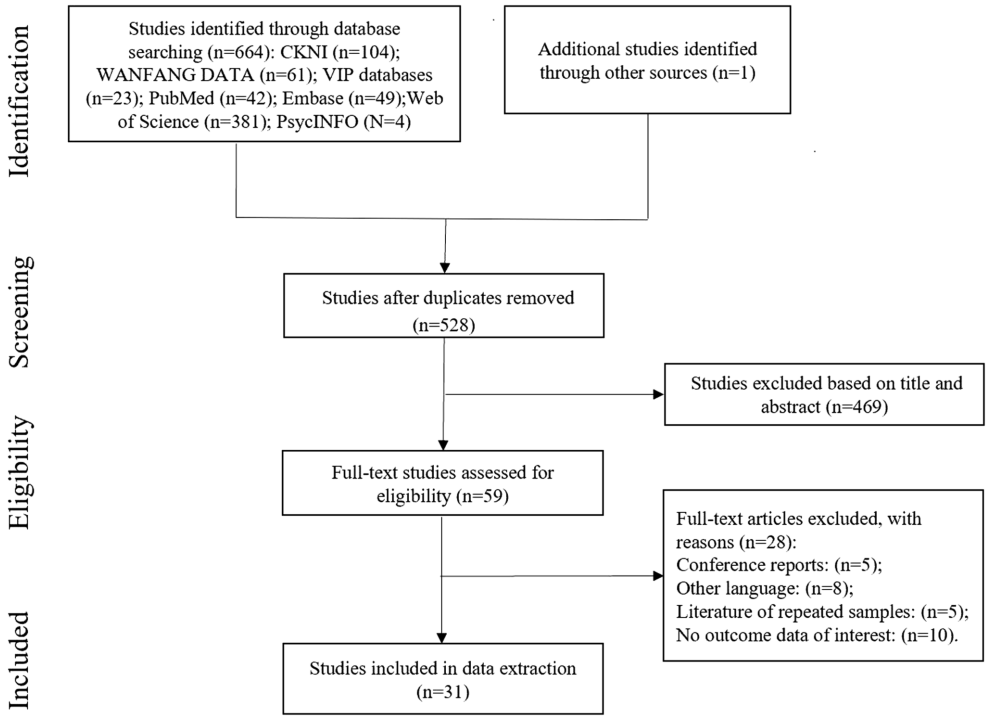

FIGURE 1
Flow chart of the research selection process.

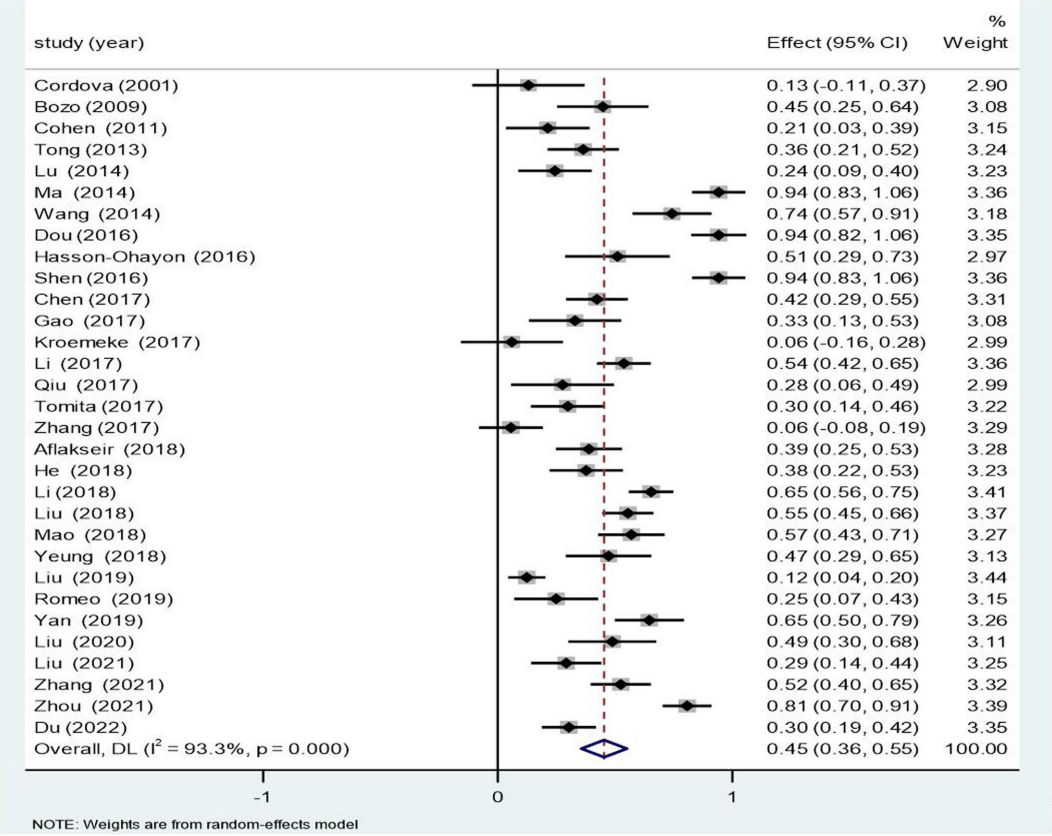

FIGURE 2
Forest plots for the link between posttraumatic growth and social support.

TABLE 2 Random effects model of the relation between PTG and social support.

K	*N*	Mean *r* effect size	95% CI for *r*	Homogeneity test			Test of null (two tailed)	
				Q(*r*)	*p*	I^2	Z-Value	*p*
31	6,380	0.425	[0.342, 0.501]	447.63	0.00	93.3%	9.166	<0.001

meta-regression analysis was conducted by us to verify the adjusting effects of the target continuous variables of year of publication and participants' age.

Meta-ANOVA

This meta-analysis showed that economic level, region, and social support measurement tools significantly regulated the link between PTG and social support in people with breast cancer (Table 3). However, publication type (journal vs. dissertation) did not regulate the correlation between social support and PTG ($Q_B = 1.02$; $df = 1$, $p > 0.05$).

Economic level significantly regulated the link between PTG and social support ($Q_B = 4.75$, $df = 1$, $p < 0.05$). Specifically, the positive relation between PTG and social support was larger in developing countries ($r = 0.450$, 95% CI [0.358, 0.533]) than in developed countries ($r = 0.303$, 95% CI [0.201, 0.398]).

Region significantly regulated the correlation between PTG and social support ($Q_B = 6.44$, $df = 1$, $p < 0.05$). Specifically, the positive link between PTG and social support was larger in China ($r = 0.469$, 95% CI [0.371, 0.556]) than in foreign countries ($r = 0.304$, 95% CI [0.217, 0.385]).

Social support measurement tools significantly regulated the connection between PTG and social support ($Q_B = 8.56$, $df = 2$, $p < 0.05$). The positive link between PTG and social support was largest in the PSSS ($r = 0.583$, 95% CI [0.478, 0.671]), smaller in the SSRS ($r = 0.408$, 95% CI [0.325, 0.485]) and smallest in the MSPSS ($r = 0.363$, 95% CI [0.212, 0.496]).

Meta-regression analysis

We meta-regressed the *r* effect size onto the year and age in each sample to test whether the continuous variables (e.g., year and age) regulated the positive association between PTG and social support. Table 4 displays that the association between PTG and social support is not regulated by year or age.

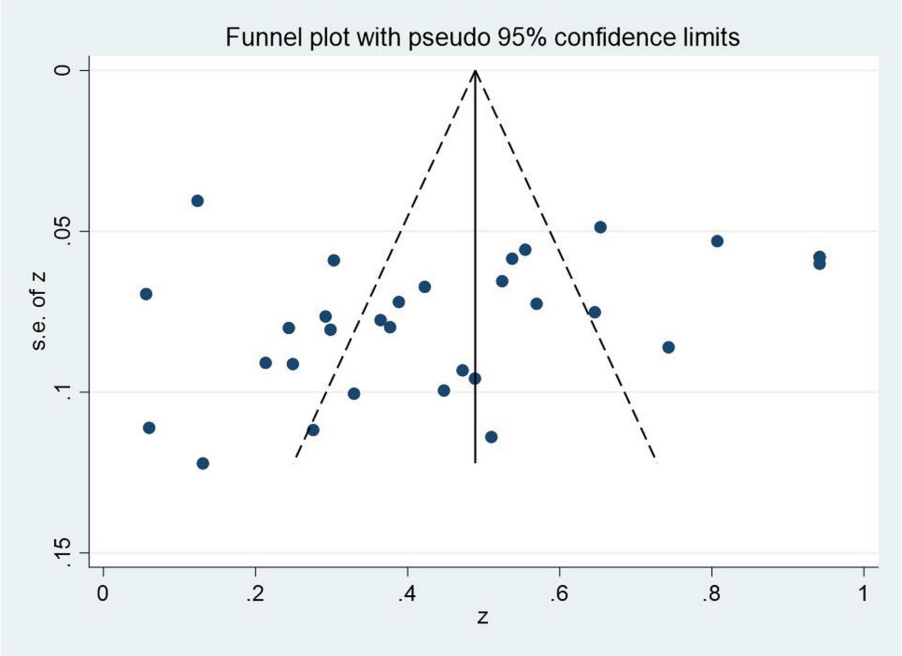

FIGURE 3
Funnel plot of the association of posttraumatic growth and social support.

TABLE 3 PTG and social support: Univariate analysis of variance for moderators.

	Between-group effect (Q_B)	K	N	Mean *r* effect size	95% CI for *r*	Homogeneity test within each group (Q_W)	I^2 (%)
Publication country	4.75*						
Developing countries		25	5,708	0.450	[0.358, 0.533]	414.88***	94.2
Developed countries		6	672	0.303	[0.201, 0.398]	9.86	49.3
Region	6.44*						
China		22	5,324	0.469	[0.371, 0.556]	394.48***	94.7
Foreign countries		9	1,056	0.304	[0.217, 0.385]	17.93*	55.4
Publication type	1.02						
Journal		24	4,718	0.400	[0.304, 0.488]	291.00***	92.1
Dissertation		7	2,202	0.501	[0.319, 0.647]	156.16***	96.2
Social support measurement	8.56*						
MSPSS		6	1,054	0.363	[0.212, 0.496]	32.18***	84.5
PSSS[a]		10	2,450	0.583	[0.478, 0.671]	118.73***	92.4
SSRS		7	1,376	0.408	[0.325, 0.485]	19.04**	68.5

[a]The Chinese version of PSSS revised by Jiang.
*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Discussion

As far as we know, it is the first meta-analysis to explore the pooled association coefficients of PTG with social support in people with breast cancer. Our results revealed that PTG was highly positively correlated with social support in people with breast cancer, which was in accordance with the results of most research on the association between PTG and social support among people with breast cancer (Bozo et al., 2009; Yeung and Lu, 2018; Zhou, 2021). This finding supports the social support buffer hypothesis (Cohen and Mckay, 1984). It shows that good social support can play a buffering role for individuals suffering

TABLE 4 Univariate regression analysis of year and age (random effects model).

Variables	K	B	SE	95%CI	*t*	*p*
Year	31	0.007	0.012	[−0.016, 0.032]	0.65	0.521
Age	25	−0.014	0.010	[−0.043, 2.186]	−1.38	0.182

from major life events such as cancer so that patients can actively adjust their mentality to effectively cope with the disease and produce PTG. It also suggested that social support exerts an important effect in maintaining a good emotional experience for individuals (Dou et al., 2016). In addition, the results indicate that having a good social support system could help breast cancer patients with PTG. First, family support, which is reported to be significantly related to adaptation (Aass et al., 2022), especially the understanding and love of spouses, can eliminate the anxiety and sense of inferiority of breast cancer patients, enhance their sense of being respected and loved, and enable them to face life positively and overcome the disease (Bellur et al., 2018). Second, the support of friends, colleagues and medical staff can make patients feel more love and energy in their lives, thereby promoting their level of PTG (Dursun and Söylemez, 2020). Third, it is important to emphasize the role of community medical institutions and cancer nonprofit organizations, increase social attention to breast cancer patients, and improve patients' objective support and utilization of social support.

According to the results of the Meta-ANOVA, economic level had a adjusting effect on the link between PTG and social support among people with breast cancer, and breast cancer patients in developing countries score higher than those in developed countries in the connection between PTG and social support. People with breast cancer need a variety of treatments, such as surgery, radiotherapy or chemotherapy, which may lead to disordered body image, decreased immunity, decreased self-care ability, and serious psychological issues, such as depression and anxiety (Janz et al., 2005; Tsaras et al., 2018; Davis et al., 2020). Studies have found that the social support of breast cancer patients mainly comes from medical staff, family members, and nurses (Hammersen et al., 2021; Zhang, 2021). However, compared with hospitals in developed countries, hospitals in developing countries currently have insufficient medical staff (Burmeister et al., 2019) and each nurse has a relatively high patient burden, which results in insufficient time to help solve patients' psychological problems and provide the social support they need after completing daily treatment. This may be the reason for the discrepancies in the link between PTG and social support in people with breast cancer in developing countries and developed countries.

Additionally, region had a adjusting effect on the correlation between PTG and social support among people with breast cancer, and breast cancer patients in China score higher than those in foreign countries in the relationship between PTG and social support. This result is consistent with our previous hypothesis. The reason for this difference may also be that most of the articles included in our research were from China, and the number of Chinese articles differs greatly from that of foreign articles. Thus, more empirical studies are needed in the future to test and verify our outcomes.

Unpublished studies should be included in meta-analyses to decrease publication deviations (Sterne et al., 2000). However, although the effect sizes of journals and dissertations were different in the literature we included in this meta-analysis, this discrepancy was not noticeable; that is, the quality of the studies on the link between PTG and social support was relatively stable. Given the results of the publication bias examination, this study is less likely to have publication bias, which is consistent with the results of the moderation effect test for publication type. At the same time, considering that this study included 7 master's and doctoral dissertations which were not officially published in journals, this also reflects the importance of the publication bias test; that is, we need to be cautious when citing the research of others. If only published journal literature is included in a meta-analysis, the representativeness of the research results will be weakened.

According to the results of the meta-regression, the year of publication did not regulate the positive connection between social support and PTG. The reason for this phenomenon may be, first, that most of the research in our study were released in the past 10 years, which is a small time span. Second, the distribution of the number of studies varied little from year to year, which may restrict the findings. Third, although the incidence of breast cancer patients is increasing yearly, with the improvement of the medical service system, people with breast cancer have a rich source of social support (Sørensen et al., 2020), which can help them grow after trauma. We found that participants' age did not moderate the link between social support and PTG, which is different from the results of the study result of Boyle et al. (2017). This may be because breast cancer is not a single event but consists of multiple chronic traumas (Wan et al., 2022). For patients of different ages, the cause of trauma may be the diagnosis of cancer or difficult cancer treatment (Tomita et al., 2017). These different kinds of trauma lead patients to seek help from medical staff, as a result, the connection between these two variables changes little.

The social support measurement tools significantly adjusted the association between PTG and social support among people with breast cancer. We found the positive connection between social support and PTG was largest when using the PSSS, smaller when using the SSRS, and smallest when using the MSPSS. First, the reason for the difference between the MSPSS and the SSRS may be that the theoretical basis and dimensions of the two social support measurement tools are different, as is the number of measurement questions (Zimet et al., 1988; Xiao, 1994). Second, the reason for the difference between the PSSS and the MSPSS may be that the cultural backgrounds of the two scales and the content of the items are different (Jiang, 1999). In addition, to

ensure the accuracy and solidity of the results, subgroups with less than 5 effect sizes were not included in the subgroup analysis (Card, 2012). Therefore, whether the link between PTG and social support is affected by the use of a smaller number of individual testing instruments remains to be confirmed in the future.

Limitations and prospects

Differing from past research on the correlation between PTG and social support among people with breast cancer, we conducted the meta-analysis method to survey the link between PTG and social support among people with breast cancer, clearing the dispute about the extent and degree of the association between them. But this study has some limitations. First, to minimize the potential source of heterogeneity, we only chose the studies of PTG measurement instruments measured by a revised PTGI scale or the PTGI. As a result, the studies involved in our meta-analysis were limited; therefore, attention should be given to the interpretation of the results, which might have been underpowered. In addition, we only performed moderating effect analysis on the variables of economic level, region, publication type, publication year, participants' age, and social support measurement tools. Whether variables such as, time since diagnosis, disease stage, and disease treatment moderate the link between PTG and social support among people with breast cancer can be further investigated in the future.

Conclusion

Although this study has some limitations, all available evidence suggests a highly positive connection between PTG and social support among people with breast cancer. The summary Pearson's correlation coefficient was 0.429. This means that people with breast cancer with high degrees of social support were more likely to have a high level of PTG. Economic level, region, and social support measurement tools adjusted the positive connection between social support and PTG, while publication type, year of publication, and participants' age did not play a role in regulating either. Whether variables such as time since diagnosis, disease stage, and disease treatment moderate the connection between PTG and social support among people with breast cancer can be further investigated in the future.

Author contributions

XM and XW conceived and designed the study, developed the search strategy, did the literature search, contributed to data acquisition and analysis, and contributed to writing of original manuscript. XM and CC were responsible for the software and were responsible for revising and reviewing. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2022.1060150/full#supplementary-material

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Corrigendum: The correlation between posttraumatic growth and social support in people with breast cancer: A meta-analysis

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In the published article, there was an error in the Funding statement. This work was not supported by the Humanities and Social Sciences youth project of Liaoning Provincial Department of Education (WQ2020012). The correct Funding statement appears below.

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Additionally, in the published article, there were some errors in the text.

In section *Pooled analyses*, the wording "the random-effects model indicated a highly positive link of 0.429" should be changed to "the random-effects model indicated a highly positive link of 0.425."

A correction has been made to *Results*, *Pooled analyses*. The corrected paragraph is shown below.

As demonstrated in Figure 2 and Table 2, the random-effects model indicated a highly positive link of 0.425 (95% CI [0.342, 0.501]) between PTG and social support. The association between PTG and social support was steady, as demonstrated by the Z value of 9.166 and $p < 0.001$. Furthermore, the homogeneity examination for 31 single samples revealed significant heterogeneity in the selected studies ($Q = 447.63$; $p < 0.001$; $I^2 = 93.3\%$) and potential moderating effects.

Lastly, in section *Conclusion*, the sentence "The summary Pearson's correlation coefficient was 0.429" should be changed to "The summary Pearson's correlation coefficient was 0.425."

A correction has been made to *Conclusion*. The corrected section is shown below.

Although this study has some limitations, all available evidence suggests a highly positive connection between PTG and social support among people with breast cancer. The summary Pearson's correlation coefficient was 0.425. This means that people with breast cancer with high degrees of social support were more likely to have a high level of PTG. Economic level, region, and social support measurement tools adjusted the positive connection between

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social support and PTG, while publication type, year of publication, and participants' age did not play a role in regulating either. Whether variables such as time since diagnosis, disease stage, and disease treatment moderate the connection between PTG and social support among people with breast cancer can be further investigated in the future.

The authors apologize for these errors and state that they do not change the scientific conclusions of the article in any way. The original article has been updated.

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Effectiveness of online expressive writing in reducing psychological distress among the asymptomatic COVID-19 patients in Fangcang Hospitals: A quasi-experiment study

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Objective: This study aimed to assess the applicability and effectiveness of an online format of expressive writing (EW) in reducing psychological distress among the asymptomatic COVID-19 patients in Fangcang Hospitals with a quasi-experiment.

Method: Altogether 244 patients were assigned to the EW group(n=122) and the control group(n=122). Besides the routine psychological intervention (broadcast relaxation training at a fixed time) in Fangcang hospitals, The EW group was engaged in 8-day theme-based adaption EW intervention, whereas the control group received no interventions. All the participants were tested with the Brief Profile of Mood States (BPOMS) and Inpatient Mental Health Preliminary Screening Scale(IMHPS) before and after the intervention. After the intervention, the writing quality and intervention satisfaction of the EW group were evaluated by a self-designed writing quality questionnaire and EW satisfaction questionnaire.

Results: The results indicated that the EW significantly improved in the BPOMS test, whereas the control group showed no significant change. The IMHPS score in the control group was statistically deteriorated than that before intervention, whereas the EW group showed no significant change. The writing quality was highly correlated with the score change of BPMOS. The overall satisfaction of patients with EW was 81.13%.

Conclusion: EW can reduce psychological distress among the asymptomatic COVID-19 patients in Fangcang Hospitals. The higher the quality of writing, the greater the improvement of mood states. As a new form of psychological intervention in Fangcang hospitals with high patient satisfaction, EW has a value of popularization and application.

KEYWORDS

COVID-19, asymptomatic, Fangcang Hospitals, expressive writing, psychological distress

Introduction

An outbreak of COVID-19 caused by the Omicron variant occurred in Shanghai in 2022. Investigation shows that asymptomatic cases account for 90% of the infected cases. To stop the spread of the virus, Shanghai has opened a number of Fangcang hospitals to receive asymptomatic patients. Fangcang hospitals refer to a novel concept: large, temporary hospitals built by converting public venues, such as stadiums and exhibition centers, into healthcare facilities to isolate patients with mild to moderate symptoms of an infectious disease from their families and communities, while providing medical care, disease monitoring, food, shelter, and social activities (Chen et al., 2020). While Fangcang hospitals have many advantages in controlling the spread of the epidemic, the relatively open space may make patients lack privacy, and the combination of many factors such as isolation from family and friends, the uncertainty of disease outcome may aggravate the patients' stress, anxiety, depression, and other adverse mood states. According to the Shanghai International Convention and Exhibition Center, the average length of hospital stay was 7.18 days. Most patients can be discharged within about 7 days of hospitalization. But, if some patients have not reached the discharge standard for more than 7 days, they are faced with greater physical and mental threats. Especially some asymptomatic patients may develop into confirmed COVID-19 patients with clinical symptoms, which causes may elicit fear and irrational responses. A systematic review and meta-analysis on the psychological impact of COVID-19 revealed increased rates of depression and anxiety across health care workers, patients, and the general public (Luo et al., 2020). One-fifth of asymptomatic or mildly symptomatic patients with COVID-19 had anxiety and/or depression (Jeong et al., 2020). Previous studies have shown that patients in Fangcang hospitals, apart from their familiar living environment, are full of loneliness and have different degrees of psychological problems (Fu et al., 2022). However, due to the isolated nature of Fangcang hospitals and the limitation of psychological professional resources, the application of traditional, face-to-face psychological intervention is facing challenge. There is a need for novel approaches, strategies, and interventions that apply to a large number of people to reduce the short and long-term adverse psychological effects of the pandemic (Markovic et al., 2020).

Expressive writing

In recent years, Expressive writing (EW) has been found to have beneficial effects on physical and mental health (Nicholls, 2009). EW is an intervention in which one is asked to disclose one's deepest thoughts and feelings surrounding a stressful life event, initially introduced by Pennebaker in 1986 (Pennebaker and Chung, 2011; Andersson and Conley, 2013). It is also a "stand-alone" technique for treating depressive, anxious, and posttraumatic stress disorder symptoms (Graf et al., 2008; Reinhold et al., 2018). Besides the assumed beneficial health effects, the parsimony of writing treatments and the considerable potential to close gaps in the provision of treatment through remote (e.g., online) delivery may have contributed to the treatment's continuing popularity over the last three decades. However, the results were inconclusive at the meta-analytic level. The largest and the most inclusive meta-analysis to date (Frattaroli, 2006) found a significant positive overall effect of EW. More specifically, he found a significant average impact for reducing symptoms of depression, as well as for distress and anxiety. On the contrary, several meta-analyses have been conducted that showed no or only minor sized beneficial effects of the original EW assignments in improving mental health (Frisina et al., 2004; Meads and Nouwen, 2005; Mogk et al., 2006; Reinhold et al., 2018; Pavlacic et al., 2019).

Thus, many conditions were examined to determine if there were optimal settings and processes for EW to produce a benefit. Some variables were determined to be important. For instance, a larger number of writing sessions, longer writing periods, and more detailed disclosure appeared to enhance the benefit of EW interventions (Smyth et al., 2008). Furthermore, to better understand processes of change in response to writing, many researchers have attempted to examine the writing content. These studies have shown that moderate amounts of negative emotion words and increases in causal/insight and positive emotion words as the sessions progress are related to improved health outcomes. Although the traditional EW instructions ask participants to focus on negative events, the improved outcome has also been associated with topics that ask for focus on positive aspects of such events (e.g., future positive goals; King and Miner, 2000). Stanton et al. (2002) found that asking patients with breast cancer to explore the potential benefit of their stressful medical experiences through writing led to reductions in both physical symptoms and symptom-related medical visits. Modifying the standard writing instructions to direct written narratives toward "intensely positive experiences" produced health benefits.

Based on these results, future research studies should focus on these and related characteristics to identify and develop the most effective conditions for administering a structured writing intervention. These findings motivated adaptions of the original paradigm to increase writing treatments observed beneficial treatment effects (Smyth and Pennebaker, 2008).

Promises of EW in the context of COVID-19 pandemic

Researchers have explored the EW intervention in the Context of the COVID-19 Pandemic in the general population and healthcare workers. Some studies reported that EW intervention improved resilience and buffered the negative side effects of stress during the COVID-19 pandemic (Bechard et al., 2021; Marschin and Herbert, 2021; Procaccia et al., 2021). While another study (Markovic et al., 2020) shows that when applied in the context of

the COVID-19 pandemic, it did not benefit one's mental health. To date, the effectiveness of EW intervention among asymptomatic COVID-19 patients is less known. Regarding accessibility, the EW protocol is ideally suited for use with patients in quarantine and observing social distancing. EW could provide a valuable tool to promote mental health with minimal contact with a therapist (Gerger et al., 2021). Furthermore, Chinese people are reserved in their emotions express. In Fangcang hospital, EW may be beneficial for individuals with limited availability of emotional outlets in their social environment.

Current study

This study aimed to assess the effectiveness of EW interventions in reducing the psychological distress of the asymptomatic COVID-19 patients in Fangcang Hospitals by conducting a quasi-experiment. Besides, the correlation between writing quality and psychological change quantity was been explored. Finally, satisfaction with EW interventions among participants was been assessed. Based on previous research conclusions, for persons in a state of crisis or with high levels of distress, clinicians might be concerned that EW could exacerbate harm (Lepore and Smyth, 2002). In this study, we modified the standard writing instructions to direct written narratives toward "intensely positive experiences." Our programs combined the original paradigm and positive writing paradigm (Baikie et al., 2012), which not only instructed participants to"really let go and experience the emotion associated with the stressor," but also focus on the perceived benefits of the stressor to "look on the bright side" or to find meaning in the event. In such instances, this alternative approach, which enables a person to adjust by focusing on positive aspects of a stressor, might be most beneficial. We hypothesized that receiving the EW intervention would be effective in the reduction of psychological distress. We may find more evident results in this more focused population to provide valuable references and scientific evidence for the application of EW interventions.

Materials and methods

Study design and participants

In the present study, convenience sampling was used to select asymptomatic patients admitted to Hall 5.2, Branch 6, The Fangcang Hospital, which was reconstructed based on Shanghai International Convention and Exhibition Center. Fangcang hospitals are open spaces, and the ward beds are close to each other. In order to reduce the contamination between the two groups, A non-randomized quasi-experimental study design was used. To be eligible for the study, participants had to be aged between 18 and 60 years (Because online EW has a time limit, patients over 60 years may not use mobile phones expertly leading to some impacts on the result); stayed in the hospital for 7 days and still did not meet the discharge criteria; no mental illness; and junior high school education or above. Patients concomitant with other underlying diseases (e.g., hypertension, diabetes, coronary heart disease, and tumor) were excluded. The patients whose hospitalization stay is the 7th day will be collected from the information system of the Fangcang hospitals from May 1 to May 10, 2022. Eligible participants who decided to participate were then asked to sign an informed consent form. The collected patients who belong to zone E are the EW group, and those who belong to zone D are the control group. This study was approved by the Medical Ethics Committee of the 988th Hospital (Protocol number #2022-GZFC652002).

The formula of $N=\left[\frac{2(\mu_\alpha+\mu_\beta)\sigma}{\delta}\right]^2$ was applied to calculate the sample size. Set the type *I* error of hypothesis testing as 0.05, the type *II* error of hypothesis testing as 0.1, and the sample size ratio of the EW group and the control group as 1. By checking the critical value table, it was found that the μ_α is 1.96, and the μ_β is 1.28. The allowable error δ is 15, which calculated according to the change of mood states of the two groups in the pre-experiment. The change value of the overall standard deviation σ is 16.53. We figured out that the sample size of each group should be at least 51.

Procedure

Patients in EW groups wrote according to an adaption instruction under the guidance of the researchers. They were instructed to write without regard to spelling, style, or grammar and were informed that their written narratives would remain confidential. Writing takes place for 8 days, 15–30 min daily. The researchers gave immediate responses to questions raised by the participants in time. The control group just completed the pre-intervention and post-intervention measures at the same time. We did not use the usual control group assignment of writing about superficial topics, such as how they use their time, because patients in the control group might refuse to comply or drop out of the study. Participants in both groups received routine psychological intervention in Fangcang hospitals (broadcast relaxation training at a fixed time).

In the pre-session, (a) Set up an intervention team: the intervention team was composed of 5 nurses who obtained the qualification of psychological consultant and a graduate student in Applied psychology who systematically studied EW. (b) Group training: The graduate student trained group members on the principles of EW, implementation methods, and scale assessment. (c) Protocol determination: Group members jointly determined the EW plan for asymptomatic patients according to professional and situational perspectives. The specific content was shown in Table 1. (d) Division of labor: Among the intervention team members, nurse 1 was responsible for the EW intervention, nurse

TABLE 1 EW intervention programs.

Stage	Topic	Aim	Instructions
First stage (first and second day)	emotion perception	To help patients feel the thoughts and emotion	(1) What thoughts and emotions do you feel when the test result fails to meet the discharge standard? (2) Please write down how these thoughts and emotions have affected your life (in terms of relationships, work, etc.).
Second stage (the 3th-4th day)	cognitive appraisal	To help patients integrate and reorganize cognition to find positive experiences brought by the disease	(1) Please describe and evaluate your knowledge of the asymptomatic infections with COVID-19; (2) What kind of help have you received from your family, friends, or social organizations since the nucleic acid testing was positive? How do you feel? (3) Did this hospitalization bring you positive experiences (e.g., relationship with family, change in attitude, personal growth, etc.)?
The third stage (the 5th-6th day)	unlock potential	To help patients recall ways to cope with setbacks and regain their confidence.	(1) How long is the longest time to be sick before? How did you deal with this situation? (2) How did you successfully deal with negative emotions or the most significant setbacks in the past?
The fourth stage (the 7th-8th day)	look ahead	To help patients feel the impact of the intervention and make plans for the future.	(1) What have you gained from this intervention? How has your thinking changed? (2) How do you plan to work and live after discharge?

2 was responsible for the evaluation of the writing quality of patients, nurses 3, 4, and 5 were responsible for the scale assessment, and the graduate students were responsible for the statistical analysis of data.

In the implementation session, Patients were asked into the WeChat group by scanning the QR code. Patients on May 1 were enrolled in EW group 1, and patients on May 2 were enrolled in EW group 2. In this order, 10 groups were generated. Each EW group started to begin EW on the second day. All 10 groups were managed by nurse 1, responsible for introducing the role, methods, and precautions to patients, especially pledging the confidentiality of their writing content. Avoid the period of patients' treatment; the EW time is 19:00 to 19:30 every day. Nurse 1 sent the instruction to the EW group at 19:00, and the patient began to write according to the guide. If patients need to deal with other matters during this period, it can be postponed to 22:00 on the same day. Writing is not limited to the number of words, but the prescribed time, that is, at least 20 min for consecutive writing; each stage of the topic can be written in 2 days. Patients wrote through the mobile phone and sent the writing content to Nurse 2.

In the post-session, nurse 2 was responsible for evaluating the writing quality and feedback to the participants. The nurse only commends that the patients finished writing intraday and did not evaluate the writing content to avoid confusing the intervention effect. Other team members did not participate in the process to ensure the unity of evaluation standards. The quality of writing was evaluated and recorded according to the following criteria: (a) the length of the writing (0 points for less than 50 words, 1 point for 50 to 100 words, 2 points for 101 to 150 words, 3 points for 151 to 200 words, 4 points for 201 to 205 words, and 5 points for more than 250 words; b) How well does the writing fit the topic? (c)To what extent does the writing describe a positive emotional experience? Each item is scored on a 6-point ranging from "not at all "(0 points) to "a great deal" (5 points); the total score ranges from 0 to 15.

Measure

The two groups were given a battery of tests online 1 day before intervention and 1 day after the final session. The severity of psychological distress was assessed using Brief Profile of Mood States (BPOMS). This scale is derived from the Profile of Mood States (POMS) compiled by McNair (McNair, 1992). The concise scale, revised and simplified by Chinese scholars (Chi and Lin, 2003), has good reliability and validity. Cronbach's α ranges from 0.67 to 0.93. It was used to assess both specific and general mood. The BPOMS is a 30 contains item Likert format (0 = "not at all" and "4 = extremely) questionnaire that measures the specific mood factors of tension (T), depression (D), anger (A), vigor (V), fatigue (F), and confusion (C). A widely used higher-order measure of total mood disturbance (TMD) was assessed by adding the negative mood variables and subtracting the positive variable of vigor. TMD = T + A + F + C + D-V, ranging from-24 to 76 points. Compared with some single emotional assessment tools (such as SDS and SAS), this scale can detect a variety of mood states, is widely used to assess the degree of symptom changes after patients receive specific treatment, and has been proved to have high sensitivity (Wang et al., 2000).

In addition to using self-report questionnaires, we used an observe-rating scale to improve the reliability of psychological state assessment results. This study was authorized to use the Inpatient Mental Health Preliminary Screening Scale (IMHPS), developed by the Nursing Psychology Committee of the Chinese Psychological Society. The scale applies to inpatients in addition to the psychiatry department. Nurses complete the assessment

based on observation and brief communication with patients. The scale has 20 items, reflecting the intensity of patients' emotional responses. Points are scored on a 5-point scale ranging from "never" (0 points) to "always" (4 points). The higher the score, the higher the intensity of the negative emotional response.

Finally, after the intervention, participants from the EW group were asked about their experiences related to the EW intervention: (1) To what extent do you think EW is suitable for asymptomatic infected persons in Fangcang hospitals? (2) To what extent do you think EW plays a role in regulating emotions? EW satisfaction questionnaire is scored on a 6-point scale ranging from "not at all "(0 points) to "a great deal" (5 points), ranging from 0 to 10. The higher the score, the more satisfied the EW intervention.

Data collection and quality control

Three intervention team members, Nurse 3, Nurse 4, and Nurse 5, who were trained in the assessment of the scales, were responsible for data collection. One day before and 1 day after, nurse 3 sent the BPMOS to the WeChat of the two groups *via* the WeChat-based survey program Questionnaire Star. After the intervention, the EW satisfaction questionnaire was sent to the WeChat of the EW group. According to the list of all included patients, nurses 4 and 5 jointly evaluated patients with the IMHPS 1 day before and 1 day after the intervention under the condition of unknown grouping. In this study, the intervention instructor, writing quality evaluators, and data collectors were separated to reduce subjectivity bias.

Statistical analyses

SPSS 24.0 statistical software was used for analysis. The data were tested for normality and homogeneity of variance. The Chi-square test and Fisher test compared the demographics of the two groups. Data were summarized using mean ± SD for continuous variables and frequency percentages for categorical variables. The primary outcomes of interest included mood states (BPMOS)and mental health (IMHPS) scores. These measurements were evaluated at baseline and 8 days later. For each group, the mean change was assessed using the 2-Sample t-Test. The difference for each outcome of interest was compared between groups also using the 2-Sample t-Test. Pearson correlation test was used to compare the pairwise correlation between changes in mood states and writing quality. In all cases, $p < 0.05$ was considered statistically significant, and findings were summarized using point estimates and corresponding 95% confidence intervals. Analysis was restricted to participants who completed the study.

Results

During the recruitment period (1 to May 10), 244 patients were eligible and consented to participate in the study (see Figure 1). One hundred seventeen patients were discharged from hospitals during the study, with 60 from the EW group and 57 from the control group. Nine patients dropped out due to incomplete eight times EW. There were 53 cases in the EW group and 65 cases in the control group, totaling 118 participants completing the study. Demographic characteristics were balanced between the EW and control groups (Table 2). All demographic and COVID-related information about the sample is presented in Table 2.

2-Sample t-Test results show that the score of TMD, tension, anger, depression + confusion, and fatigue in the EW group were lower than those in the control group, and the score of vigor was higher than those in the control group after intervention. The differences were statistically significant ($p < 0.05$). The change of the TMD score in the EW group was lower than before intervention, and the vigor score was higher than before intervention. The difference was statistically significant ($p < 0.05$). See Table 3.

After the intervention, the score of IMHPS in the EW group was lower than that in the control group, and the difference was statistically significant ($p < 0.001$). The score in the EW group after intervention was lower than before. Still, the difference was not statistically significant ($p > 0.05$), while the score in the control group after intervention was higher than that before intervention, and the difference was statistically significant ($p < 0.01$). See Table 4.

Since there was little difference in the score of the IMHPS before and after the intervention in the EW group, only the correlation between the change of BPOMS score and writing quality was analyzed. Mood states change = pre-scale score - post-scale score. Those with mood states change greater than 0 (i.e., those with effective EW intervention) were screened out, and the correlation between the improvement effect of mood states and writing quality was analyzed. The results are shown in Table 5. The total score of writing quality, writing length, and the degree of positive emotional experience described by writing was highly correlated with the change of mood states ($r > 0.8$), and the degree of writing fit the topic was low correlated with the change of mood states ($0.3 \leq R < 0.5$).

The percentage of satisfaction index with medium level and above ranged from 77.36 to 90.57%, as shown in Table 6.

Discussion

The results of BPMOS showed that the TMD score and scores of each dimension of BPOMS in the EW group were significantly better than those in the control group, indicating that EW can reduce the psychological distress of the asymptomatic COVID-19

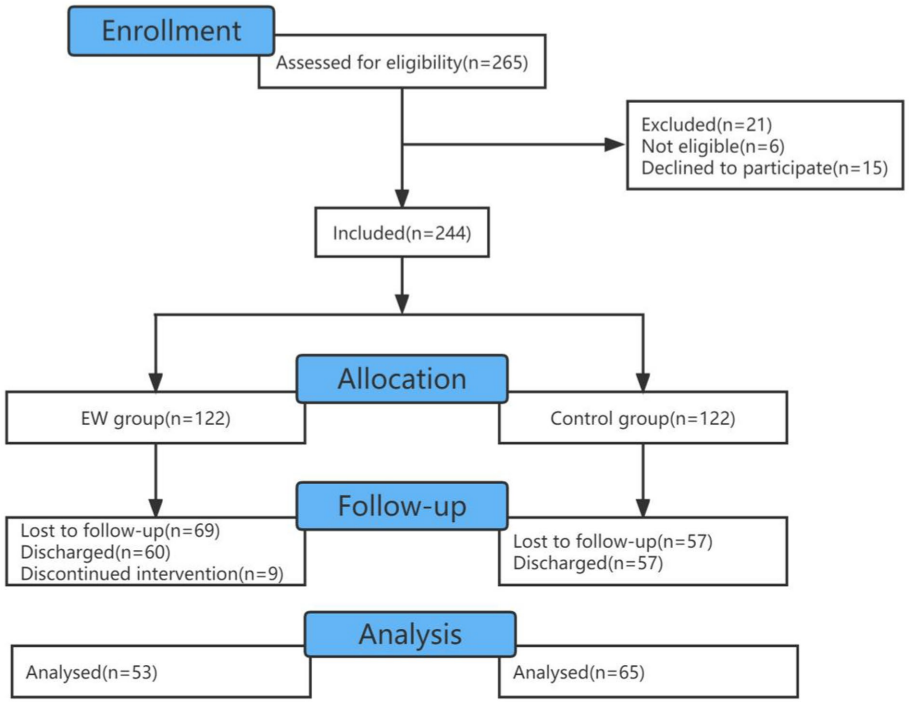

FIGURE 1
Flow diagram to indicate the included and excluded participants.

TABLE 2 Comparison of general information between two groups (case).

Variable		EW group ($n=53$)	Control group ($n=65$)	χ^2	p
Gender, *n* (%)	Male	36 (67.9)	38 (58.5)	1.118	0.290
	Female	17 (32.1)	27 (41.5)		
Age, *n* (%)	18 ~ 29	15 (28.3)	24 (36.9)	1.02	0.796
	30 ~ 39	19 (35.8)	21 (32.3)		
	40 ~ 49	9 (17.0)	10 (15.4)		
	50 ~ 60	10 (18.9)	10 (15.4)		
Ethnicity, *n* (%)	Han	53 (100)	62 (95.3)	-	0.251
	Minority	0	3 (4.7)		
Marital status, *n* (%)	Single	14 (26.4)	23 (35.4)	1.401	0.496
	Married	36 (67.9)	40 (61.5)		
	Divorced/ widowed	3 (5.7)	2 (3.1)		
Education, *n* (%)	Junior high	15 (28.3)	23 (35.4)	6.494	0.165
	High school	17 (32.1)	20 (30.8)		
	Bachelor	18 (34.0)	21 (32.3)		
	Master and above	3 (5.6)	1 (1.5)		

- is Fisher test

patients in Fangcang Hospitals. While the EW group still had a certain amount of tension and fatigue after the intervention, the vigor score was significantly improved compared with those before the intervention. It suggests that EW can provide an outlet to express the inhibited content and thus reduce internal tension. Furthermore, thorough the Topic orientation: focusing on the good, guides patients to increase their benefit findings from the illness. For example, some patients noted, "Maybe my self-protection measures are not good enough to make the virus like me so much. It could also be that I had been staying up too late, and my immune system had dropped. This illness may be a reminder to my body and a gift. Whatever you do, you should have a healthy body. Just thinking about it, I feel lucky." "Although the pandemic brought us many negative experiences, it also made us realize the value of time and the seriousness of our habits." This result supports the view that stressful events' negative and positive effects on individuals can exist independently (Fontana and Rosenheck, 1998). In the control group, the negative mood worsened with the increase of the length of hospital stay. It is also consistent with the theory of emotional inhibition (Sloan, 2004) that "the inhibition of emotions associated with stress has a negative impact on health." Patients who fail to discharge after an average stay (7 days) are prone to have a strong psychological gap when they see their fellow patients discharged successively. They worry about the potential risks caused by newly admitted patients. The control group did not have a channel to reduce the cognitive confusion surrounding an emotional event, which may further aggravate the negative emotions such as tension, anger, and confusion. This study is based on the healing effect of EW (expression and connection, reflection and reinterpretation, acceptance and completion) to design four topics (emotion expression, cognitive appraisal, unlock potential, and look ahead).

TABLE 3 Comparison of BPOMS before and after intervention between two groups (score).

group	Pre-intervention	Post-intervention	*t*	*p*	Pre-intervention	Post-intervention	*t*	*p*
		TMD				tension		
EW group	1.6 ± 13.66	−3.25 ± 7.61	2.257	0.027*	1.92 ± 1.86	1.3 ± 1.31	1.986	0.050
Control group	3.51 ± 16.24	7.17 ± 17.65	−1.230	0.221	2.03 ± 2.51	2.51 ± 2.74	−1.032	0.304
t	0.679	4.291			0.255	3.131		
p	0.498	0.000***			0.799	0.002**		
		anger				depression + confusion		
EW group	2.34 ± 3.04	1.91 ± 2.34	0.822	0.413	4.75 ± 4.96	3.89 ± 2.79	1.108	0.271
Control group	2.6 ± 3.86	3.2 ± 4.37	−0.829	0.409	5.35 ± 6.13	6.43 ± 6.73	−0.953	0.343
t	0.4	2.050			0.574	2.765		
p	0.69	0.043*			0.567	0.007**		
		fatigue				vigor		
EW group	2.47 ± 3.04	1.92 ± 1.63	1.153	0.252	9.89 ± 5.37	12.26 ± 3.00	2.811	0.006**
Control group	2.78 ± 3.53	3.55 ± 4.07	−1.15	0.252	9.26 ± 4.98	8.52 ± 4.78	−0.862	0.390
t	0.509	2.945			0.654	5.177		
p	0.612	0.004**			0.514	0.000***		

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

TABLE 4 Comparison of IMHPS before and after intervention between two groups (score).

Group	IMHPS		*t*	*p*
	Pre-intervention	Post-intervention		
EW group	15.45 ± 8.75	15.13 ± 8.53	0.191	0.849
Control group	16.6 ± 10.70	23.23 ± 13.16	−3.151	0.002**
t	−0.628	−4.030		
p	0.532	0.000***		

**$p < 0.01$, ***$p < 0.001$.

The results indicated that the modified instructions were ideal for fostering both catharsis and reappraisal. During the upheaval of COVID-19 restrictions, EW can promote individual growth and rebuild their confidence by reducing avoidance of stressors, facilitating problem-solving, and increasing reflection upon epidemic and holistic life balance.

The IMHPS results showed that EW could prevent the aggravation of negative emotions among patients in Fangcang hospitals. In order to ensure the objectivity and comprehensiveness of the assessment results, the observe-rating scale was used. The analysis results showed that the IMHPS and BPOMS scores of inpatients were almost consistent; that is, the psychological state of the EW group was significantly better than that of the control group after the intervention, and the psychological state of the EW group was improved compared with that before the intervention. The only difference is that the psychological state of the control group was significantly aggravated after 8 days ($p < 0.01$) in the IMHPS results. The possible reason is that patients in the control group fail to vent and transform their emotions through certain channels. With the increase of hospitalization days, they pay excessive attention to the negative impact of the disease on themselves, repeatedly questioning the test results. These performances are easier to capture by nurses in the form of observe-rating. The psychological states of the EW group were relatively stable, suggesting that EW can positively affect the psychological activities of patients and help them obtain an appropriate mental state. For example, a patient mentions in his writing, "I think it is a kind of success to change my mind from anger to inner peace. How important it is to experience more; even if it is a failure or danger, there is a precious treasure hidden in it. This can also be called living in abundance." EW can allow patients to reorganize their thoughts of hospitalization and organize the event cognitively into a coherent narrative. This would allow for the event to be assimilated and, ultimately, resolved and/or forgotten, thereby alleviating the maladaptive effects of incomplete emotional processing on health.

The writing quality was highly correlated with the psychological change quantity. The length of writing and the degree of writing describing positive emotional experiences are highly correlated with the amount of mood states change in patients. This is consistent with the research of Smyth et al. (2008). The higher the information disclosure, the more benefit the individual will get. For example, one patient submitted more than 300 words each time, describing details and emotional disclosure were detailed and delicate. The main tone of the patient expression is gratitude and strength. After the intervention, the TMD score of the patient was significantly reduced. It shows that a detailed description of the event can produce a more vivid image, lead to the maximum emotional arousal of patients, and ultimately reduce their negative emotions (Holmes and Mathews, 2010). Other studies have suggested the expression of positive emotion words and negative emotion words can improve an individual's mental state, but the effectiveness of positive emotions produces more (Burton and King, 2004; Pennebaker and Chung, 2007). The expression of positive experiences shows that patients are experiencing deliberate rumination, which is more likely to facilitate posttraumatic growth (Qu et al., 2022). Thus, the expression of positive emotion is more associated with

TABLE 5 Correlation analysis between writing quality and score change of BPMOS (*r*).

Item	The length of the writing	How well does the writing fit the topic?	To what extent does the writing describe a positive emotional experience?	The total score of writing quality
Amount of mood states change	0.847**	0.430*	0.858**	0.832**

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

TABLE 6 Descriptive analysis of patients' satisfaction with EW (score).

Item	*M*	*SD*	Percentage of items with a score of medium level or above (%)
To what extent do you think EW is suitable for asymptomatic infected patients in Fangcang hospitals?	3.38	1.274	77.36
To what extent do you think EW plays a role in reducing psychological distress?	3.83	0.914	90.57
Total scores	7.21	1.801	81.13

the amount of mood change. As for the degree of writing fits the topic, it indicates that the appropriate relaxation of the topic of writing will not hinder the positive effect of writing too much, which is also consistent with the research results of Ireland et al. (2007). Although some patients did not describe a prominent topic, their focus had expanded from the current disease to other aspects. The shift of attention may play a certain role in the improvement of mental state.

Compared with other interventions, EW has the advantages of low-cost treatment and low dependence on professionals. This study showed that 77.36% of the patients believed that the EW was suitable for the patients in Fangcang hospitals. 90.57% of the patients thought that EW could regulate emotions, indicating that patients had high satisfaction with the intervention. Therefore, EW, as a novel form of psychological intervention for patients in Fangcang hospitals, has the value of promotion and use.

Conclusion

This study contributes to help researchers and clinicians understanding the effectiveness of online EW intervention for the reduction of psychological distress among the asymptomatic COVID-19 patients in Fangcang Hospitals. The results add value to the current literature on psychological health in this specific population, and provide insights into designing larger randomized clinical trials for intervention development and implementation. However, much remains to be understood regarding EW among asymptomatic COVID-19 patients. Among four topics (emotion expression, cognitive appraisal, unlock potential, and look ahead) of the program, which topic could produce more psychological benefits? Is a whole greater than any of its parts? Further research is needed to explore the problems by conducting different experimental groups.

Limitations

This study only explored the effect of EW on the psychological well-being of patients and did not investigate whether it could produce utility on physiologic functioning. Many studies have shown that EW can improve one's physiologic functioning (Wilhelm and Crawford, 2020), such as improving the immune function of HIV patients (Ennis and Cartagena, 2020), etc. Future studies can verify its promoting effect on patients' immune function and rehabilitation. In addition, the post-test of the scale was only carried out 1 day after the intervention. As some patients left the Fangcang hospitals after the intervention, a follow-up investigation could not be carried out, which could not prove the utility time of the EW. Finally, this quasi-experiment did not randomly assign the patients to the experiment and control conditions because of restrictions on the structure of Fangcang hospitals.

Data availability statement

The raw data cannot be shared at this time as the data also forms part of an ongoing study. Requests to access the datasets should be directed to contact the corresponding author.

Ethics statement

The studies involving human participants were reviewed and approved by the Medical Ethics Committee of the 988th Hospital. The patients/participants provided their written informed consent to participate in this study.

Author contributions

JX, WY, and XL meet the four criteria of author guidelines. JX helped perform the analysis with constructive conclusion and clarify the confused content in original manuscript. WY and XL helped revise the introduction of the paper, polish the manuscript, and provided financial support for the project leading to this publication.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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The mediating effect of resilience on mental health literacy and positive coping style among Chinese empty nesters: A cross-sectional study

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Objectives: Empty nesters in China have limited mental health literacy (MHL), which may lead to poorer health outcomes. Studies demonstrate that MHL is associated with both resilience and positive coping style. However, the potential mechanism of MHL, resilience and positive coping style remain unclear. Therefore, the study aims to investigate the possible mediating role of resilience in the relationship between MHL and positive coping style.

Method: In this cross-sectional study, a total of 363 empty nesters from Huzhou, China were surveyed in 2022. The Chinese version of Mental Health Literacy Scale (C-MHLS), the Chinese version of 10-item Connor-Davidson Resilience Scale (CD-RISC-10) and the Simplified Coping Style Questionnaire (SCSQ-19) were used to assess MHL, resilience, and positive coping style, respectively.

Results: Positive coping style was significantly correlated with MHL and resilience, and MHL was positively correlated with resilience ($p<0.01$). MHL can significantly and positively predict the positive coping style, and resilience played a partial intermediary role between MHL and positive coping style, with the intermediary effect of 77.36%.

Conclusion: This study indicates that MHL not only directly affected positive coping style, but also indirectly influences positive coping style by increasing the resilience of empty nesters. The results provide an empirical evidence for the development of intervention programs to improve positive coping style directly and indirectly. Consequently, community health servicers should take targeted measures which focus on MHL and resilience as breakthrough points to stimulate positive coping style of empty nesters, and ultimately achieve their overall well-being.

KEYWORDS

mental health literacy, resilience, positive coping style, empty nester, mental health

1. Introduction

The World Health Organization predicts that by 2030, one in six people in the world will be aged 60 years or over (World Health Organization, 2021). According to the annual data of the National Bureau of Statistics of China, the number of people who aged over 65 in China has increased sharply from 123 million in 2011 to 201 million in 2021, nearly doubling (Nation Bureau of Statistics, 2021).

The explosive growth of the elderly population has brought severe challenges to the Chinese public health, among which empty nesters deserve more attention.

Empty nesters refers to the elderly over 60; have no children or have children, but are not around; live alone or only with their spouses. It can be further divided into absolute empty-nesters (those who do not live with their children in the same city or have no children) and relative empty-nesters (those who live with their children in the same city but do not live together; Yao et al., 2019). Based on the data of China's seventh census, there are about 119 million empty nesters, and the proportion of empty nesters' families has reached 44.82%. Hence forecasts, "empty-nest" of Chinese elderly families has become an inevitable trend (National Bureau of Statistics, 2021).

Long-term lacking of care and emotional support will lead to adverse psychological outcomes of empty nesters, such as loneliness, anxiety and depression, and even suffering from mental illness. A survey manifests that up to 54.5% of empty nesters in China have experienced loneliness (Wang et al., 2017). Depression and anxiety are the most common psychological problems of empty nesters in China, with prevalence rates of 38.6 and 41%, respectively, (Wang et al., 2020; Zhang et al., 2020), nearly twice that of the general elderly (23.6 and 22.1%; Su et al., 2011; Li et al., 2014). A study in Shanxi Province proofs that the prevalence of mental disorders among empty nesters is significantly higher than that of non-empty nesters (26.9% vs. 23.5%; Zhang et al., 2019). It can be seen that the current psychological condition of empty nesters is not optimistic at present, which may be closely related to their poor coping style.

Previous studies have pointed out that coping style acts a pivotal part in regulating individual's psychological state and maintaining mental balance (Li et al., 2022). Coping style refers to a cognitive adjustment behavior method and strategy adopted by an individual to adapt to the requirements of the internal and external environment in the face of stressful events, which can be divided into positive coping style and negative coping style (Lazarus and Folkman, 1984). Su's research have verified that coping style can directly affect the mental health of empty nesters, and positive coping style is a positive predictor of mental health, while negative coping style is a negative predictor of mental health (Su et al., 2018).

Mental health is a development process in which risk factors and protection factors compete with each other (World Health Organization, 2014). The characteristics of empty nesters are that they need to face the double pressures of material level and spiritual level, which makes them easy to suffer from mental disorders. Old age, infirmity, lack of child support, difficulty in seeking medical care and loneliness are the stressors they face. Based on the stress-coping model by Lazarus and Folkman, stress is the product of the interaction between human and environment. If the internal and external environment stimulation exceeds one's own coping ability and coping resources, pressure will be generated. Whether a stressor can produce stress after acting on an individual mainly depends on cognitive evaluation and response (Folkman et al., 1986). In this process, mental health literacy (MHL) and resilience can work as protective factors to build cognitive and behavioral resources to cope with psychological stress (Carvalho and Dias, 2021).

Mental health literacy was defined as knowledge and beliefs that contribute to the recognition, management, and prevention of mental illness. It includes the following 6 dimensions: the ability to recognize mental illness; the knowledge of causes and risk factors of mental illness; the knowledge of self-treatment; the knowledge of professional help available; the knowledge of how to seek information related to mental health; the attitudes that promote recognition or appropriate help seeking behavior (Jorm et al., 1997). Several studies suggest that MHL is strongly associated with coping style (Chen, 2016; Li, 2018; Dong, 2019; Carvalho and Dias, 2021), and improving MHL can help enhance coping skills (Katz et al., 2020). The higher the MHL of individuals, the more inclined they are to adopt positive coping style when encountering psychological stress (Li, 2018).

Resilience refers to an individual' mental ability to actively adjust and adapt in the face of adversity, trauma and other pressures (Schwarz, 2018). A higher level of resilience was related to more positive coping style (Zhao et al., 2020; Xu et al., 2022), and those with high resilience are more inclined to choose positive coping style to deal with stressful events in life, including better problem solving and less avoidant coping (Wu et al., 2020). In addition, Jorm's research found that increased MHL implies promise in its ability to increase resilience and possibly master more coping strategies (Jorm, 2012). This view has been supported by several studies (Fraser and Pakenham, 2009; Cavanaugh et al., 2021; Sullivan et al., 2021).

Although a large number of studies have revealed the influence of MHL in maintaining and promoting mental health (Brijnath et al., 2016). However, there are few studies on the correlation between MHL and other variables, which variables mediate in the maintenance and promotion of mental health, and how they influence are influenced, remains to be further explored. Consequently, this study aims to explore the relationship between MHL, resilience and positive coping style of empty nesters, so as to provide the basis for ameliorating their mental health.

2. Methods

2.1. Study population

A multistage stratified random sampling was adopted in Huzhou City, China from March to July, 2022. In the first stage, we used a table of random digit to randomly select one county from five counties in Huzhou City, and then randomly selected five streets from this county. Next, we randomly selected one community from each street, and a total of five communities were extracted. In the second stage, we used the residential information of community health records to randomly select participants under the permission of community health servicers in the selected communities. (1) Inclusion criteria: age $\geq$ 60; elderly who lived alone or only with their spouse for more than 6 months each year, and their children were absent or childless; awareness was clear, and communication with investigators was barrier-free; volunteered and signed informed consent. (2) Exclusion criteria: had serious physical diseases, mental disorders or cognitive disorders; unable to take care of themselves; children living nearby could take care of the elderly at any time.

2.2. Data collection

Before the formal survey, 30 empty nesters were selected by convenience sampling to test the reliability and validity of the instruments, as well as the appropriateness of the survey method and field. During the formal survey, with the assistance of community health servicers, we used a combination of centralized investigation (community health checkups, health lectures, free clinics, etc.), and individual household surveys to conduct on-site investigations. Each data was obtained through a face-to-face survey of about 30 min. The trained researchers used unified instructions to explain the purpose and significance of the study. Prior to the survey, informed consent was obtained from each participant.

2.3. Instruments

The general information questionnaire was used to assess the demographic information, including gender, age, residence, degree of education, living style, marital status, monthly income and other information.

Mental health literacy was measured by the Chinese version of Mental Health Literacy Scale (C-MHLS), which was developed by O'Connor and Casey (2015), and translated into Chinese version in 2019 by Ma (2019). It is the first tool to measure all dimensions in the definition of MHL proposed by Jorm. MHL was measured through 35 items in 6 dimensions, which included the ability to recognize mental illness (8 items), the knowledge of causes and risk factors of mental illness (2 items), the knowledge of self-treatment (2 items), the knowledge of professional help available (3 items), the knowledge of seeking information related to mental health (4 items), the attitudes that promote recognition or appropriate help seeking behavior (16 items). 4-point Likert and 5-point Likert scoring method were used in the scale. Items 10, 12, 15 and 20–28 were scored reversely, with a total score of 35–160. Higher scores indicated better MHL. MHLS is a previously verified tool with good internal consistency (Cronbach's alpha = 0.873). In this study, The Cronbach's alpha of this scale was 0.879.

Resilience was measured by the Chinese version of the 10-item Connor-Davidson Resilience Scale (CD-RISC-10). The CD-RISC-10 was first simplified by Professor Campbell-shills, who extracted 10 items from the 25-item Connor-Davidson Resilience Scale (CD-RISC; Campbell-Sills and Stein, 2007), and then translated and revised into the Chinese version by Zhang et al. (2018). The scale had 10 items and 2 dimensions: strength (5 items) and tenacity (5 items). The scale was scored by 5-point Likert, with "never," "rarely," "sometimes," "often" and "always" being 0–4 points in turn, with a total score of 40. Higher scores represented better resilience. The scale has been evaluated in Chinese older adults, displaying good reliability and validity (Meng et al., 2019). In this study, The Cronbach's alpha of this scale was 0.904.

Positive coping style was measured by the Simplified Coping Style Questionnaire (SCSQ-19). The SCSQ-19 was compiled by Xie (1998) based on a broad coping style questionnaire, and then revised by Zhu et al. (2016) according to the context of the Chinese elderly. This questionnaire consisted of positive and negative style, with the positive coping style assessed in items 1–12, and the negative coping style assessed in items 13–19. The responses ranged from 3 (often) to 0 (not at all). The SCSQ was used to assess coping style among elderly adults in China, and it demonstrated good internal consistency (Cronbach's alpha = 0.886). In this study, The Cronbach's alpha of this questionnaire was 0.801.

2.4. Statistical analysis

All statistical analyses were carried out using SPSS 24.0 and AMOS 26.0. The analysis strategy was divided into three steps. Firstly, descriptive statistics was used to process sociodemographic data, of which observable variables were presented as the means ± standard deviations (M ± SD) for continuous variables and frequencies and percentages for categorical variables. Secondly, correlation analysis and multiple linear regression analysis were used to explore the direct relationship among variables. Thirdly, we used the bootstrap-based structural equation modeling analysis in AMOS 26.0 software to test the mediating role of resilience between MHL and positive coping style. For the mediation analysis, the positive coping style was considered a dependent variable, MHL was considered an independent variable, and the resilience was entered as mediating variable.

3. Results

3.1. Demographic characteristics of the participants

Three hundred and seventy-five individuals were enrolled, and 363 completed the questionnaires, for a recovery rate of 96.8%. Eighty-nine cases were absolute empty-nesters, and 274 were relative empty-nesters. The age of these respondents ranged from 60 to 94 years ($M = 72.69$, SD = 8.56) and more than half of them were female (50.7%), married (79.9%), and lived in city (61.4%). The level of education was predominantly primary school (125 cases, 34.4%). Monthly income was mostly <5,000 RMB (62.3%; Table 1).

3.2. Positive coping style, MHL and resilience of participants

The scores of positive coping style, MHL and resilience were shown in Table 2. Furthermore, we compared the average scores of six dimensions of MHL. On the 4-point scoring dimension, the scores from high to low were: the knowledge of causes and risk factors of mental illness (2.76 ± 0.81), the knowledge of self-treatment

TABLE 1 Demographic characteristics of the participants (n=363).

Variable	Group	*N* (%)
Gender	Male	179 (49.3)
	Female	184 (50.7)
Age	60–69	141 (38.9)
	70–79	137 (37.7)
	≥80	85 (23.4)
Residence	City	223 (61.4)
	Countryside	140 (38.6)
Education	Illiterate	86 (23.7)
	Primary school	125 (34.4)
	Junior school	93 (25.6)
	High school	30 (8.3)
	Bachelor degree or above	29 (8.0)
Marital status	Married	290 (79.9)
	Single	3 (0.8)
	Divorced	14 (3.9)
	Widowed	56 (15.4)
Living style	Relative empty nest	274 (75.5)
	Absolute empty nest	89 (24.5)
Monthly income	<1,000 RMB	36 (9.9)
	1,000–3,000 RMB	103 (28.4)
	3,000–5,000 RMB	87 (24.0)
	>5,000 RMB	137 (37.7)

(2.70 ± 0.54), the knowledge of professional help available (2.63 ± 0.58), and the ability to recognize mental illness (2.61 ± 0.78). On the 5-point scoring dimension, the score of the knowledge of seeking information related to mental health (3.07 ± 1.20) was higher than the attitudes that promote recognition or appropriate help seeking behavior (2.75 ± 0.79).

3.3. The direct association among MHL, resilience and positive coping style

Correlation analysis (Table 3) showed that positive coping style was significantly and positively correlated with MHL ($r = 0.554$, $p < 0.01$) and resilience ($r = 0.711$, $p < 0.01$). Moreover, there was a significant positive correlation between MHL and resilience ($r = 0.586$, $p < 0.01$).

Multiple linear regression models were constructed to expose the effects of resilience and MHL on positive coping style (Table 4). Two dimensions of resilience, namely tenacity and strength were significantly associated with positive coping style ($p < 0.001$, $p = 0.038$, respectively). "knowledge of self-treatment" and "attitudes that promote recognition or appropriate help seeking behavior" of MHL were significantly associated with positive coping style ($p = 0.012$, $p = 0.001$, respectively). However, other dimensions of MHL had no statistical significant effect on positive coping style ($p > 0.05$).

TABLE 2 The scores of positive coping style, MHL and resilience.

Variable	Score
Positive coping style	21.68 ± 6.28
MHL	95.98 ± 21.46
Ability to recognize mental illness	20.90 ± 6.20
Knowledge of causes and risk factors of mental illness	5.53 ± 1.63
Knowledge of self-treatment	5.40 ± 1.08
Knowledge of professional help available	7.88 ± 1.75
Knowledge of how to seek information related to mental health	12.28 ± 4.80
Attitudes that promote recognition or appropriate help seeking behavior	44.00 ± 21.59
Resilience	24.72 ± 7.07
Tenacity	12.44 ± 3.63
Strength	12.28 ± 3.73

TABLE 3 Correlations among MHL, positive coping style and resilience.

Variable	Positive coping style	MHL
MHL	0.554**	
Resilience	0.711**	0.586**

**$p < 0.01$.

3.4. Mediating effect of resilience of empty nesters on MHL and positive coping style

3.4.1. Common method variance

We used Harman's one-factor method to test the common method deviation. All the items of the scale used to measure MHL, resilience and positive coping style were included in SPSS 24.0 software for exploratory factor analysis. The results showed that 12 factors with characteristic root > 1 were extracted, and the maximum factor variance explanation rate was 15.15% (< 40%), so there was no serious common method deviation in this study (Podsakoff et al., 2012).

3.4.2. Mediary model estimation

In this study, the analysis was performed by a bootstrap-based structural equation model to test the mediation effect of the resilience on the correlation between MHL and positive coping style. Several indexes were calculated to evaluate the model fit to the data: chi-square statistic (χ^2), χ^2/df, root mean square error of approximation (RMSEA), adjusted goodness-of-fit index (AGFI), comparative fitting index (CFI), goodness-of-fit index (GFI), and normed fit index (NFI).

The fitting results of the model was suggestive of all fitting indexes of the model met the standard, indicating that the fitting effect of the model was good. See Table 5 for the results. See Figure 1 for the model.

TABLE 4 The effects of MHL and resilience on positive coping style.

Dependent variable	Independent variable	*B*	S.E.	*β*	*t*	*p*
Positive coping style	MHL					
	Ability to recognize mental illness	−0.048	0.055	−0.048	−0.881	0.379
	Knowledge of causes and risk factors of mental illness	0.066	0.148	0.017	0.448	0.654
	Knowledge of self-treatment	0.588	0.232	0.101	2.538	0.012*
	Knowledge of professional help available	0.214	0.177	0.060	1.210	0.227
	Knowledge of how to seek information related to mental health	0.043	0.070	0.033	0.616	0.538
	Attitudes that promote recognition or appropriate help seeking behavior	0.073	0.021	0.146	3.054	0.001*
	Resilience					
	Tenacity	0.809	0.120	0.469	6.740	0.000*
	Strength	0.242	0.116	0.144	2.082	0.038*

*$p < 0.05$.

3.4.3. Mediation effect test

According to the structural equation model, the preliminary judgment was that a positive coping style mediation path existed, but the mediation effect (path coefficient of the product) needed further verification. Bootstrapping was performed to confirm the mediation effect, taking 95% confidence interval (CI) and sampling number of 5,000. The results were shown in Table 6. The 95%CI of the direct and indirect effects of MHL on positive coping style did not contain 0, indicating that the mediation effect model was established. As seen in Figure 1 and Table 6 that the indirect effect of MHL on positive coping style through resilience is 0.451, and the total effect value is 0.584, with the mediating effect accounting for 77.36% of the total effect.

4. Discussion

As far as we know, this is the first study to investigate the MHL among empty nesters, and analysis the mediating role of resilience on MHL and the positive coping style using a structural equation model. Findings highlighted that positive coping style is influenced by both MHL and resilience, and the indirect pathway is more influential. The scores of MHL, resilience and positive coping style of empty nesters in this study belong to the lower middle level, which were consistent with previous studies (Kim et al., 2017; Cao et al., 2018; Hao et al., 2021).

Empty nesters with enough MHL are more likely to adopt positive coping styles. On the one hand, characters with high MHL possess sufficient mental health knowledge, so that they can identify mental diseases accurately in the early stage (Yu et al., 2016). Furthmore, it is easier for them to seek effective information related to mental health, and master certain mental health first aid ability, so they are more capable of taking positive coping styles (E.g., using mental health services.) to manage their own and others' mental health (Mackenzie and Pankratz, 2022). On the other hand, MHL is the strongest factor affecting mental health attitude (Lee et al., 2020). Characters with insufficient MHL usually exist a higher degree of stigma towards mental illness (Svensson and Hansson, 2016). They are more inclined to adopt negative coping styles, such as concealing their illness and avoiding medical treatment (Conner et al., 2010), which not only hinders themselves from seeking professional help, but also make them more likely to treat psychiatric patients with discrimination instead of assistance (Schnyder et al., 2017).

In our study, MHL is proved to influence coping style through resilience, which is consistent with the findings of Sun et al. (2021). When facing with psychological pressure, people with high MHL can quickly adjust their mentality and strengthen their beliefs, so that they can recover from troubles as soon as possible. During the period, their adaptability is gradually improved, which provides a favorable prerequisite for the development of resilience (Fraser and Pakenham, 2009). Previous studies have revealed that resilience is significantly associated with positive coping style (Luo, 2013; Yang, 2015). Someone with high resilience tend to keep a positive and optimistic attitude towards life, and usually regard stress as a controllable event (Wu et al., 2021). Meanwhile, they can understand the cruciality of positive coping style more clearly, and their self-confidence and problem-solving ability are relatively strong (Steinhardt and Dolbier, 2008). All these are beneficial to encourage them to adopt positive coping styles under psychological pressure, effectively overcome the adverse effects of negative emotions, thus reducing or even eliminating symptoms.

In China, poor MHL among empty nesters is alarming. Studies substantiates that MHL will influence empty nesters' ability to comprehensively apply mental health knowledge, skills and attitudes to deal with mental diseases (Wei et al., 2015), which in turn affects their coping style and mental health outcomes. However, it is remarkable that interventions targeting people with low MHL can be effective in improving their mental health, such as mental health education activities, anti-stigma

TABLE 5 Model fitting index.

Indice	χ^2/df	AGFI	CFI	GFI	NFI	RMSEA
Reference range	1–3	>0.90	>0.90	>0.90	>0.90	<0.08
Fitting result	2.605	0.932	0.974	0.962	0.959	0.067

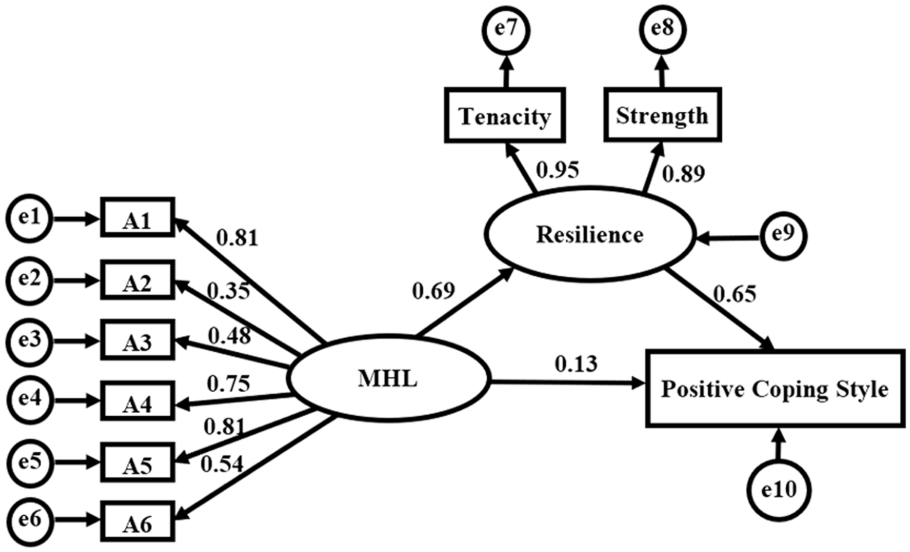

FIGURE 1
The structural equation model of MHL and resilience affecting positive coping style among empty nesters. A1: the ability to recognize mental illness; A2: the knowledge of causes and risk factors of mental illness; A3: the knowledge of self-treatment; A4: the knowledge of professional help available; A5: the knowledge of how to seek information related to mental health; A6: the attitudes that promote recognition or appropriate help seeking behavior.

TABLE 6 The mediating effect of resilience on MHL and positive coping style.

Variable	Coefficient	SE	*p*	95%CI
MHL → resilience → positive coping style				
Total effect	0.584	0.039	<0.001	0.507–0.657
Direct effect	0.133	0.060	0.037	0.008–0.247
MHL → resilience	0.689	0.037	<0.001	0.613–0.759
Resilience → positive coping style	0.655	0.049	<0.001	0.559–0.751
Indirect effect	0.451	0.045	<0.001	0.371–0.552

campaigns and mental health first aid trainings (Jorm, 2012). In addition, as a positive personality trait that can well regulate emotions and psychological resources, resilience may lead to better MHL, thereby enhancing their positive coping style (Cao et al., 2020). Therefore, community health servicers should focus on the MHL and resilience of empty nesters, then take these two intervenable and changeable factors as entry points to develop intervention programs that directly or indirectly improve their positive coping style. Since positive coping style is an important positive predictor of empty nesters' mental health, promoting positive coping style will help achieve their overall well-being. It will also imperceptibly enhance empty nesters' awareness of their own mental health care, mobilize their initiative, and encourage them to be the first responsible person for their own mental health, thus providing a feasible path to cope with the current situation of aging and declining birthrate in China.

5. Limitations

Several limitations of this research should be noted. First, the sample population of empty nesters included only a few randomly selected communities in a city, which may introduce bias and limit the universality of the research results. Accordingly, it is indispensable to conduct future research with empty nesters from different regions. Second, it is difficult to draw a conclusion on the causal relationship between the research variables because of the cross-sectional design used in this study. Third, the data were collected through self-report questionnaires, which may be subject to reporting bias.

6. Conclusion

This study bears out that resilience is an important mediator in the relationship between MHL and positive coping style of empty nesters. The results provide an empirical evidence for the development of intervention programs to improve positive coping style directly and indirectly. Consequently, community health servicers should take targeted measures which focus on MHL and resilience as breakthrough points to stimulate positive coping style of empty nesters, and ultimately achieve their overall well-being.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving human participants were reviewed and approved by the ethics committee of the School of Nursing, College of Medicine, Huzhou University (2022-03-14). The patients/participants provided their written informed consent to participate in this study.

Author contributions

QZ was involved in research design and critical revision for intellectual content of the manuscript. LS completed the first draft of the manuscript, submitted the manuscript for publication. YW, JY, and WG contributed to assist in the development of the study protocol. SS and LQ assisted with participant enrollment and consent, and worked out the data acquisition plan. All authors commented on previous versions of the manuscript, read and approved the final manuscript.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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Effects of different psychological interventions on quality of life and remission rate in patients with acute leukemia receiving chemotherapy: A randomized controlled trial

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Aims: This study aimed to examine and compare different psychological intervention effects on the quality of life (QoL) and remission rates of patients with acute leukemia receiving chemotherapy.

Methods: A total of 180 participants were randomly divided into a cognitive intervention group, a progressive muscle relaxation (PMR) group, a cognitive intervention plus PMR group, and a usual care control group. QoL via the Chinese version of the European Organization for Research and Treatment of Cancer Quality of Life Questionnaire Core-30 and remission rate were assessed at baseline and immediate post-intervention. A Generalized Linear Mixed Model was used for statistical analysis. Cost-effectiveness analysis with the value of the Incremental Cost-effectiveness Ratio was conducted to realize the economic evaluation of psychological interventions.

Results: The total score of QoL and its most dimensions were significantly improved for participants in the intervention groups compared with the control group. The cognitive intervention plus PMR intervention was the most effective concerning QoL with cost-effectiveness. No significant improvements were indicated in participants' remission rates among the groups.

Conclusion: The cognitive intervention plus PMR intervention is the most effective in improving QoL with cost-effectiveness among patients with acute leukemia receiving chemotherapy. More rigorous randomized controlled trials with multiple follow-up points are suggested to clarify the psychological interventions on remission rates in this population.

KEYWORDS

acute leukemia, cognitive intervention, progressive muscle relaxation, quality of life, remission

Introduction

Acute leukemia (AL) is a malignant clonal disease originating from hematopoietic stem cells, the most common hematologic cancer worldwide (Khan et al., 2018). As an aggressive disease develops rapidly, patients often require immediate hospitalization to initiate intensive chemotherapy (Byrant et al., 2018). Patients with AL treated with chemotherapy tend to face

many challenges. Not only the AL disease itself but also AL-related chemotherapy impair physical function (Oztürkmen et al., 2010; Musarezaie et al., 2014; Miladinia et al., 2018), resulting in fatigue, diarrhea, nausea, and vomiting (Burns et al., 2008). Mental health is also adversely affected in patients receiving chemotherapy for leukemia. Many patients experience high-level psychological distress due to the protracted time required for chemotherapy, high treatment cost, and less than optimal therapeutic effects (Albrecht, 2014; Wang et al., 2021). Decreased physical functions also impede their responsibility fulfillment in their families and societies and cause dramatic changes in lifestyles (Jie et al., 2020), contributing negatively to a downward spiral of physical deconditioning that affects physical and psychological functions, finally causing a poor quality of life (QoL) (Byrant et al., 2018; Nørskov et al., 2019).

The World Health Organization (WHO) has emphasized that successful leukemia treatments must improve patients' survival rate and QoL (Khan et al., 2018). QoL is a multidimensional concept and subjective experience determined by patients' physical, psychological, and social health (Chabowski et al., 2018; Wang et al., 2020). Studies have shown that the QoL for patients with AL needs to be improved (Bryant et al., 2015). However, existing studies have mainly focused on the effects of anti-leukemic treatments (i.e., chemotherapy and stem cell transplantation) in AL patients (Messerer et al., 2008; Grulke et al., 2012), failing to pay sufficient attention to different aspects of the well-being of AL patients. Meanwhile, remission rates directly affect survival and are the ultimate objective of chemotherapy among AL patients (Blackburn et al., 2019). Achieving high-quality complete remission in the short term can help patients kill more leukemia cells before developing secondary resistance and prolong the patient survival rates (Ravandi, 2014). However, remission rates (Ravandi, 2014; Yoon et al., 2017) are often used as assessment indicators for pharmacological studies, with little consideration of remission as a dependent variable in nonpharmacological interventions. Therefore, identifying effective nonpharmacological interventions that enhance QoL and promote remission rates for patients with AL receiving chemotherapy is particularly important.

Among various nonpharmacological interventions, psychological intervention is one of the most commonly used means to improve cancer patients' QoL and relieve their diverse distress aspects, especially cognitive-based therapy and progressive muscle relaxation (PMR). Cognitive therapy (Schilder, 1953) is a form of structured, short-term, and present-oriented psychotherapy to alter harmful cognitions by changing individuals' thoughts, beliefs, and behaviors. Previous studies suggested its promising effects in reducing the side effects of cancer-related treatments and improving cognitive and emotional functions and QoL in cancer patients (Munir et al., 2011; Bail et al., 2020). Despite the impacts of cognitive difficulties on cancer patients, evidence claiming that cognitive therapy improves QoL in patients with AL receiving chemotherapy is scant.

PMR is a complementary and alternative medicine intervention (Park, 2013) that includes repetitive cycles of tensing and relaxing major muscle groups combined with breathing exercises (Jacobson, 1938). A recent systematic review has demonstrated that PMR benefits patients undergoing chemotherapy, not only diminishing stress but also alleviating anxiety and side effects caused by chemotherapy. However, the effects of PMR on improving QoL remain unclear in patients with AL receiving chemotherapy.

Psychological interventions have been evaluated in patients with solid tumors. Still, as a kind of hematologic malignancy, patients with AL receiving chemotherapy are rarely studied as a single population, and few psychological interventions (Gray et al., 2021) have been conducted in these patients. Compared with patients with solid tumors, many patients with hematologic malignancies require intensive treatments. At the expense of substantial toxicities and impairments to QoL, it causes a double burden on patients' physical and mental health (El-Jawahri et al., 2020). Literature reports that psychological factors (i.e., depression and anxiety) directly affect disease occurrences and outcomes (Messerer et al., 2008), impacting AL patients' remission (Albrecht, 2014; Zhang et al., 2021). Cognitive intervention has also indicated its promising effects in improving psychological well-being in cancer patients (Compen et al., 2018). However, the effects of cognitive intervention effects on improving remission rates by correcting cognitions to improve psychological outcomes remain unclear. In addition, although cognitive intervention and PMR have been widely used in cancer patients, cognitive intervention plus PMR based on changing patient cognition has rarely been carried out. A single intervention program may no longer meet patients' physical and mental care demands during treatments. Developing an intervention that combines cognitive intervention and PMR to improve QoL and remission in patients with AL receiving chemotherapy is necessary.

This study aimed to examine and compare the effects of three psychological interventions on the QoL and remission rates of patients with AL receiving chemotherapy. The results will be beneficial in identifying the best intervention for improving survival outcomes for this population.

Materials and methods

Research design and participants

A randomized, assessor-blind, controlled trial design (RCT) was adopted. The study was conducted for 4 months, from July 2009 to November 2009, in three university-affiliated hospitals in Central China, comprising a baseline survey, an intervention implementation and conclusion, and an immediate postintervention assessment (Figure 1). This RCT adhered to the CONSORT Statement.

The inclusion criteria were as follows: (1) diagnosed with AL based on bone marrow morphology, histochemistry, and immunophenotype; (2) aged ≥18 years; (3) had just begun chemotherapy; (4) Karnofsky Performance Status (KPS) scale score ≥ 60; and (5) were able to provide written informed consent.

Participants who (1) were receiving concurrent radiation therapy or bone marrow transplantation; (2) had other severe physical illnesses; (3) had difficulty with self-expression due to psychological or cognitive issues; or (4) refused to participate or complete questionnaires were excluded from the study.

The sample size estimate per group ($n = 36$) was calculated using G*Power based on the effect size $d = 0.73$, two-trailed $\alpha = 0.05$, and $1\text{-}\beta = 0.86$ (Amir and Ramati, 2002). As a 20% attrition rate was anticipated, the total sample size was 180, with 45 patients per group.

Randomization

Clinical nurses reviewed medical charts and identified eligible participants according to eligibility criteria. The researchers then

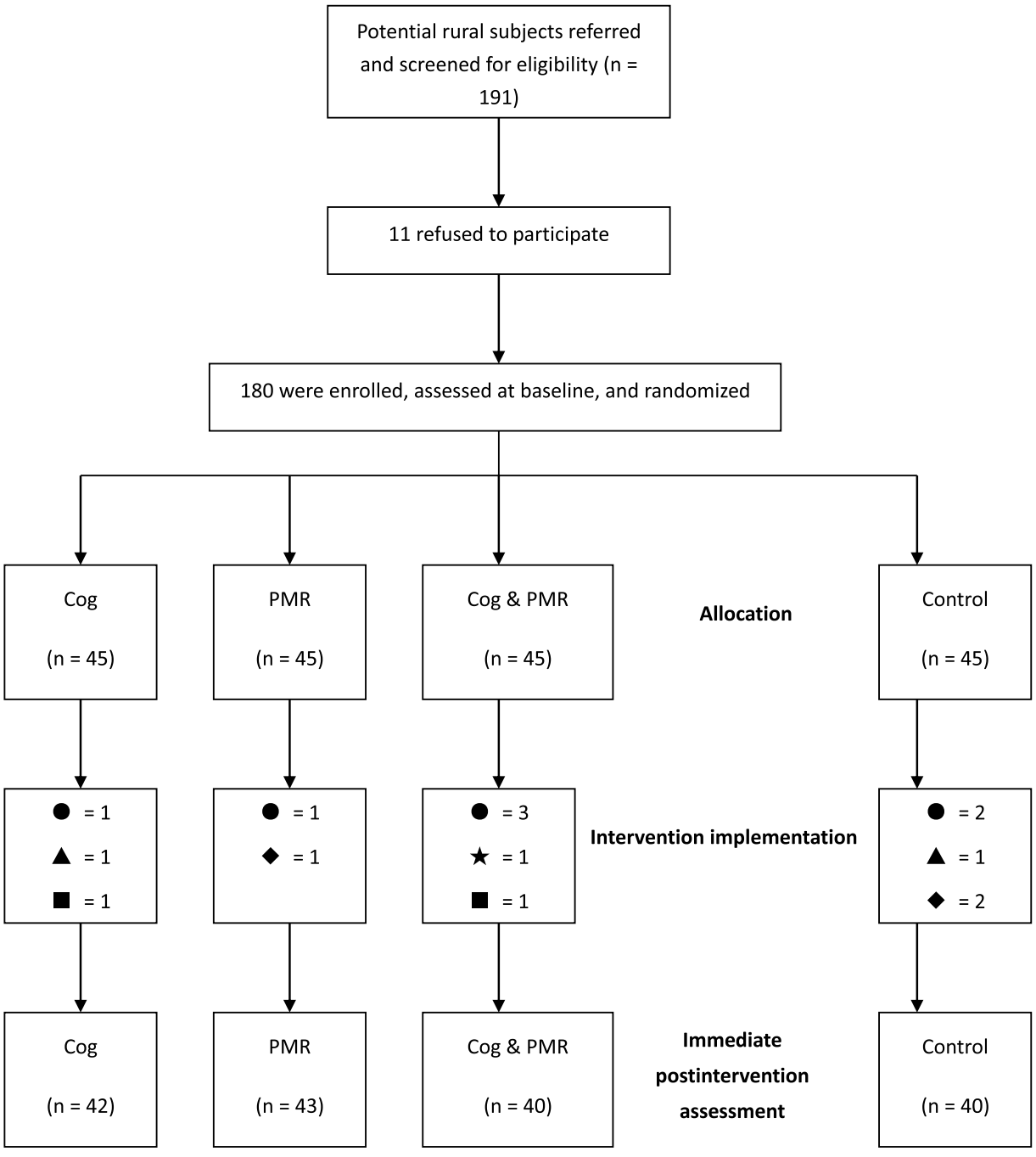

FIGURE 1
Study procedure. Cog, cognitive intervention; PMR, progressive muscle relaxation.

approached and explained the study aim and procedure. Those who agreed to participate gave written informed consent and completed a baseline assessment. The randomization procedure was then performed by a research assistant who was not involved in the recruitment, enrollment, and treatment process. Participants were randomized at a 1:1:1:1 ratio to the intervention groups or control group using an independent web-based randomization system. The research assistant, who performed randomization, informed the participants about the allocation using an opaque and sealed envelope.

Procedure

A total of 180 patients were recruited and randomly divided into four groups. Each group had 45 patients based on a random number table. The three intervention groups received cognitive intervention (G1), PMR (G2), and cognitive intervention plus PMR intervention (G3) apart from routine nursing care. The interventions in the three groups were provided by the principal investigator (FP), who has a master's degree in nursing at the time of intervention implementation, with extensive experiences in hematologic cancer care and

psychological support. The interventionist received the cognitive intervention and PMR training from experienced therapists and experts for 1 year. Before the intervention procedure, the interventionist adopted the standardized intervention manual and practiced with research assistants until fidelity was achieved. During the intervention process, the interventionist received weekly supervision (JZ) to ensure adherence to the study protocol, and self-reflection diaries were documented. The control group (G4) received only routine nursing care, including hospital education and general nursing procedures. All participants completed questionnaires at baseline (T1: the day after admission) and immediately after the intervention (T2). Each group's intervention was conducted in an independent department office, separated from patients' activity area. Participants in each group were encouraged not to discuss the content of the intervention they received with others to avoid contamination.

Cognitive intervention

Interventions were carried out as group activities, with three to five participants in each group. The cognitive intervention comprised three weekly sessions (50–60 min/session). The interventionist directed each activity, guided group discussions, recorded each participant's main idea, and summarized every activity. Each was encouraged to participate in three sessions and completed written assignments after each session.

The first session sought to confirm the negative factors that affect their emotion management. The specific approach was establishing good relationships within patient groups and helping participants recognize depression and emotional disturbances after hospitalization. Furthermore, patients were taught standard methods of psychological self-adjustment, emotion management, and basic knowledge of AL chemotherapeutic treatment.

The second session focused on the recognition of and response to social support, with an emphasis on positive thinking and the use of social support resources. Participants were encouraged to change negative and irrational perceptions and form positive thinking, such as focusing on the good aspects of any given situation. They were also suggested to cultivate active coping styles. The interventionist explained how to effectively use social support resources by combining the content of the expression of each participant.

The third session comprised education, encouragement, and future perspective. Each participant shared a successful experience with the group to build confidence and defeat the illness. The interventionist guided them to appreciate the life meaning and helped them determine their expectations and objectives for the future. Last, the interventionist helped the participants review and examine their understanding of the contents of each cognitive group session.

Progressive muscle relaxation (PMR)

PMR was used as the muscle relaxation intervention without interfering with cancer treatment. An experienced interventionist supervised the participants in 20–30-min PMR twice or thrice daily within 3 weeks.

The relaxation movement was conducted in consecutive steps (McCallie et al., 2006). (1) The interventionist provided a quiet and comfortable environment for relaxation with temperature maintained at 22°C–28°C. Participants were told to lie down evenly and rest for 10 min with their minds focused and without distracting thoughts. (2) Testing and recording the skin electromyography value before relaxation. (3) The interventionist guided the participants to relax with music from an MP3 player (produced by Chinese Medical Multimedia Press) and carry out PMR with each body part. The essential action points of PMR included: tense muscles, paying attention to this feeling of tension, maintaining this tension for 10 s, then relaxing for 5–10 s, and experiencing the sense of the muscles while relaxing. (4) Re-testing and recording skin electromyography after relaxing the muscles.

Signs of successful relaxation included: (1) absence of facial expressions, (2) every part of the muscle was slack, (3) tension in the limbs and neck was relieved, (4) breathing slowed, (5) the feet would abduct when the patient reclined on their back.

Skin electromyography was recorded by a computer biofeedback instrument for monitoring (JD-2A), which is a kind of precision electronic equipment for psychosomatic disease prevention and treatment using the feedback signal of electromyography. The instrument uses sensors to detect the electrical signals of participants' muscles. After amplifying and filtering the signs, the analog quantity is converted into a digital portion through A/D conversion. The muscle activity is expressed by numbers, cursors, and sounds and fed back to trainees. Thus, participants can consciously regulate and control their physiological functions and reshape their emotions, visceral activities, and physical behaviors to achieve the purposes of curing diseases and recovering. Therefore, the utilization of recording skin electromyography *via* JD-2A can realize: (1) Monitoring (Patients' mastery of relaxation techniques may directly affect intervention effects, so the biofeedback signal of skin electromyography can help observe whether participants achieve true relaxation after the intervention); and (2) Feedback (Through the feedback function of the instrument, patients can get timely feedback while performing relaxation, which allows them to adjust the technique dynamically and better master the relaxation technique).

Cognitive intervention plus PMR

The intervention combined the abovementioned cognitive intervention and PMR within 3 weeks. The interventionist conducted PMR first per day. After participants completed this section 2–3 times, each session of the cognitive intervention was conducted in order. Each participant in this group was encouraged to finish the whole intervention program, including the cognitive intervention and PMR part.

Measurements

Sociodemographic questionnaire

The questionnaire included basic demographic information (e.g., sex, age, profession, education level, marital status, and economic condition) and relevant clinical characteristics (e.g., diagnosis, chemotherapy session, number of hospitalizations, satisfaction with medical and nursing care).

European organization for research and treatment of cancer quality of life questionnaire core-30

EORTC-QLQ-C30 (Grulke et al., 2012) is an established QoL questionnaire for cancer patients, including five functional sub-questionnaires (physical, role, emotional, cognitive, and social functions); three symptom sub-questionnaires (weariness, nausea and vomiting, and pain); one sub-questionnaire on general health condition; and six single-factor entries (polypnea, insomnia,

inappetence, constipation, diarrhea, and economic difficulties). The greater the score for general health/QoL, the better the participant's condition; the greater the score for each sub-questionnaire, the poorer the participant's condition. The Chinese version showed acceptable reliability and good construct validity in measuring QoL among Chinese cancer patients (Wan et al., 2008). Cronbach's α ranged from 0.86 to 0.91 for the total scale and subscales in the present study.

Remission

Physicians judged clinical remission on the basis of the Standard of Diagnosis and Therapeutic Effect of Hematopathy (Zhang and Shen, 2007), which categorizes remissions as complete remission (CR), partial remission (PR), and non-remission (NR). Indices for judgment often include clinical manifestations, physical signs, hemograms, and bone marrow characteristics. For AL, CR refers to the absence of leukemic cell infiltration, clinical signs and symptoms, with the patient's life being normal or near normal, Hb ≥ 100 g/l (male) or ≥ 90 g/l (female and children), platelets ≥100 × 109/L, neutrophils ≥100 × 109/L, absence of leukemic cells in the peripheral blood, and changes in the bone marrow.

PR refers to myeloid progenitor cell types 1 and 2 (monoblast + promonocyte or lymphoblast + prolymphocyte) > 5% but ≤20%, failing to meet the CR standard for clinical symptoms or hemograms.

NR (recurrence) refers to one of the following three conditions after complete remission: (1) Myeloid progenitor cell types 1 and 2 (monoblast + promonocyte or lymphoblast + prolymphocyte) > 5% but ≤20%, with a myelogram that fails to meet the CR standard after a course of an effective anti-leukemia treatment; (2) Myeloid progenitor cell types 1 and 2 (monoblast + promonocyte or lymphoblast + prolymphocyte) > 20%; and (3) extramedullary leukemia cell infiltration.

Data analysis

Data collection and sorting were accomplished promptly. Baseline assessment (T1) before randomization and immediate postintervention assessment (T2) were conducted by two independent and trained assessors who were blinded to the study. Database construction, data input, and statistical analysis were all carried out under statistical expert supervision.

SPSS 22.0 was used to establish the database. After inputting data, the researcher used SPSS to sort data and check for logic errors. The GLIMMIX macro process of SAS 9.4 was employed to fit a generalized linear mixed model (GLMM) of measurement data and repeated measurement data. The GLMM was used for parameter estimation and hypothesis testing (Dean and Nielsen, 2007). Descriptive analysis was performed for general data. The Chi-square test was performed to compare data among the four groups. The GLMM was conducted to analyze interaction effects on QoL and remission among groups across time.

In addition, the economic evaluation of the three psychological interventions encompassed a cost-effectiveness analysis (CEA) (Sanders et al., 2019). Incremental Cost-effectiveness Ratio (ICER), an economic value of an intervention compared with an alternative way, was calculated by the difference in cost between target intervention and usual care, divided by the difference in their effect (Chen et al., 2020). It represents the average incremental cost associated with one additional unit of the effect measure. ICERs are most valuable when the new intervention is costly but generates improved health effects. It can help contain health care costs while minimizing adverse health consequences (Dakin et al., 2015). ICERs reported by economic evaluations are compared with a predetermined threshold to decide whether choosing the new intervention is an efficient resource use.

Ethical consideration

The study was conducted following the Helsinki Declaration of the World Medical Association Assembly. The experimental procedure was approved by the Clinical Research Ethics Review Committee of Central South University. Research significance, anonymity principles, collected data confidentiality, and the right to leave the study at any time without any penalty were explained to participants. All individuals participated voluntarily and signed the informed consent form before randomization.

Results

Demographics and clinical characteristics

A total of 180 participants were recruited for the study, with 45 participants in each group. At the end of the study, a total of 165 participants completed the whole intervention with a completion rate of 91.7%. The number of valid participants who completed the study in each group was 42, 43, 40, and 40, respectively. Reasons for lack of completion were failure to keep in contact ($n = 7$), quitting the study ($n = 3$), illness exacerbation ($n = 2$), being discharged ($n = 2$), or therapy changed to bone marrow transplantation ($n = 1$).

The mean age was 34.52 ± 13.27 (14–66) years. Most participants were males ($n = 93$, 56%), married ($n = 102$, 62%), and completed high school or polytechnic school ($n = 66$, 40%). No between-group differences in demographics or clinical characteristics were observed ($p > 0.05$), except ethnic group and years of disease course ($p < 0.05$; Table 1).

Changes in QoL

The raw score for general health conditions was 4.11 ± 1.21. After conversion, all standard scores for function dimensions, symptom dimensions, and six single-factor dimensions decreased after interventions, with scores for general health improved (Table 2).

Effects of the psychological interventions on QoL

In the GLMM model, the total score of QoL and score for each dimension were set as response variables. The fixed effects involved the intervention group, time, ethnic group, disease course, and intervention–time interactions; meanwhile, the random effects involved individual factors. The model was used as a covariate to account for the confounding effects of ethnic group and disease course. The results demonstrated a main intervention effect on the total QoL score ($p < 0.05$). The main time

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TABLE 1 Sample demographics and clinical characteristics.

Item	Classification	Cognitive group n=42		PMR group n=43		Cognitive plus PMR group n=40		Control group n=40		χ^2	p^a
		n	%	n	%	n	%	n	%		
Sex	Male	20	48	21	49	24	60	28	70	5.54	0.137
	Female	22	52	22	51	16	40	12	30		
Age	≤35	18	43	28	65	18	45	20	50	5.14	0.162
	35	24	57	15	35	22	55	20	50		
Ethnic group	Han	40	95	33	77	37	93	38	95	21.71	0.007**
	Ethnic minor	2	5	10	23	3	8	2	5		
Religion	No	40	2	42	98	36	90	37	93	2.41	0.426
	Yes	95	5	1	2	4	10	3	7		
Residence	Country	19	45	24	56	24	60	23	58	2.12	0.549
	Town	23	55	19	44	16	40	17	42		
Marital status	Married	28	67	24	56	26	65	24	60	8.52	0.708
	Single/divorced	14	33	19	44	14	35	16	40		
Junior middle school and below	Junior middle school and below	22	52	14	33	12	30	15	38	3.51	0.319
	High school or polytechnic	11	26	16	37	21	53	18	45		
	College and above	9	21	13	30	7	18	7	18		
Occupation	Workman	7	17	4	9	3	7	6	15	25.8	0.211
	Farmer	14	33	13	30	9	23	10	25		
	Official	2	5	2	5	6	15	0	0		
	Teacher	5	12	4	9	4	10	3	7		
	Student	8	19	9	21	8	20	9	23		
	Other	3	7	1	2	1	2	0	0		
	Unemployed	3	7	10	24	9	23	12	30		
Economic condition	Very poor	11	26	14	33	8	20	10	25	5.31	0.151
	Poor	4	10	11	26	4	10	5	13		
	Ordinary	25	60	14	33	22	55	23	58		
	Rich	2	5	4	9	6	15	2	5		
Admission diagnosis	AML	21	50	29	67	26	65	24	60	3.15	0.369
	ALL	21	50	24	23	14	35	16	40		
Disease course year	≤1 year	35	81	26	60	36	90	34	85	9.80	0.020
	>1 year	7	19	17	40	4	10	6	15		
Initial treatment	Yes	13	31	8	19	8	20	9	23	2.18	0.537
	No	29	69	35	81	32	80	31	78		
Phase of chemotherapy	Induction therapy	21	50	13	30	15	38	14	35	9.32	0.156
	Consolidation therapy	13	31	11	26	15	38	16	40		
	Maintenance therapy	8	19	19	44	10	25	10	25		
Hospitalization frequency	1–5	28	67	27	63	28	70	30	75	4.85	0.563
	6–10	12	29	13	30	11	28	6	15		
	11–15	2	5	3	7	1	3	4	10		
Other diseases	Associated	6	14	9	21	9	23	4	10	2.94	0.401
	Unassociated	36	86	34	79	31	78	36	90		
KPS score	90	10	24	7	16	9	23	7	18	0.81	0.847
	80	11	26	14	33	16	40	15	38		
	70	11	26	14	33	10	25	11	28		
	60	10	24	8	19	5	13	7	18		

[a]Value of p for controls vs. patients based on the chi-square test for categorical data. PMR, progressive muscle relaxation.

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TABLE 2 Quality of life measurement scale scores before and after interventions [$\bar{x}$ ±standard deviation (SD)].

Dimension	PMR (n=43)		Cognitive intervention (n=42)		Cognitive intervention plus PMR (n=40)		Control group (n=40)	
	Before	After	Before	After	Before	After	Before	After
Functional dimensions								
Physical function	2.23 ± 0.10	1.60 ± 0.35	2.20 ± 0.11	1.90 ± 0.45	2.17 ± 0.11	1.60 ± 0.36	2.17 ± 0.11	1.90 ± 0.56
Role function	2.78 ± 0.13	1.90 ± 0.63	2.40 ± 0.13	1.80 ± 0.62	2.66 ± 0.14	1.50 ± 0.40	2.55 ± 0.14	2.66 ± 0.12
Emotional function	1.67 ± 0.07	1.60 ± 0.46	1.70 ± 0.07	1.70 ± 0.38	1.56 ± 0.08	1.50 ± 0.42	2.25 ± 0.08	2.25 ± 0.62
Cognitive function	1.67 ± 0.09	1.40 ± 0.44	1.50 ± 0.09	1.20 ± 0.35	1.89 ± 0.09	1.40 ± 0.44	1.78 ± 0.09	1.95 ± 0.63
Social function	2.70 ± 0.12	2.40 ± 0.76	2.50 ± 0.12	2.00 ± 0.75	2.55 ± 0.13	1.90 ± 0.62	2.43 ± 0.13	2.25 ± 0.77
Symptom dimensions								
Weariness	2.33 ± 0.09	1.80 ± 0.62	2.40 ± 0.09	1.70 ± 0.52	1.93 ± 0.09	1.50 ± 0.44	2.40 ± 0.09	2.11 ± 0.66
Nausea and vomiting	2.23 ± 0.12	1.50 ± 0.48	1.80 ± 0.12	1.40 ± 0.41	2.05 ± 0.13	1.40 ± 0.44	2.05 ± 0.13	1.78 ± 0.65
Pain	1.97 ± 0.10	1.50 ± 0.08	2.10 ± 0.10	1.76 ± 0.09	2.19 ± 0.11	1.65 ± 0.09	2.20 ± 0.11	1.99 ± 0.09
Single dimensions								
Polypnea	1.61 ± 0.10	1.30 ± 0.47	1.80 ± 0.11	1.50 ± 0.59	1.68 ± 0.11	1.20 ± 0.42	1.85 ± 0.11	1.63 ± 0.59
Insomnia	2.00 ± 0.14	1.40 ± 0.63	2.10 ± 0.14	1.70 ± 0.84	2.23 ± 0.14	1.70 ± 0.69	2.18 ± 0.14	2.13 ± 0.88
Inappetence	2.49 ± 0.14	1.50 ± 0.50	2.30 ± 0.14	1.70 ± 0.66	2.05 ± 0.14	1.60 ± 0.66	2.13 ± 0.14	2.05 ± 0.82
Constipation	1.72 ± 0.12	1.40 ± 0.50	1.50 ± 0.12	1.40 ± 0.63	1.83 ± 0.12	1.10 ± 0.39	1.73 ± 0.12	1.63 ± 0.71
Diarrhea	1.77 ± 0.11	1.56 ± 0.09	1.4 ± 0.11	1.24 ± 0.09	1.60 ± 0.11	1.43 ± 0.09	1.70 ± 0.11	1.50 ± 0.09
Economic difficulty	3.14 ± 0.14	3.40 ± 0.62	2.90 ± 0.15	3.10 ± 0.70	2.85 ± 0.15	3.00 ± 0.75	3.08 ± 0.15	3.05 ± 0.64
General health	3.92 ± 0.19	5.30 ± 0.84	4.10 ± 0.19	5.30 ± 0.71	4.13 ± 0.19	5.50 ± 0.74	4.26 ± 0.19	4.93 ± 0.69

PMR, progressive muscle relaxation.

effect was insignificant ($p > 0.05$). An interaction was found between intervention and time ($p < 0.05$). No significant differences were observed for ethnic group or disease course ($p > 0.05$; Table 3). Regarding the total score, in the GLMM model (Table 4), the estimated values for groups 1, 2, and 3 were −0.10, −0.11, and −0.15, respectively. These results demonstrated the efficacy of the experimental groups compared with that of the control group. The advantage efficacy of the experimental groups was 1.02 times greater than the control group. The estimated value for the time group was 0.02, demonstrating that the QoL after interventions significantly improved (Table 4).

For the 15 dimension scores, the interactions between intervention and time groups were observed ($p < 0.05$), except for emotional function, weariness, polypnea, inappetence, constipation, diarrhea, economic difficulty, and general health. As a covariate, ethnic group differences were insignificant for any dimension, except weariness ($p > 0.05$). Differences in disease course were insignificant for any dimension, except emotional function and pain ($p > 0.05$; Tables 3, 4).

In sum, cognitive intervention plus PMR significantly improved the overall QoL, four functional dimensions, two symptom dimensions, and insomnia.

Changes in remission degree over time

The GLMM was built by setting remission degree as the response variable. Intervention group, time, ethnic group, disease course, and interaction between intervention and time were fixed effects, whereas individual factors were random effects. A significant difference was found in time, with different effects at different times (Type III fixed effects of remission over time: $F = 13.49$, $p < 0.05$). The interaction effects of the interventions were insignificant between intervention and time groups ($p > 0.05$; Tables 5).

Cost-effectiveness of the three psychological interventions

According to ICER calculation, considering that the estimated values for the PMR group, cognitive intervention group, and cognitive intervention plus PMR group were −0.10, −0.11, and −0.15, respectively, the costs of the three interventions were 1,850 RMB, 3,150 RMB, and 5,000 RMB. Thus, compared with cognitive intervention, the ICER value of cognitive intervention plus PMR was 46,250 RMB. Compared with the PMR, the ICER value of cognitive intervention plus PMR was 63,000 RMB. Compared with the PMR, the ICER value of cognitive intervention was 130,000 RMB. As no research and recommendation on willingness to pay (WTP) in China is currently found, our study adopted three times Chinese *per capita* in 2019 (70,892 RMB) according to WHO regulations, which is 212,676 RMB as WTP. Thus, ICER values indicated the cost-effectiveness of all three psychological interventions, among which the cognitive intervention plus PMR program showed the most significant cost-effectiveness advantage.

Discussion

To our knowledge, our study is one of the few to conduct a psychological intervention combining cognitive intervention and PMR and examine its

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TABLE 3 Type III fixed effects of quality of life (n=165).

Effect		Group		Time		Ethnic group		Disease course		Group*time	
		Num DF [a]3	Den DF [b]159	Num DF 1	Den DF 160	Num DF 1	Den DF 159	Num DF 1	Den DF 161	Num DF 3	Den DF 160
Total score	*F*	4.71		94.51		1.06		1.57		6.74	
	p	<0.01**		<0.01**		0.30		0.21		<0.01**	
Physical function	*F*	1.41		128.08		4.47		4.84		4.55	
	p	0.24		<0.01**		0.04*		0.03		<0.01**	
Role function	*F*	3.42		88.09		2.44		1.68		16.46	
	p	0.02*		<0.01**		0.12		0.20		<0.01**	
Emotional function	*F*	11.75		0.00		2.08		46.60		0.00	
	p	<0.01**		1.00		0.15		<0.01**		1.00	
Cognitive function	*F*	6.21		16.87		0.42		0.36		9.07	
	p	<0.01**		<0.01**		0.52		0.55		<0.01**	
Social function	*F*	1.62		37.60		2.79		1.02		3.01	
	p	0.19		<0.01**		0.10		0.31		0.03*	
Weariness	*F*	6.89		95.46		8.52		0.04		1.78	
	p	<0.01**		<0.01**		< 0.01**		0.83		0.15	
Nausea and vomiting	*F*	1.41		85.69		0.00		0.22		2.47	
	p	0.24		<0.01**		0.98		0.64		0.06	
Pain	*F*	2.04		64.24		0.08		5.63		2.78	
	p	0.11		<0.01**		0.78		0.02*		0.04*	
General health	*F*	0.33		115.25		2.51		0.00		1.36	
	p	0.80		<0.01**		0.16		0.98		0.26	
Polypnea	*F*	3.32		40.20		0.29		1.65		0.98	
	p	0.02*		<0.01**		0.59		0.20		0.41	
Insomnia	*F*	1.67		38.31		0.26		0.10		3.68	
	p	0.18		<0.01**		0.61		0.76		<0.01**	
Inappetence	*F*	1.20		37.75		0.03		2.11		4.45	
	p	0.31		<0.01**		0.86		0.15		<0.01**	
Constipation	*F*	0.78		27.63		0.85		1.69		4.60	
	p	0.50		<0.01**		0.36		0.19		<0.01**	
Diarrhea	*F*	3.90		7.23		0.29		0.58		0.06	
	p	0.01**		0.01**		0.59		0.45		0.98	
Economic difficulty	*F*	0.75		9.44		0.66		0.09		1.02	
	p	0.52		<0.01**		0.42		0.76		0.38	

[a]Degree of freedom of numerator; [b]Degree of freedom of denominator. *$p \leq 0.05$; **$p < 0.01$.

effects on QoL and remission in AL patients receiving chemotherapy. Our findings indicate that the QoL in AL patients receiving chemotherapy in the cognitive intervention plus PMR group was significantly improved compared with other groups. Cognitive intervention plus PMR is highly cost-effective for AL patients receiving chemotherapy in China.

Effects of different interventions on the QoL of patients with AL treated with chemotherapy

The results showed that the cognitive intervention plus PMR group significantly improved the total QoL score and symptom dimensions scores, i.e., physical function, role function, and cognitive function, consistent with Persson et al. (2001). The reason may be through cognitive intervention, participants may have had strategies for handling various situations. As interventions were conducted at the initiation of chemotherapy, PMR–as a necessary relaxation therapy–in the combined intervention may prevent or considerably delay the onset of conditioned responses, therefore relieving distress to some degree (Tian et al., 2020). However, effects on emotional functions differ from Alibhai et al. (2012). This result may be because medical expenses are a considerable burden for most patients and their families, especially for patients in rural areas in China, weakening optimism and satisfaction with life. Psychological coping resources may also be poor without adequate financial resources (Zhang et al., 2009). Weariness insignificantly improves in intervention

TABLE 4 Fixed effects of quality of life results (n=165).

	Group 1[a]			Group 2[b]			Group 3[c]			Time 1[d]			Group 1*time 1			Group 2*time 1			Group 3*time 1		
	E[e]	*t*	*p*[f]	*E*	*t*	*p*	*E*	*t*	*p*	*E*	*t*	*p*	*E*	*t*	*p*	*E*	*t*	*p*	*E*	*t*	*p*
Total score	−0.10	−3.40	<0.01**	−0.11	−3.81	<0.01**	−0.15	−5.16	<0.01**	0.02	1.08	0.28	0.10	3.49	<0.01**	0.08	2.89	<0.01**	0.12	4.20	<0.01**
Physical function	−0.09	−1.51	0.13	0.05	0.88	0.38	−0.11	−1.80	0.07	0.13	3.61	<0.01**	0.14	2.91	<0.01**	0.01	0.23	0.82	0.12	2.47	0.01**
Role function	−0.28	−3.27	<0.01**	−0.36	−4.42	<0.01**	−0.48	−5.83	<0.01**	−0.06	−1.00	0.32	0.40	4.91	<0.01**	0.36	4.34	<0.01**	0.56	6.81	<0.01**
Emotional function	−0.20	−3.08	<0.01**	−0.26	−4.20	<0.01**	−0.36	−5.73	<0.01**	−2 E-16	−0.00	1.00	2.56 E-16	0.00	1.00	3.32 E-16	0.00	1.00	2.02 E-16	0.00	1.00
Cognitive function	−0.28	−3.83	<0.01**	−0.40	−5.73	<0.01**	−0.29	−4.00	<0.01**	−0.12	−2.28	0.02*	0.24	3.33	0.00**	0.29	4.10	<0.01**	0.35	4.83	<0.01**
Social function	0.09	1.08	0.28	−0.11	−1.32	0.19	−0.14	−1.79	0.08	0.08	1.35	0.18	0.03	0.35	0.73	0.15	1.84	0.07	0.21	2.58	0.01**
Weariness	−0.18	−2.61	0.01**	−0.15	−2.32	0.02*	−0.29	−4.44	<0.01**	0.15	3.00	<0.01**	0.11	1.68	0.10	0.15	2.23	0.03*	0.09	1.29	0.20
Nausea and vomiting	−0.14	−1.73	0.09	−0.18	−2.26	0.03*	−0.16	−2.00	0.05*	0.14	2.60	0.01**	0.19	2.48	0.01**	0.08	1.05	0.30	0.16	2.08	0.04*
Pain	−0.25	−3.34	<0.01**	−0.12	−1.69	0.09	−0.19	−2.66	0.01**	0.09	1.71	0.09	0.19	2.52	0.01**	0.11	1.41	0.16	0.19	2.46	0.01**
Polypnea	−0.17	−2.03	0.04*	−0.05	−0.59	0.56	−0.26	−3.13	<0.01**	0.14	2.24	0.03*	0.04	0.51	0.61	0.03	0.37	0.71	0.14	1.62	0.11
Insomnia	−0.32	−3.28	<0.01**	−0.22	−2.34	0.02*	−0.21	−2.13	0.03*	0.01	0.22	0.82	0.27	2.86	<0.01**	0.23	2.43	0.02*	0.26	2.80	0.01*
Inappetence	−0.28	−3.01	<0.01**	−0.14	−1.53	0.13	−0.20	−2.12	0.04*	0.03	0.36	0.72	0.37	3.52	<0.01**	0.17	1.59	0.11	0.17	1.59	0.11
Constipation	−0.16	−1.36	0.18	−0.14	−1.59	0.11	−0.28	−3.10	<0.01**	0.03	0.51	0.61	0.12	1.30	0.20	0.10	1.03	0.31	0.17	1.59	0.11
Diarrhea	0.06	0.64	0.52	−0.16	−1.80	0.07	−0.04	−0.47	0.64	0.13	1.60	0.11	−0.02	−0.15	0.88	−0.03	−0.24	0.81	−0.05	−0.41	0.68
Economic difficulty	0.11	1.53	0.13	0.02	0.25	0.81	−0.01	−0.07	0.94	−0.01	−0.22	0.82	−0.13	−1.73	0.09	−0.06	−0.87	0.38	−0.08	−1.08	0.28
General health	0.09	1.31	0.19	0.07	1.07	0.29	0.12	1.81	0.07	−0.21	−3.64	<0.01**	−0.14	−1.80	0.07	−0.10	−1.20	0.23	−0.14	−1.71	0.09

[a]PMR group; [b]Cognitive intervention group; [c]Cognitive intervention plus PMR group; [d]After the intervention; [e]E = Estimate; [f]Pr > |t|; *$p \leq 0.05$; **$p < 0.01$.

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TABLE 5 Fixed effects of remission results (n=165).

Effect	Group	Time	Estimate	t	p
Intercept1			−2.66	−3.98	<0.01**
Intercept2			1.99	2.99	<0.01**
Group	1		−0.95	−1.22	0.22
Group	2		−0.65	−0.88	0.38
Group	3		−1.08	−1.43	0.16
Group	4		0		
Time		1	−1.15	−2.18	0.03*
Time		2	0		
Ethnic group			0.60	2.05	0.04*
Disease course			0.35	1.36	0.18
Group*time	1	1	0.18	0.24	0.81
Group*time	1	2	0		
Group*time	2	1	0.04	0.05	0.96
Group*time	2	2	0		
Group*time	3	1	0.46	0.61	0.54
Group*time	3	2	0		
Group*time	4	1	0		
Group*time	4	2	0		

Group 1: PMR group; Group 2: Cognitive intervention group; Group 3: Cognitive intervention plus PMR group; Group 4: Control group; Time 1: Immediately post-intervention; T2: Baseline. *$p \leq 0.05$; **$p < 0.01$.

groups because it is a prominent symptom of AL survivors. After all, it interferes with daily living and the ability to perform social roles (Zhang et al., 2009). The other possible reason may be due to personality factors, supported by a previous systematic review that coping strategies depend on individual internal adaptation, on an unconscious level, resulting in life satisfaction, in combination with external adjustment, including actions on a conscious level, resulting in well-being (Leamy et al., 2011). Participants accustomed to a strong sense of experiential avoidance and self-defense may have difficulty generating timely internal adaptations and external actions, thus maintaining fatigue-related and emotional problems. Nevertheless, weariness improved over time from the start of treatment to the end of the study. In future studies, adding follow-up evaluations to further confirm these intervention effects in AL patients treated with chemotherapy is essential.

Based on these results, the cognitive intervention plus PMR group indicated the best outcomes with improvements in total QoL score, most dimensions, and the greatest cost-effectiveness. These results are consistent with Espie et al. (2008) and Hopko et al. (2008) and suggest that combined behavioral and cognitive interventions can tremendously improve well-being. The possible reason for the effects is the brief and group-based intervention. The brief cognitive intervention plus PMR intervention may make them less difficult to incorporate into existing medical systems and promote adherence. The group format may provide opportunities for social interaction and support along the leukemia trajectory, thus remarkably improving social function (Hunter et al., 2009). The other probable reason is that according to the stress theory of Lazarus and Folkman (1984), the cognitive evaluation of a stressful situation determines the coping behavior and affect what follows. Adding the PMR part further promotes participants' ability to manage the difficulties they may face in the future. The effects of combined cognitive and muscle relaxation can also be supported by previous studies on different cancer patients (O'Dowd et al., 2006; Hunter et al., 2009).

Moreover, this study indicated that cognitive intervention improves the total QoL score, role and cognitive function, weariness and insomnia compared with the control group. Chemotherapy-associated cognitive dysfunction is an essential factor affecting prognosis, severely impairing QoL (Vetto and Vetto, 2007), with an overall consensus that cognitive therapy improves cancer patients' QoL (Foley et al., 2010). AL and its treatment are adverse severe life events, which induce various negative emotions, impairing mental and physical health. Changing the cognitive process and concepts that emerge in this process, cognitive therapy corrects patients' maladaptive feelings and behaviors, thus improving mental and physical health and treatment efficacy.

The PMR's capacity to improve cancer patients' QoL receiving chemotherapy was established in a previous study (Kwekkeboom et al., 2008). However, PMR had a weaker effect than cognitive intervention or cognitive intervention plus PMR in our study. Different from solely conducting PMR, adding a cognitive portion may help participants adjust to their internal experience, increase their endurance to the disease, and enhance self-efficacy through peer support. In turn, it promotes participants' greater motivations to participate in interventions and make behavioral changes, finally improving their QoL.

Different intervention methods suggest that the psychological cognition of patients with AL significantly benefits their QoL more than PMR. A significant positive correlation exists between positive psychology and QoL in AL patients. Compared with PMR, which indirectly changes participants' negative emotions through physical relaxation, cognitive therapy is nurses' direct intervention in participants' cognitive and psychological states that is more beneficial in relieving their negative emotions. The intervention combined with both methods further extends the intervention effects in this population.

Effects of different interventions on the remission of patients with AL treated with chemotherapy

Cancer remission is of utmost importance to cancer patients and their families. Data show no significant difference among the four groups but a significant difference over time. Hence, the remission of patients with AL receiving chemotherapy is only marginally related to three interventions. Remission is closely associated with natural disease course and its treatment. These interventions do not change these patients' remission degrees and survival rates. However, psychological interventions can improve QoL and patients' general mental and physical conditions, permitting comfortable and dignified lives. Considering that QoL is closely related to disease remission rates and survival outcomes, different intervention effects on remission rates should be further investigated by increasing follow-up time points.

Limitations

Several limitations should be noted in our study. First, the convenience sampling method and practical reasons may reduce the representativeness of the sample and the generalization of our findings.

Second, the effects are only examined immediately after interventions due to time constraints and data collection challenges (e.g., missing participant contacts). Considering that the remission rate improvement cannot be instantaneous and cognitive intervention effects on QoL can strengthen over time as patients incorporate psychological intervention skills into everyday lives, long intervention procedures with multiple follow-up time points are recommended to confirm the effects and explore its maintenance effects in this population. Third, the intention-to-treat analysis was not adopted in this study; alternatively, per-protocol (PP) analysis was used to evaluate the effects of actually receiving interventions, which may not preserve the randomization and instead create bias. Thus, future studies may consider using intention-to-treat and PP analyzes and reporting alongside each other for comparison.

Research and clinical practice implications

Our results provide implications for further research. First, cognitive intervention plus PMR is promising and cost-effective in improving QoL. More rigorous RCTs with follow-up time points are suggested to further clarify its effects in strengthening remission rates in AL patients treated with chemotherapy. Second, understanding patient experiences and perceptions during interventions may help refine existing intervention protocols. Therefore, qualitative studies are necessary to enrich our understanding of psychological intervention effects on this population. In addition, exploring the mechanisms of different psychological interventions in improving the QoL of AL patients receiving chemotherapy is profound to help clarify mediating intervention factors.

Our findings also provide several implications for clinical nursing practice. AL patients receiving chemotherapy experience severe physical, mental, and social strains imposed by the disease and treatment and decreased QoL, threatening their remission rates. Psychological interventions are highly recommended, especially cognitive–behavioral interventions. Our study confirms clinical nurses' great potential in providing psychological support to oncology patients. In this case, clinical nursing administrators should pay further attention to training psychological nurses in oncology departments, making psychological support become a part of daily cost-effective routine care during hospitalization and after discharge. In addition, our study gives the initial support for providing AL patients with brief and group-based cognitive intervention plus PMR to improve their QoL. Hence, repeated bolus maintenance sessions (Trask et al., 2003) provided on a regular nursing basis may be beneficial in extending the initial change observed in the current study and tracking their progress.

Conclusion

The cognitive intervention plus PMR intervention produces the best results for AL patients receiving chemotherapy with good cost-effectiveness. Cognitive intervention is an economical and convenient method when the required conditions are in place. The effect of PMR is the poorest among the three interventions, yet it is effective in improving QoL and can be used under certain circumstances. More rigorous RCTs with larger samples and longer follow-ups are recommended to further confirm these psychological intervention effects.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving human participants were reviewed and approved by the study was reviewed and approved by the Xiangya School of Nursing, Central South University. The patients/participants provided their written informed consent to participate in this study.

Author contributions

FP, HL, and JZ conceived the study. FP and XL collected and analyzed the data. JZ supervised the study conduction. FP and HL wrote the first draft of the manuscript. HZ and YL interpreted the results. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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The effect of perceived stress on depression in college students: The role of emotion regulation and positive psychological capital

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Introduction: College students have become a high prevalence group and vulnerable group of depression. The present study aims to explore the effect of perceived stress on depression in a sample of Chinese college students and proposes that both emotion regulation and positive psychological capital play a moderating role between the two, so as to provide rational intervention for the prevention of potential depression among college students.

Method: In this study, 1,267 college students (46.4% female) from a university in western China were selected for the study using a whole-group convenience sampling method.

Results: After controlling for gender, this study found that both cognitive reappraisal and positive psychological capital positively moderated the relationship between perceived stress and depression, and both significantly inhibited depression in high and low stress perceivers, and the inhibitory effect was more pronounced in high stress perceivers, but expression inhibition did not moderate the relationship between perceived stress and depression.

Discussion: The results suggest that college students can be helped to cope with the negative effects of perceived stress on depression by increasing the frequency of their use of cognitive reappraisal strategies and encouraging the accumulation of positive psychological capital. This study provides theoretical and practical implications for rational interventions for depression among college students.

KEYWORDS

perceived stress, depression, emotion regulation, positive psychology capital, moderating effect

Introduction

Depression is a widespread mood disorder accompanied by key features such as depressed mood, reduced volitional activity, and reduced verbal actions (Smith and De Torres, 2014). It not only leads to impairment of social functions such as socialization and learning, but even triggers self-injurious and suicidal behaviors in individuals (Li et al., 2015). Depression is extremely common among the college student population (Liu et al., 2019). A Meta-analysis found a relatively high prevalence of depression among college students (31.38%) compared to the general population (5–6%) (Wang et al., 2020; Zhang et al., 2020). Recent studies have found that the prevalence of depression among Chinese college students reached 37.0% during the

Covid-19 epidemic (Zhou et al., 2021). Notably, several studies have shown that depression causes severe impairments in cognitive and social functioning in some college students currently, such as decreased executive and memory functions, difficulty concentrating, and social avoidance (Rock et al., 2014), and individuals with severe depression are prone to severe insomnia, self-injury, and suicide due to their extreme psychological distress (Riemann et al., 2020). It is evident that current college students have become a high prevalence group of mental illness and a vulnerable group of mental health. Depression among college students deserves to be focused on because of its larger scope, deeper impact, and more serious outcome (Yang and Chen, 2015). Therefore, this study attempts to investigate the intrinsic regulatory mechanisms affecting depression among college students and provide intervention for the reasonable prevention of potential depression among college students.

Literature review

Perceived stress and depression

Perceived Stress is a stress perception that refers to an individual's perception of the degree of stress caused by an external event, as well as the individual's interpretation of the stressful event and perception of its objective existence as a variety of physical and mental tensions and discomforts (Cohen et al., 1983; Yang and Huang, 2003). Stress is seen as an important risk factor for mental health, and high stress perceptions often lead to a range of mental health impairments (O'Connor et al., 2021). The non-homeostatic model of stress suggests that the more stressful events an individual experiences and the longer they last, the more likely they are to perceive greater stress and the more likely they are to experience non-homeostatic states of mind and body, such as excessive emotional arousal (Yan et al., 2010). Empirical studies have shown that the higher the level of stress perception, the more likely it is to cause depression (Anyan and Hjemdal, 2016; Yang et al., 2020). Stressful events induce individuals' perceived stress, especially in individuals who are more sensitive to stress. Perceptions of stress contribute to an increase in negative emotional experiences and a decrease in positive emotional experiences (Li et al., 2021) and a decrease in life satisfaction and psychological well-being (Fu et al., 2012), which in turn leads to depression (Li et al., 2015). In addition, compared to men, women are more sensitive to stress perception, who are less resilient, have higher emotional reactions to stress, have a more difficult time recovering from negative states, and are therefore at higher risk for depression (Liu et al., 2021). Therefore, it is necessary to explore the underlying psychological mechanisms between perceived stress and depression and then provide a scientific basis for the reasonable prevention of depression among college students.

Moderating role of emotion regulation

Emotion regulation refers to the efforts of individuals to keep their emotions in a balanced and stable state to adapt and meet the needs of the social environment in a certain situation (Gross, 2015a). It is one of the important predictors of mental health by providing individuals with information related to their environment and protecting them from maintaining emotional balance (Khodami and Sheibani, 2020). The Emotion Regulation Process Model proposes that cognitive reappraisal and expression inhibition are two regulatory strategies that act on different emotion processing processes (Gross, 2015b). Several studies have found that greater use of cognitive reappraisal strategies implies a better state of mental health (Yang et al., 2020) and frequent use of expression-inhibitory strategies leads to increased psychological symptoms and impaired social functioning (Aldao et al., 2010; Lee et al., 2020). The interaction model of psychological resilience (Masten, 2001; Masten and Red, 2002) suggests that risk factors affect individuals less when protective factors are present than when they are not, that protective factors confer immunity to stress/adversity (the degree of immunity to individuals may vary across protective factors), and that protective factors influence the role of stress/adversity factors to psychosocial development through regulatory mechanisms. Research suggests that on a social reality level, individuals who use cognitive reappraisal strategies are more likely to share emotional experiences with others, build intimate relationships, and have more social support (Lu et al., 2019). Based on this, it is hypothesized that cognitive reappraisal acts as a buffer between perceived stress and depression in college students, and the interaction between protective factors (cognitive reappraisal) and risk factors (perceived stress) will reduce the possibility of adverse outcomes. When the frequency of cognitive reappraisal was low, the depression level of college students tended to increase significantly with the increase of perceived stress; when the frequency of cognitive reappraisal was high, the depression level of college students tended to increase slowly with the increase of perceived stress. In addition, cognitive reappraisal is a strategy to reduce negative emotional experiences with positive emotional connotations, whereas expression inhibition suppresses negative emotions, which remain (Lu et al., 2019). According to Li (2012) "provide timely help" model, individual resource factors moderate the relationship between risk factors and social adaptation, buffer or weaken the adverse effects of risk factors, and the development disadvantage of those with high risk compared to those with low ecological risk is reflected more in the case of low individual resources than in the case of high individual resources. Expression inhibition as a maladaptive emotion regulation strategy has been shown to consume more cognitive resources than adaptive emotion regulation strategies, as evidenced by inducing stronger peripheral physiological responses and limbic system activation (Yuan et al., 2014). Based on this, the present study hypothesized that the depression level of college students showed a significant upward trend with the increase of perceived stress when the frequency of expression inhibition use was high, and the depression level of college students decreased at a slower rate with the increase of perceived stress when the frequency of expression suppression use was low.

Moderating role of positive psychological capital

Positive psychology reawakens focus on the positive qualities and good living of human being. In contrast to traditional cognitive theories of depression that focus on negative factors, positive

psychology suggests that depression is caused by a lack of positive resources (Zhou et al., 2010). Positive psychological capital refers to a positive psychological state during an individual's growth and development, including four core components of resiliency, optimism, hope, and self-efficacy (Ye and Fang, 2015), and effectively promote healthy behaviors by helping individuals cope with challenging environments (Cho et al., 2021). Also according to the interaction model of psychological resilience and the "provide timely help" model, psychological capital is a protective factor against depression in adolescents, and individuals with higher levels of psychological capital are able to use their positive abilities to cope with negative emotions, enhance their own protectiveness and adaptability to the outside world, and are less likely to experience emotional problems in risky stressful situations (Li et al., 2014). Individuals with lower levels of psychological capital, on the other hand, are more susceptible to their own state and may not be able to adequately mobilize internal resources to cope with negative emotions when faced with more stress, and thus may be more prone to emotional problems in risky stressful situations (Jeong and Jung, 2017; Turliuc and Candel, 2022). Based on this, it is hypothesized that positive psychological capital has a buffering effect on depression among college students. When the level of positive psychological capital is high, the depression level of college students tends to decrease significantly with the increase of perceived stress; when the level of psychological capital is low, the depression level of college students decreases slowly with the increase of perceived stress.

The current study

In order to understand the effects of emotion regulation and positive psychological capital on the relationship between perceived stress and depression, a group of college students was selected as subjects in this study. Based on the "non-stationary" model of stress, the interaction model of psychological resilience, and the "provide timely help" model, we investigated the effects of perceived stress on depression, and further explored the moderating effects of emotion regulation and positive psychological capital on the relationship between perceived stress and depression in college students.

This study hypothesized that cognitive reappraisal could moderate the relationship between perceived stress and depression among college students, and that high-frequency cognitive reappraisal reduced the association between stress perception and depression, while low-frequency cognitive reappraisal enhanced the association between stress perception and depression (Hypothesis 1); Expression inhibition moderates the relationship between perceived stress and depression in college students, with high frequency of expression inhibition enhancing the association between stress perception and depression, and low frequency of expression inhibition decreasing the association between stress perception and depression (Hypothesis 2); positive psychological capital moderates the relationship between stress perception and depression in college students, with high level of positive psychological capital decreasing the association between stress perception and depression, and low level of positive psychological capital enhancing the association between stress perception and depression (Hypothesis 3).

Materials and methods

Participants

Using the whole group convenience sampling method, 1,312 questionnaires were distributed to all college students from freshman to senior students in a university in western China. After the questionnaires were returned, 45 invalid questionnaires were eliminated according to the criteria of invalid questionnaires if there were omissions or the same choice in multiple questions, and 1,267 valid questionnaires were obtained, with a valid return rate of 95.6%. Among them, 679 (53.6%) were male and 588 (46.4%) were female; 560 (44.2%) lived in rural areas and 707 (55.8%) lived in urban areas; 434 (34.3%) were only children and 833 (65.7%) were children with siblings; fathers' education level: 208 (16.4%) were elementary school students and below, 540 (42.6%) were junior high school students, 297 (23.4%) were senior high school (or technical school) students, 214 (16.9%) were undergraduates (or junior college students) and 8 (0.6%) were graduate students and above; mothers' education level: 352 (27.8%) were elementary school students and below, 468 (36.9%) were junior high school students, 279 (22.0%) were senior high school (or technical school) students, 162 (12.8%) were undergraduates (or junior college students), and 6 (0.5%) were graduate students and above. The study was approved by the Science and Technology Ethics Committee of the First Affiliated Hospital of Shihezi University School of Medicine (approval number: KJ2022-152-01), and all investigated college students gave their informed consent.

Measurements

Perceived stress scale

The Chinese version of Perceived Stress Scale developed by Cohen et al. and revised by Yang and Huang (2003) was used, consisting of 14 items, including two facets, tension (e.g., "feeling tense and stressed") and loss of control (feeling unable to control the important things in one's life), which are used to detect the overall and prevalent stress in life. It indicates a degree of self-awareness. Participants rated each item on a 5-point likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*), with higher scores indicating greater perceived psychological stress. The scale has good reliability and validity, and the Cronbach's alpha coefficient in this study was 0.71.

Emotion regulation questionnaire

The Chinese version of the Emotion Regulation Questionnaire, developed by Gross and revised by Wang et al. (2007), was used to assess the frequency of emotion regulation among college students. It includes 10 items, divided into two dimensions: cognitive reappraisal and expression inhibition. Cognitive reappraisal is a strategy for shifting situationally evoked emotions before they arise (e.g., "I control my emotions by changing the way I think about the situation"), and expression inhibition is a strategy for individuals to inhibit the expression of emotions after they arise (e.g., "I control my emotions by not expressing them") (Ogbaselase et al., 2022). The 7-point likert scale was used ranging from 1 (*strongly disagree*) to 7 (*strongly agree*), with higher scores on the dimension indicating that the individual uses the strategy more frequently. The reliability of the scale was good. The Cronbach's alpha coefficients for cognitive reappraisal and

expression suppression in this study were 0.85 and 0.60, respectively, and the Cronbach's coefficient for the total scale was 0.80.

Positive psychological capital questionnaire

The Positive Psychological Capital Questionnaire developed by Zhang G et al. (2010) was used to assess the level of positive psychological capital development among college students (e.g., "When the situation is uncertain, I always expect a good outcome"). It includes 26 items divided into four facets: self-efficacy, resilience, hope, and optimism. The 7-point likert scale was used from 1 (*not at all likely*) to 7 (*highly likely*), and the higher the scores, the better the psychological capital development of the individual. The reliability of the questionnaire was good, and the Cronbach's alpha coefficient was 0.93 in this study.

The Center for Epidemiological Studies Depression Scale

The Center for Epidemiological Studies Depression Scale developed by Radloff and revised by Zhang J et al. (2010), was used to examine individuals' depressed mood status (e.g., "I feel that I cannot get rid of this misery even with the help of my lover or friends") over a 1-week period. It includes 20 items divided into four facets: depressed mood, somatic symptoms, positive mood, and interpersonal relationship. A 4-point likert scale was used from 0 (*occasionally or not, less than one day*) to 3 (*most of the time, 5–7 days/week*), with higher scores indicating more severe depression. The reliability of the scale was good, and the Cronbach's alpha coefficient in this study was 0.88.

Procedure

College students at a university in western China were used as the subjects and the investigators were well-trained graduate students. Informed consent was signed prior to administration, a group instruction was read out explaining the purpose of the study and promising to keep the subjects' responses confidential, and independent responses and silence were emphasized during the administration of the test. The administration process took approximately 20 min, and all questionnaires were collected on site.

Data analysis

Data were analyzed using SPSS 21.0 software, and Pearson product difference correlation analysis was used to predict the correlation of key variables: perceived stress, emotion regulation, positive psychological capital, and depression. RStudio software (R version 3.3.1) was used to apply the process and combine the selected point method and Johnson-Neyman method to test for moderating and simple effects.

Results

Common method bias test

In this study, common method bias was controlled by measures such as anonymous measurement and partial item reversal (Zhou and Long, 2004), but the problem of common method bias may still exist, so the Harman's one-way method was used to test for common method bias. Exploratory factor analysis of perceived stress, cognitive reappraisal, expression inhibition， positive psychological capital, and depression showed that unrotated factor analysis indicated 12 common factors with eigenvalues greater than 1. The first factor explained only 26.80% of the overall variance, well below the threshold of 40%, indicating that the study did not have common method bias problems of a more serious nature.

Descriptives and correlations

To understand gender differences in perceived stress, cognitive reappraisal, expressive inhibition, positive psychological capital, and depression among college students, independent samples t-tests were conducted to examine perceived stress, cognitive reappraisal, expressive inhibition, positive psychological capital, and depression among college students. The results showed that there were significant differences in perceived stress between male and female students ($t = -2.42$, $p < 0.05$, Cohen's $d = -0.15$), and male students' perceived stress ($M = 2.68$, $SD = 0.46$) was significantly lower than that of female students ($M = 2.74$, $SD = 0.44$); male and female students differed significantly in expression inhibition ($t = 6.91$, $p < 0.001$, Cohen's $d = 0.39$), with male students expressing significantly more inhibition ($M = 4.60$, $SD = 0.95$) than female students ($M = 4.24$, $SD = 0.90$); male and female students differed significantly in positive psychological capital ($t = 2.52$, $p < 0.05$, Cohen's $d = 0.14$), with male students having significantly higher positive psychological capital ($M = 4.99$, $SD = 0.82$) than female students ($M = 4.88$, $SD = 0.76$); however, the differences in cognitive reappraisal and depression between male and female students were not significant ($p > 0.05$).

The results of descriptive statistics and correlation matrix analysis for each variable are shown in Table 1. perceived stress, cognitive reappraisal, expression inhibition, positive psychological capital, and depression were significantly correlated with each other, except for expression inhibition, which was not correlated with perceived stress and depression. In addition, gender was significantly and positively correlated with perceived stress, and negatively correlated with expression inhibition and positive psychological capital, while other additional variables (including family residence and parental education level) were not correlated with the predictor variables. Based on this, gender was used as a control variable in the subsequent test analysis.

Analysis of the moderating effects of emotion regulation and positive psychological capital

Prior to further analysis, all predictor variables were standardized. Given that the moderating variables were all continuous, this study used RStudio to apply process (Model 1) to analyze the standardized moderating effects. Results showed that the model for the moderating effect of cognitive reappraisal between perceived stress and depression was significant $F(4,1,262) = 220.40$, $p < 0.001$, with a model explained R^2 of 0.41. After controlling for the additional variable gender, perceived stress significantly predicted depression positively ($\beta = 0.53$, $t = 23.44$, $p < 0.001$), with a confidence interval of [0.49, 0.58]. Cognitive reappraisal significantly negatively predicted depression ($\beta = -0.21$, $t = -9.23$, $p < 0.01$) with a confidence interval of [−0.25, −0.17]; and the interaction term for perceived stress and cognitive

TABLE 1 Descriptive analysis and correlation coefficients of the study variables.

variables	$M \pm SD$	1	2	3	4	5	6
1. Gender		1					
2. Perceived stress	2.71 ± 0.45	0.07*	1				
3. Cognitive appraisal	4.98 ± 0.87	−0.03	−0.31**	1			
4. Expression inhibition	4.43 ± 0.94	−0.19**	−0.03	0.39**	1		
5. Positive psychological capital	4.94 ± 0.80	−0.07*	−0.61**	0.59**	0.15**	1	
6. Depression	1.51 ± 0.40	−0.04	0.59**	−0.36**	−0.01	−0.63**	1

Gender was a dummy variable coded as 1 = male and 2 = female.
*The correlation is significant at the 0.05 level.
**The correlation is significant at the 0.01 level.

reappraisal was significant (β = −0.12, t = −6.31, p < 0.001), with a confidence interval of [−0.15, −0.08], indicating a significant moderating effect of cognitive reappraisal between perceived stress and depression; however, the moderating effect of expression inhibition between perceived stress and depression was significant $F(4,1,262) = 176.23$, $p < 0.001$, with a model explained R^2 of 0.36. After controlling for the additional variable gender, perceived stress was a significant positive predictor of depression (β = 0.60, t = 26.32, p < 0.001) with a confidence interval of [0.55, 0.64]; expression inhibition failed to predict depression significantly (β = −0.01, t = −0.47, p > 0.05) with a confidence interval of [−0.06, 0.03]; and the interaction term between perceived stress and expression inhibition was also not significant (β = −0.04, t = −1.93, p > 0.05) with a confidence interval of [−0.08, 0.00], indicating that the moderating effect of expression inhibition between perceived stress and depression was not significant. In addition, the model for the moderating effect of positive psychological capital between perceived stress and depression was significant, $F(4,1,262) = 315.91$, $p < 0.001$, with a model explanatory R^2 of 0.50. After controlling for the additional variable gender, perceived stress significantly positively predicted depression (β = 0.34, t = 13.51, p < 0.001), with a confidence interval of [0.29, 0.39], positive psychological capital significantly negatively predicted depression (β = −0.43, t = −17.11, p < 0.001), with a confidence interval of [−0.48, −0.38], and the interaction term between perceived stress and positive psychological capital was significant (β = −0.13, t = −8.21, p < 0.001), with a confidence interval of [−0.16, −0.10], indicating a significant moderating effect of positive psychological capital between perceived stress and depression.

The selected point method and Johnson-Neyman method are commonly used to conduct simple slope tests. The Johnson-Neyman method can overcome the limitation that the selected-point method can only test one value of the moderating variable at a time by fixing the t-value as the critical value and finding the range of values of the moderating variable when the simple slope is significantly non-zero (Fang et al., 2015). In order to clarify the moderating effects of cognitive reappraisal and positive psychological capital on perceived stress and depression among college students, this study used both methods to conduct simple slope tests simultaneously. For cognitive reappraisal, the results of the selected-point method analysis revealed that cognitive reappraisal significantly and positively predicted depression in both the high stress perception group (M + 1SD, i.e., one standard deviation above the mean) and the low stress perception group (M-1SD, i.e., one standard deviation below the mean) ($\beta_{high\ perceived\ stress\ group} = 0.42$, $t_{high\ perceived\ stress\ group} = 14.20$, $p < 0.001$; $\beta_{low\ perceived\ stress\ group} = 0.65$, $t_{low\ perceived\ stress\ group} = 22.28$, $p < 0.001$) (see Figure 1A). At the same time, the Johnson-Neyman method analysis revealed that the simple slope was significantly non-zero over the range of values of cognitive reappraisal [−4.56, 2.31] (after standardization) (see Figure 1B). The higher the level of perceived stress, the stronger the effect of cognitive reappraisal in negatively predicting depression, i.e., the value of the inhibitory effect of cognitive reappraisal on depression gradually increases as perceived stress rises.

For the moderating effect of positive psychological capital, the results of the selected-point method analysis found that positive psychological capital significantly and positively predicted depression in both the high stress perception group (M + 1SD) and the low stress perception group (M-1SD) ($\beta_{high\ perceived\ stress\ group} = 0.21$, $t_{high\ perceived\ stress\ group} = 7.23$, $p < 0.001$; $\beta_{low\ perceived\ stress\ group} = 0.47$, $t_{low\ perceived\ stress\ group} = 15.67$, $p < 0.001$) (see Figure 2A). Meanwhile, the Johnson-Neyman method analysis found that the confidence interval of the simple slope did not contain 0 within the range of values of positive psychological capital [−4.21, 2.04] (after standardization) (see Figure 2B), and the simple slope was significant. Also, in this range, the higher the level of perceived stress, the stronger the effect of positive psychological capital in negatively predicting depression, i.e., as perceived stress rises, the value of the inhibitory effect of positive psychological capital on depression gradually increases.

Discussion

The relationship between perceived stress and depression among college students

The present study found that gender did not differ in depression levels among college students, which is not consistent with the results of previous studies (Liu et al., 2021). Existing studies have generally concluded that there are gender differences in depression, and that the differences in depression by gender are reflected in many aspects such as influencing factors, onset symptoms, age of onset, and incidence of depression (Ren et al., 2019). However, a recent study found cross-gender consistency between individual genders in network structure, network connection strength, and core symptoms based on the network analysis level, possibly implying mutual independence

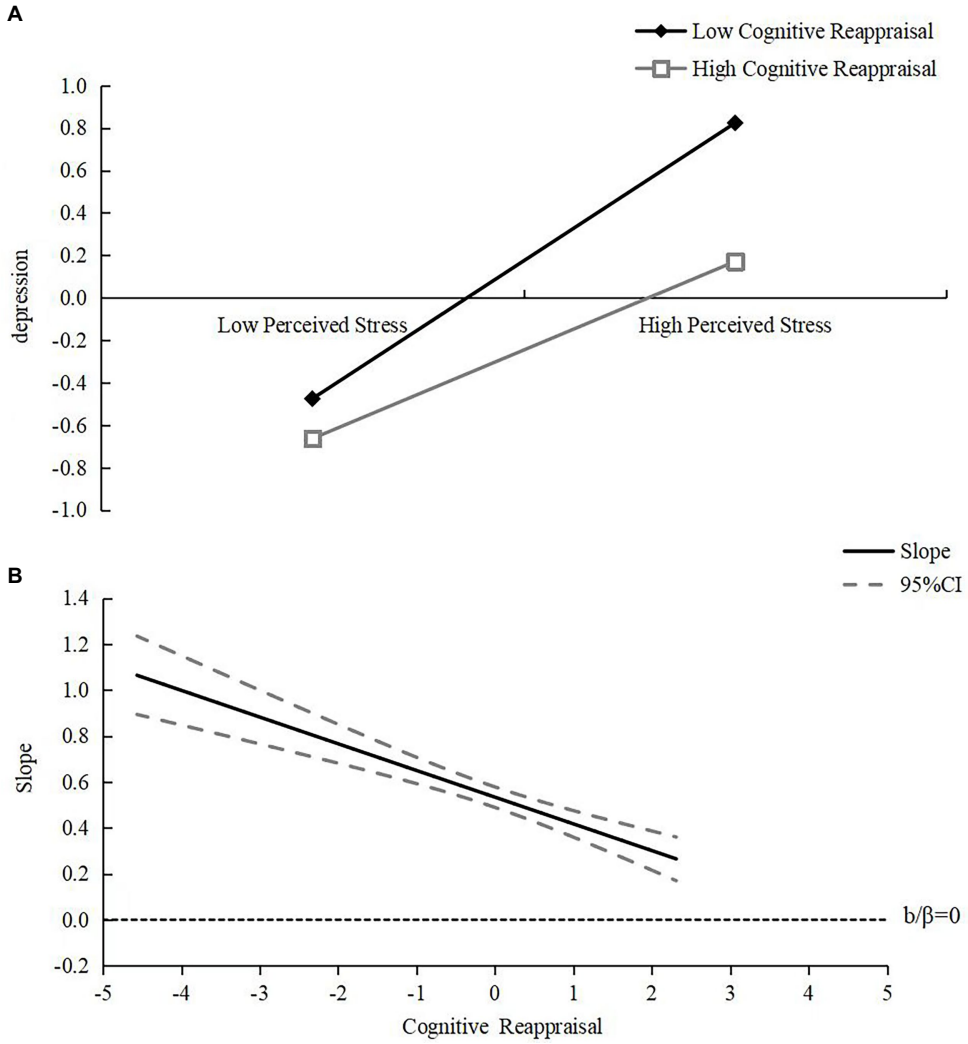

FIGURE 1
The moderating role of cognitive reappraisal in the relationship between perceived stress depression **(A)** and change of its simple slope **(B)**.

between depression networks and total depression scores (Huang et al., 2022). This explains the possibility that gender does not differ in depression levels among college students, but follow-up studies are still needed to verify this.

Previous studies have shown that individuals who are more sensitive to perceived stress have higher levels of depression (Zandifar et al., 2020). The present study found that perceived stress positively influenced depression among college students, suggesting that perceived stress is an important predictor of depression among college students. Thus, the result of this study is consistent with previous studies. Study the reasons, on the one hand, physiological evidence of neurohumoral mechanisms suggests that psychological stress activates the thalamic-pituitary–adrenal axis, releasing major neurotransmitters of stress, such as adrenaline, while inducing a series of peripheral responses to negative emotions (i.e., anger and fear). In contrast, the emergency state prompts the release of central adrenaline, which stimulates the main neurotransmitter of depressed mood, pentraxin, and ultimately leads to the central production of depressed mood (Zheng et al., 2015). This also confirms the non-homeostatic model of stress. On the other hand, the quality-stress interaction model suggests that the properties of the event itself and psychological susceptibility are the determinants of the emergence of depression and anxiety after a negative life event, where psychological susceptibility emphasizes that the specific environment is more likely to activate the individual's susceptibility. The psychological susceptibility emphasizes that a particular environment is more likely to activate the susceptible qualities of an individual (Rosenthal, 1963). According to this theory, the stronger the individual's perception of stress, the more likely he or she is to perceive or notice threatening stimuli in the external environment, which causes psychological tension and discomfort and contributes to a recurrent cycle of negative emotions, leading to higher levels of depression (Yuan, 2016). Both evidence from neurohumoral mechanisms and theoretical interpretations of environmental formation suggest that perceived stress is a booster for predicting psychological problems such as depression in individuals (Yang et al., 2020). Therefore, it is important to minimize the impact of stress on depression in college students and to improve their mental health.

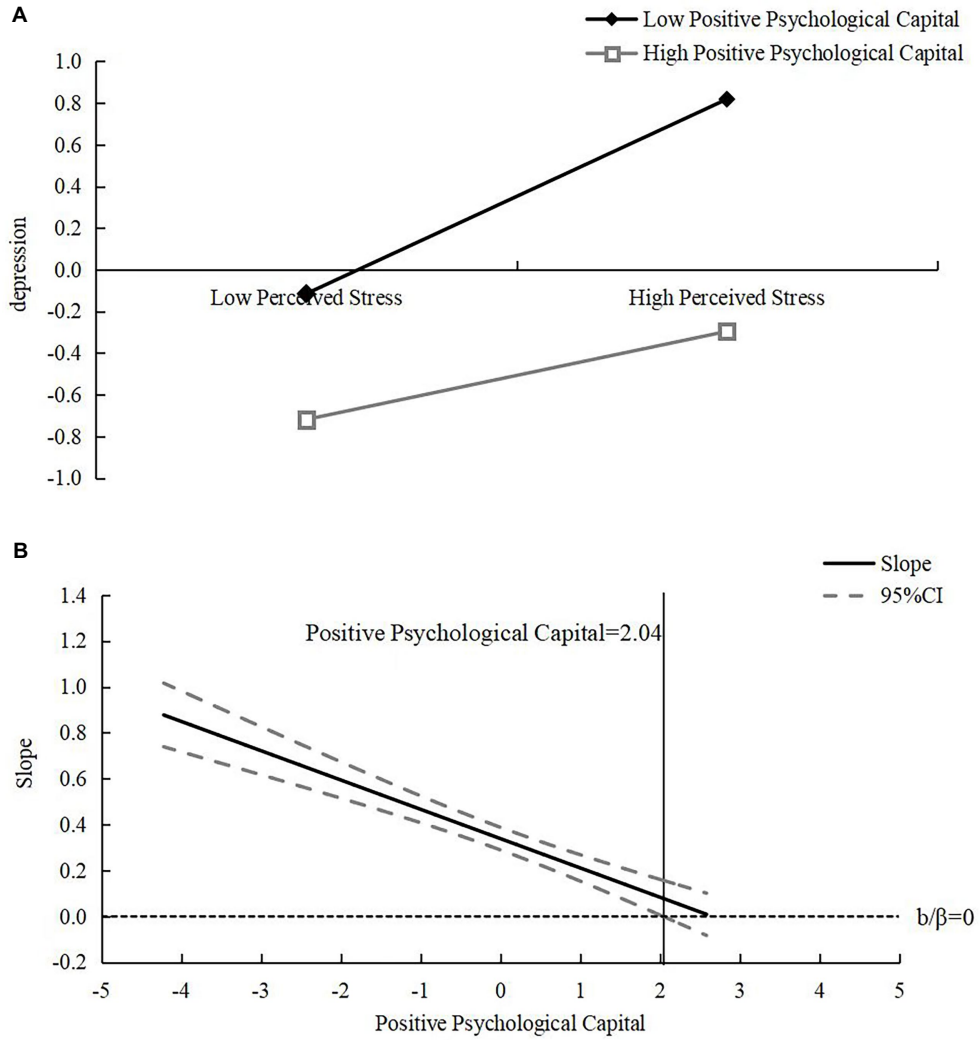

FIGURE 2
The moderating role of positive psychological capital in the relationship between perceived stress and depression **(A)** and change of its simple slope **(B)**.

Moderating effects of emotion regulation and positive psychological capital between perceived stress and depression among college students

In this study, we found that both cognitive reappraisal and positive psychological capital positively moderated the relationship between perceived stress and depression among college students. The positive predictive effect of cognitive reappraisal and positive psychological capital on depression was stronger when the level of perceived stress was higher, i.e., the inhibitory effect of cognitive reappraisal and positive psychological capital on depression was more obvious as the level of perceived stress increased. This may be due to the fact that cognitive reappraisal and positive psychological capital, as a protective factor, can provide individuals with useful help and support to mitigate the effects of perceived stress on depression, enhance the ability to adapt to high-pressure environments, and resist the generation of negative emotions such as depression. This suggests that cultivating and improving cognitive reappraisal strategies and positive psychological capital can be more effective in reducing the risk of depression among high perceived stress college students and also help to reduce the likelihood of depression among low perceived stress college students.

Notably, the present study found that expressive inhibition failed to moderate the relationship between perceived stress and depression in college students. Previous studies have found that expression inhibition inhibits emotions at the behavioral level and does not promote sympathetic nervous system activity to mobilize the potential of multiple organs of the individual to adapt to environmental changes (Huang et al., 2021). It has been shown that cognitive reappraisal occurs early in the process of emotion generation and intervenes before the tendency to respond to emotions is fully developed, and is effective in changing subsequent emotional trajectories, compared to expression inhibition, which is effective in controlling and reducing the expression of emotional behaviors but not the frequency of emotional experiences (Gross and John, 2003). Thus individuals who exhibit depressive symptoms are more likely to overuse expression inhibition to cope with negative events, but good use of cognitive

reappraisal can help them mitigate and shorten the cycles, thereby reducing vulnerability to depressive impairment (Balderas et al., 2021). The results of this study further illustrate the effectiveness and adaptability of cognitive reappraisal strategies in regulating stress perceptions and depression in college students.

In addition, this study found that cognitive reappraisal and positive psychological capital had similar effects, but the inhibitory effects of cognitive reappraisal and positive psychological capital on perceived stress and depression differed in two ways. On the one hand, the simple slope analysis of the selected point method shows that the slope of cognitive reappraisal is greater, more effective and more efficient than that of positive psychological capital in suppressing depression in college students. On the other hand, the simple slope of the Johnson-Neyman method shows that the effect of cognitive reappraisal on depression is better than that of positive psychological capital, and the effect can be achieved from −4.56 standard scores of perceived stress, indicating that college students with low perceived stress below zero standard scores can be protected by cognitive reappraisal. The importance of cognitive reappraisal for college students' mental health is slightly better than that of positive psychological capital. This may be due to the fact that cognitive reappraisal can improve the effect of perceived stress on depression by changing the poor perception of the cause of emotional events and using positive thinking to explain the negative emotional events they face, which can lead to more positive emotional experiences and increase happiness and life satisfaction, and then further promote the improvement of positive psychological capital on this basis.

Implications, limitations, and future directions

This study innovatively used both the selected point method and Johnson-Neyman method to test the simple slope, and more clearly verified the predictive role of perceived stress on college students' depression and the buffering role of emotion regulation and positive psychological capital in between, which has some implications for colleges to pay attention to students' mental health and develop intervention programs. First, since perceived stress can positively predict depression among college students, society and colleges should pay attention to reducing college students' stress and improving their ability to cope with stress, so as to reduce their risk of depression. Secondly, cognitive reappraisal and positive psychological capital can effectively reduce the risk of depression in high perceived stress. Therefore, mental health education in colleges and universities should focus on cultivating and enhancing students' ability to use adaptive emotion regulation strategies and encouraging and guiding the accumulation of positive psychological capital in order to effectively reduce the risk of depression in high perceived stress college students and prevent the possibility of depression in low perceived stress college students. Finally, cognitive reappraisal is more effective in inhibiting high perceived stress college students, so more attention should be paid to cultivating college students' ability to use cognitive reappraisal strategies to help them have more positive emotions to resist stress risks in various stressful situations.

There are two shortcomings in this study: on the one hand, considering that the current sample was taken from a group of college students in a western university, the sampling range is slightly narrow, and the generalizability of the results needs to be tested. Future studies can be conducted on a nationwide basis with a large sample. On the other hand, the data in the current study are cross-sectional data, and it is not possible to determine the causality of each variable in a strict sense. Future studies could combine cross-lagged designs and experimental studies to investigate the causal mechanisms between the two.

Conclusion

The present study found that both cognitive reappraisal and positive psychological capital positively moderated the relationship between perceived stress and depression, and both significantly inhibited depression in high and low stress perceivers, and the inhibitory effect was more pronounced in high stress perceivers, but expression inhibition could not moderate the relationship between perceived stress and depression.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by Science and Technology Ethics Committee of the First Affiliated Hospital of Shihezi University School of Medicine. The patients/participants provided their written informed consent to participate in this study.

Author contributions

YL and HY designed the experiment, collected data, prepared the manuscript, and made data analysis. YS corrected the whole language of the manuscript and made final approval. CM gave technique supports and valuable suggestions in experiment designing. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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The effects of positive leadership on quality of work and life of family doctors: The moderated role of culture

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Background: Quality of work and life (QWL) of family doctors is highly valued in improving access and equity of healthcare; however, the current low level of QWL in many countries and regions needs to be improved urgently.

Methods: This study explored the effect of positive leadership on the QWL of family doctors, as well as the moderating role of culture, via analysis of data from 473 valid questionnaires of family doctors in China as a sample using SEM, hierarchical linear regression, and a simple slope test.

Results: The empirical results show that positive leadership promoted the QWL of family doctors by improving their achievement motivation and coordinating supportive resources. In addition, our hierarchical linear regression analysis found that the interactive items of positive leadership and culture had a positive effect on achievement motivation ($\beta_{(a)} = 0.192$), QWL ($\beta_{(b)} = 0.215$) and supportive resources ($\beta_{(c)} = 0.195$). Meanwhile, culture had a moderated mediating effect on the relationship between positive leadership and QWL via the achievement motivation of family doctors and supportive resources.

Conclusion: These findings suggest that the interaction among multiple factors, including environmental factors, individual physiological features and culture, may influence the impact of positive leadership on the QWL of family doctors. The possible reasons of these findings and theoretical and practical implications are discussed in this study.

KEYWORDS

family doctor, positive leadership, QWL, culture, achievement motivation

1. Introduction

Family doctors, as healthcare gatekeepers provide comprehensive, continuous, and coordinated health services. They have become the key to promoting access and equity in health care. Evidence has shown that family doctor services have achieved significant progress in solving various health problems such as multiple chronic diseases and emerging epidemics, and are especially effective in cost-saving and life-quality improvement under limited healthcare resources (Ferrer et al., 2005). Quality of work and life (QWL) is a key in improving the service quality of family doctors. QWL, first introduced in the 1930s (Che Rose et al., 2006), is an umbrella concept

that includes a number of job-related issues that medical staff consider or assess on the job, which in turn have a further impact on the outcome of work (Nowrouzi et al., 2016). Evidence has demonstrated that high levels of QWL, such as reasonable compensation and satisfactory benefits, career expectations, improved interaction among individuals, and high self-efficacy at work, may lead to active work engagement and better service quality (Mohammadi and Ameri Shahrabi, 2013; Srivastava et al., 2019).

Currently, the QWL of family doctors is quite unsatisfactory in many healthcare systems, such as China, one of the largest healthcare systems in the world with inadequate health resources. Meanwhile, in many areas, the lack of resources affects family doctors' work motivation and leads to their low QWL, which further influences the quality of family doctors' services. First, the rewards for family doctors, such as compensation and promotion opportunities, are relatively limited. For instance, the 2015 Medscape Physician Compensation Report found that the income gap between family doctors and other specialists remains huge in the United States, and family doctors earn an average of $195,000 annually in comparison with $284,000 for doctors in other specialties (Laff, 2015). In addition, the career expectations of family doctors are not well met. For example, in 2012, 63.5% of family doctors in Changning District of Shanghai City were dissatisfied with their current work (Yuan et al., 2014). In addition, it is very common for family doctors to face an intense working environment, such as long working hours, heavy workloads, and pressure from doctor–patient relationships (Nejatzadegan et al., 2016). The results from a German population-based cohort study reported that the time of family doctor service *per capita* was extremely short due to the heavy workload (Pantenburg et al., 2018). Consequently, the heavy workload may negatively impact the efficiency of doctor–patient communication (Dinkel et al., 2016). Moreover, family doctors have quite low self-efficacy of their job. In an evaluation of service competence in Guangxi Province in China, the general practitioner, the main group of family doctors, only gained an average score of 2.46 out of 5 in a test of services knowledge and skills (Su et al., 2015).

Recently, scholars worldwide have paid close attention to the factors influencing QWL, and there has been a drastic increase in research on the application of positive leadership to improve QWL (Hargett et al., 2017). Positive leadership is a series of leadership strategies that draw on scientific evidence in terms of positive psychology to help leaders develop the medial workforce's capacity to thrive (Pio, 2021). Positive leadership emphasizes strengths rather than simply focusing on weaknesses; fosters virtuous actions such as compassion, gratitude, and forgiveness; encourages contribution goals in addition to achievement goals; and enables meaningfulness in work (Graves et al., 2013). Increasingly, theoretical and empirical studies have revealed that positive leadership may promote medical staff's QWL, such as satisfaction of expectations, workplace well-being and self-efficacy, which may further promote the productivity and profitability of work (Gillet et al., 2018). For instance, a study in German hospital surgical departments proved that qualified and efficient leadership was needed to improve doctors' QWL (Schmitz-Rixen and Grundmann, 2019). A review based on 31 high-quality studies on QWL reported that positive leadership and mindfulness practices will reduce physician burnout, enhance emotional stability and improve cognitive function (Malik and Annabi, 2022).

There might be an important opportunity for developing positive leadership of family doctor service, that is, the development of people-centered integrated care (PCIC). PCIC is a healthcare strategy proposed by the World Health Organization, the two core approaches of which are integration and people-centeredness (The World Bank et al., 2016). PCIC has been promoted in multiple countries and regions, thus providing an environment for developing positive leadership. First, the key approach of PCIC, integration at multiple levels such as organizational integration, resource sharing, and interprofessional collaboration, may provide a bedrock for positive leadership to promote trust and encourage participation (Yuan et al., 2021). For instance, in China, a series of actions guided by positive leadership has been explored, including establishing cross-professional relationships among doctors, nurses, and medical technicians to promote trust, communication and understanding; promoting organizational integration, resource sharing, and cross-professional collaboration such as remote consultation and multidisciplinary team service to leverage the strengths of each participant; and designing a reasonable value-oriented incentive system to encourage contribution. Meanwhile, people-centeredness has also gradually led to a trusting leadership of family doctor teamwork, with a focus on responsiveness, that consciously adopts individuals as participants in, and beneficiaries of trusted team work (Liddle and Ulrich, 2021). People-centered culture has been gradually cultivated through organizational cultural construction, including strategies, goals, guidelines, etc., cultural activities such as publicity and recommendation, and tangible cultural materials such as slogans and banners.

However, it is not clear how positive leadership promotes the QWL of family doctors in the context of PCIC construction. Although some studies have mentioned that the effect of positive leadership on QWL is influenced by multiple factors, such as environmental factors (funding, resources, etc.), individual physiological factors (achievement motivation, etc.), and culture (explicit culture and implicit culture), the complex interactive effect has not yet been clarified. First, most of the existing studies have adopted qualitative research methods rather than sufficient quantitative evidence. In addition, influencing factors are often simply screened, while the interactions among multiple factors have not yet been clarified. Above all, very few studies have analyzed the impact of positive leadership in the context of PCIC, although PCIC is an important global health strategy. Therefore, this study aims to explore the influence of positive leadership on the QWL of family doctors in China by clarifying the interaction among multiple influencing factors, including environmental factors, physiological factors, and culture in the context of PCIC.

2. Theoretical basis

2.1. Positive leadership and QWL of family doctors

QWL is an umbrella concept that includes a number of job-related issues including work reward, work environment, work-life balance and self-efficacy. Recent studies suggest that positive leadership may have a direct positive effect on QWL. For instance, during the epidemic in America, sufficient positive leadership in medical service improved healthcare providers' perceived professional identity and work reward (Ness et al., 2021). A study from the Mayo Clinic reported that support of positive leadership was conducive to improving the work environment and motivating higher self-efficacy of US physicians to some extent (Shanafelt and Noseworthy, 2017). A

study in Switzerland also proved that high-quality leadership reduced the work stress of doctors in acute and rehabilitation hospitals by improving their work environments and promoting their work-life balance (Peter et al., 2021).

Given that positive leadership may have a positive effect on QWL, the following hypothesis is proposed for this study:

> *H1*: Positive leadership has positive effects on QWL.

2.2. The mediating roles of individual physiological factors between positive leadership and QWL

Previous studies have shown that positive leadership may be associated with achievement motivation, one of the most important factors in psychology. Achievement motivations are defined as the internal drivers of individuals to pursue valuable goals, achieve high performance, and strive for success (Elliot et al., 2016). As proof, a study in Harbin City in China proposed that leadership improved the psychological quality of doctors and promoted them to pursue more extrusive achievements, contributions, honor and social status (Chu et al., 2021). Research from 17 government hospitals in Pakistan showed that positive leadership improved nurses' job motivation to achieve high performance (Asif et al., 2019). A study from Morocco proved that positive leadership enhanced health workers' willingness to pursue public service values, which further promoted their achievement motivation (Belrhiti et al., 2020).

In addition, achievement motivation is possibly related to QWL, such as work expectation, self-efficacy, and work-life balance. For instance, a study from 11 community healthcare centers (CHCs) in Zhenjiang Province, China proved that general physicians with higher achievement motivation achieved better self-efficacy and work expectations (Ge et al., 2022). A study about burnout syndrome in Spain, Ceuta, demonstrated that health workers with greater achievement motivation scored higher, which may be related to their higher demand for efficacy and work expectations (Domínguez Fernández et al., 2012). A study conducted in the southeastern region of Nigeria confirmed that tuberculosis management medical workers' motivation to finish work tasks was related to their high sense of work-life balance (Ogbuabor and Okoronkwo, 2022).

By integrating these findings, we may conclude that positive leadership could positively influence QWL through achievement motivation. Thus, the following hypotheses are proposed for this study:

> *H2*: Positive leadership has positive effects on achievement motivation.
>
> *H3*: Achievement motivation has positive effects on QWL.

2.3. The mediating roles of supportive resources between positive leadership and QWL

For healthcare decision makers, supportive resources are a pivotal challenge (Smith et al., 2013). Prior research has verified that supportive resources may be associated with positive leadership, and evidence has also proven that positive leadership development is essential to address resource inequalities in health care (Pascal et al., 2017). For example, a summary of the experience from the American Human Resource Management Program noted that positive leadership helped leaders to coordinate various departments and optimize their functions to solve human resource crises in healthcare (Sherk et al., 2009). A literature review of human capital resources suggested that managers with positive leadership were able to coordinate the organizational human resource management process and strengthen the performance assessment system related to financial distribution (Eckardt et al., 2020). Research on emergency management in elderly healthcare from America confirmed that rapid coordination of intensive care beds and reasonable allocation of ventilator use during the epidemic relied on physicians' emergency response capacity of positive leadership (Aitken and Ibrahim, 2021).

Additionally, previous studies have revealed that physicians' QWL may be improved by supportive resources, including health human resources, financial input and medical equipment resources. For example, proof from Polish hospitals suggested that human resource management was related to the working efficacy of physicians and doctor–patient relationships (Storman et al., 2021). A study in Nepal attested that material resource support is associated with doctors' financial satisfaction (Vaidya et al., 2020). Research on physicians' career retention from Tanzania proved that general physicians' work environment and career expectations were improved by increasing financial resource investment (Sirili et al., 2018).

Moreover, evidence also proved that reasonable supportive resources may benefit the achievement motivation of doctors. For example, doctors from 30 different cities in China mentioned that supportive resources of clinical practice made them maintain greater comfort and psychological security, thus boosting their positive emotions, stability of work and personal goal (Zhang et al., 2021). A qualitative study from Abbottabad, Pakistan, showed that physicians' work motivation was related to adequate remuneration, supplies and medical facilities (Shah et al., 2016).

Integrating these findings, positive leadership may have a significant effect on QWL through the chain mediation of supportive resources and achievement motivation. As a result, the following hypotheses are proposed for this study:

> *H4*: Positive leadership has positive effects on supportive resources.
>
> *H5*: Supportive resources have positive effects on QWL.
>
> *H6*: Supportive resources have positive effects on achievement motivation.

2.4. The moderating role of organizational culture

Organizational culture is defined as the values and beliefs of the organizational environment (Schneider et al., 2013). Previous studies have revealed that culture is important to improve the development of organizations and, in turn, to improve workers' QWL in hospitals. As an example, a study from two private hospitals in the city of Madiun, Indonesia, testified that a positive organizational culture helped

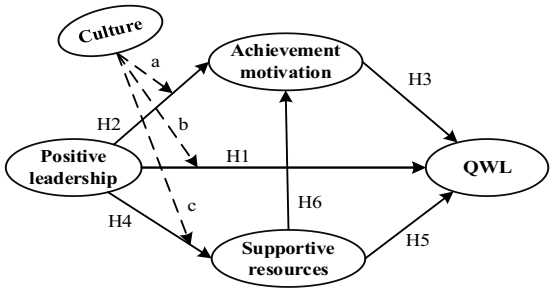

FIGURE 1
Research model diagram of promoting the QWL of family doctors.

medical physicians feel satisfied with the work environment and boosted their active work engagement (Srimulyani and Hermanto, 2022). A national survey in America during the pandemic proved that organizational culture had an effect on work expectations and achievement motivation among physicians (Young et al., 2020). In addition, research at Consultant Company in Indonesia proved that sharping a positive organizational culture changed employees' attitudes toward work and thus improved their QWL (Fakhri et al., 2020). A study in Korea certified that positive culture support was the key to relieving employees' perceived fatigue and improving self-efficacy and ultimately had a positive impact on their QWL (Kim and Jang, 2018). Therefore, we predict that culture may facilitate the influence of QWL (Figure 1).

3. Materials and methods

3.1. Participants and data collection

The data used in this study were collected in China. The Chinese government begun exploring the family doctor services as early as the 1980s and has recently committed to developing a contract-based family doctor service system. In 2016, the State Council Medical Reform Office issued the *Opinions on Promoting Family Doctors' Contracting Services*, which aimed to establish a contract-based family doctor service system in a CHC, with family doctor teams composed of Western doctors, traditional Chinese medicine doctors, nurses, medical technicians, public health doctors, etc. (China State Council Healthcare Reform Leading Group et al., 2016). Family doctor service is likely to touch on a wide range of people and it is estimated to be provided to at least 75% of China's population by 2035. Thus, it is urgently needed to improve the QWL of family doctors.

Zhejiang Province was selected as the sampling area for two reasons. First, family doctor services have a wide impact on the residents of Zhejiang Province, since Zhejiang Province is one of the first regions in China to explore family doctor services, and more than 85% of key groups, including elderly and chronic patients, have signed service contracts with family doctors. The government has implemented a series of policies to develop family doctor services, including measures aimed at improving service capacity and quality. Second, the reform of the PCIC has had a great impact on Zhejiang Province. In 2016, the World Bank Group, the World Health Organization, and the China Health Planning Commission jointly issued the *Report on Deepening the Reform of China's Medical and Health System*, which suggested that China should take steps in practicing PCIC, and Zhejiang Province was one of the earliest regions to carry out PCIC in China. Hangzhou City and Changxing County of Zhejiang Province were selected as sample areas for the WHO to evaluate the development level of PCIC in China. With a *per capita* GDP of 113,000 yuan in 2021, Zhejiang Province has an advanced economic status. By the end of 2021, more than 27 thousand family doctors in Zhejiang had signed service contracts with 24.49 million residents.

Inclusion criteria for voluntary participation in this study were as follows: (1) offered informed consent; (2) worked in CHCs in Zhejiang Province and provided family doctor service for more than six months; and (3) aware of QWL of the family doctor service. Exclusion criteria were as follows: (1) had no contract with residents for family doctor services; (2) provision of family doctor service was no more than six months; (3) trainee medical staff, medical staff from hospitals temporarily providing services in CHCs.

We determined the sample size according to the principle of structural equation model (SEM). Thompson B suggested that the ratio of the number of people to the number of measured variables in SEM should be at least 10:1, and 15:1 or 20:1 are much better (Thompson, 1998). Since there are 21 measured variables in the SEM, 420 respondents is sufficient in theory, and in practice, 500 questionnaires were distributed to family doctors between July 1 and November 30, 2021, in which 473 questionnaires qualified, and sample effective rate 94.6%. Sampling regions were selected with judgment sampling on the basis of economic development. We stratified counties and districts in Zhejiang Province into developed regions, developing regions and underdeveloped regions by systematic clustering analysis and took indicators into consideration, such as regional economic indicators (gross domestic product, total retail sales of consumer products, etc.), public finance indicators (total fiscal revenue, general public budget revenue, etc.), and medical and health services indicators (the number of medical institutions, the number of accommodations, the number of health technicians, etc.) On the basis of the above cluster analysis, we selected Hangzhou as the representative of developed areas, Lishui as the representative of underdeveloped areas, and Jiaxing Nanhu District, Pinghu County, Jiaxing Port District, and Huzhou Changxing County as the representatives of developing areas. With convenience sampling, 20 family doctors were chosen from medical institutions in each district. This study carried out a formal survey after a pilot study was applied and was modified. Then, the exclusion criteria for questionnaires were as follows: (1) omissions in the answer; (2) more than half of the responses were the same; and (3) similar answers to apparently contradictory questions. If the questionnaire met any of these criteria, it was excluded. We provide the variance-covariance matrices of this study (Supplementary material).

3.2. Measurement

A questionnaire was exploited for this study using the following steps: first, measurement indicators including positive leadership, supportive resources, achievement motivation and QWL, were screened through a literature review; second, the indicators draw from the literature was translated to Chinese language. The indicator which needed to be translated mainly included the Positive

Leadership scale (Meijer et al., 2018), supportive resources scale (Lukes and Stephan, 2017), Achievement Motivation Scale (Smith et al., 2019). However, the initial indicators which were Chinese version in previous studies needed no translation, for instance, the Brooks QWL questionnaire (Brooks and Anderson, 2004) and the General Self-Efficacy Scale (Schwarzer et al., 1999). A series of measurements were taken to insure the accuracy of translation. For example, the indicators was translated by professional translation software, and then checked by native Chinese speakers whose major is English. A preliminary survey was also conducted to encourage participants to express their perceptions of the indicators, and further to ensure that the questionnaire will be able to fully and accurately achieve the measurement objectives; third, telephone interviews were conducted with 70 medical staff members, the visit records were analyzed in NVivo (11th edition) on the basis of grounded theory, and the evaluation indicators were summarized; fourth, two rounds of Delphi consultation were carried out with 22 scholars, medical staff and health administrators, and the measurement indicators were optimized; and fifth, the questionnaire was further modified and verified by a pilot study. Internal consistency (Cronbach's α coefficient) and composite reliability (CR) were used to evaluate the reliability of the questionnaire, and then the convergent validity and heteroplasm-elemental ratio were used to assess the validity of the questionnaire. The questionnaire comprised the following: general information, positive leadership scale, supportive resources scale, achievement motivation scale, QWL scale, and culture scale.

3.2.1. General information

The form for general information comprised items pertaining to gender, age, marital status, educational level, post, income, work shift, and work seniority.

3.2.2. Positive leadership

The positive leadership scale was conducted to assess whether the leaders of healthcare institutions coordinated and motivated the development of family doctor services. We extracted the initial indicators from the literature, including a questionnaire about leadership designed by Meijer (Meijer et al., 2018) and the findings of different leadership forms (D'Innocenzo et al., 2016). We also distilled indicators through thematic analysis to optimize the indicators, with a total word frequency of 60. The indicators were acquired through two rounds of Delphi consultation, with an average score for importance over 4 and an average score for availability above 3.5. The indicators consist of 3 items: organization of positive leadership, coordination of positive leadership and incentive of positive leadership. All items were rated on a seven-point Likert scale, ranging from 1 = fully disagree to 7 = fully agree. The internal consistency of this scale was satisfactory with a Cronbach's alpha of 0.977, CR of 0.979, AVE of 0.941, and the heteroplasm-elemental ratio was less than 0.90.

3.2.3. Supportive resources

The supportive supportive resources scale was conducted to estimate whether the human resources, funding and material resources of family doctor services are sufficient. We extracted the initial indicators from the literature, including the Innovation Support Scale (ISI) (Lukes and Stephan, 2017) and the organizational environment framework validated by Meijer et al. (2018). We further optimized the indicators through thematic analysis, with a total word frequency of 129. The indicators were obtained through the two rounds of Delphi consultation, with an average score for importance over 4 and an average score for availability above 3.5. The indicators consist of 3 items, human resources, financial support and material resources, and a seven-point Likert scale was used to measure each item, ranging from 1 = fully disagree to 7 = fully agree for the scale. The scale demonstrated high interitem consistency with a Cronbach's alpha of 0.977, CR of 0.936, AVE of 0.834 and the heteroplasm-elemental ratio was less than 0.90.

3.2.4. Achievement motivation

The achievement motivation scale was conducted to evaluate family doctors' intrinsic motivation to provide family doctor services. We extracted the initial indicators from the literature, including the Achievement Motivation Scale (AMS) (Smith et al., 2019) and the revised 10-item version of the AMS (Lang and Fries, 2006). Then, we further enriched the indicators of achievement motivation. The indicators consist of 3 items, including interest, work attraction and concern about work, with a seven-point Likert scale measurement, ranging from 1 = fully disagree to 7 = fully agree. The achievement motivation scale was qualified, with a Cronbach's alpha of 0.866, CR value of 0.897, and AVE value of 0.750 (Tables 1, 2).

3.2.5. QWL

The QWL scale was conducted to evaluate the family doctor's perception of work, including working reward, working expectation, working environment and self-efficacy. Of them, working rewards refer to whether family doctors are provided with satisfying compensation and opportunities for career development. Work expectation refers to whether family doctors achieve professional value and personal growth through their work; working environment refers to whether family doctor services are supported by a favorable and friendly environment; and self-efficacy refers to family doctors' confidence level in their capability. We extracted the initial indicators from the Brooks QWL questionnaire (Brooks and Anderson, 2004) and the General Self-Efficacy Scale (GSES) (Schwarzer et al., 1999). Then, because the items extracted from these scales did not absolutely match our measurement goals and method programs, we adjusted the QWL scale to some extent. The four dimensions of QWL are measured by twelve items, with a seven-point Likert scale measurement, ranging from 1 = fully disagree to 7 = fully agree. Each dimension of the QWL scale was qualified, with a Cronbach's alpha of 0.939, 0.912, 0.889, and 0.913.

3.2.6. Culture

The culture scale was conducted to assess whether people-centered culture was developed for family doctor services. We extracted the initial indicators from the organizational culture conception in the Innovation Support Scale (Lukes and Stephan, 2017) and further optimized the culture scale. The indicators consist of 3 items, including organizational culture, cultural activities and tangible cultural materials, with a seven-point Likert scale measurement, ranging from 1 = fully disagree to 7 = fully agree. The culture scale was qualified, with a Cronbach's alpha of 0.964, CR value of 0.964, and AVE value of 0.899.

TABLE 1 Measurement items and results of reliability and validity analysis of the questionnaire (N=473).

Construct	Dimension	Measurement items	Load[a]	Cronbach'α	CR	AVE
Positive leadership		A1 Family doctor services are organized by positive leadership.	0.975	0.977	0.979	0.941
		A2 Teamwork are coordinated and interpersonal relationship are promoted by positive leadership.	0.986			
		A3 Team members are motivate to participate actively by positive leadership.	0.948			
Supportive resources		B1 There are sufficient human resources involved in the family doctor services.	0.901	0.936	0.938	0.834
		B2 Family doctor services are well funded by the government.	0.923			
		B3 There are sufficient resources to support family doctor services.	0.916			
Achievement motivation		C1 I am interested in family doctor services.	0.928	0.886	0.897	0.750
		C2 I am attracted by the challenge of the family doctor services.	0.975			
		C3 I care if I am qualified for family doctor services.	0.661			
QWL	Reward	D1 I am satisfied with the compensation of family doctor services.	0.872	0.939	0.940	0.840
		D2 I am given the chance to gain honorary title through family doctor services.	0.939			
		D3 I gain promotion opportunities or learning opportunities through family doctor services.	0.937			
	Expectation of work	E1 I can realize my life value though family doctor services.	0.825	0.912	0.918	0.790
		E2 I am optimistic about the development of the family doctor services.	0.927			
		E3 My expectation for work is satisfied by family doctor services.	0.911			
	Working environment	F1 Family doctor services are supported by preferential medical insurance.	0.870			
		F2 Family doctor services are supported by friendly health laws, regulations and policies.	0.875	0.889	0.891	0.732
		F3 Family doctor services are supported by harmonious doctor–patient interaction environment.	0.821			
	Self-efficacy	G1 I am qualified to serve as a family doctor if I make my effort.	0.900			
		G2 I can find the solution when I encounter difficulties in family doctor services.	0.954	0.913	0.916	0.786
		G3 I have confidence in my skills in family doctor services.	0.799			
Culture		H1 People-Centered organizational strategies, targets, guidelines, etc., for family doctor services.	0.975	0.964	0.964	0.899
		H2 People-Centered cultural activities such as publicity and commendation for family doctor services.	0.942			
		H3 People-Centered tangible materials such as slogans, banners and brochures for family doctor services.	0.927			

[a]All loading values are significant at the 0.001 level. CR, composite reliability; AVE, average variance extraction.

3.3. Quality control

After designing the questionnaire, we ran a preliminary test. We asked the participants who took part in the preliminary test about their perceptions of the questionnaire to improve it. A pilot questionnaire survey with a sample size of 200 was conducted, the reliability and the validity of the questionnaire was evaluated. During the whole process of the pilot study, each participant was informed the purpose and method of the study. In addition, the questionnaires were distributed by graduate students with survey experience. Prior to the formal survey, standardized training was provided to the investigators to ensure that they had a clear understanding of the survey content and that they followed unanimous standards and methods. They administered the investigation by distributing the paper questionnaire to the family doctors who met the inclusion criteria. Each participant completed a questionnaire independently, with investigators available to address the questions. In the questionnaire, participants were asked to fill in their cell phone number and ID number to match the research

TABLE 2 Heterotrait – Monotrait (HTMT) of the questionnaire (N =473).

HTMT	F1	F2	F3	F4	F5	F6	F7	F8
Positive leadership	—							
Supportive resources	0.783	—						
Achievement motivation	0.768	0.821	—					
Reward	0.796	0.881	0.808	—				
Expectation of work	0.851	0.845	0.970	0.892	—			
Working environment	0.870	0.885	0.878	0.848	0.908	—		
Self-efficacy	0.813	0.891	0.921	0.853	0.930	0.912	—	
Culture	0.893	0.772	0.807	0.822	0.922	0.859	0.829	—

data obtained from the survey. This information served to identify and match identities under conditions of anonymity. After data collection was completed, the questionnaires were examined by the investigators, and those that did not meet the study requirements were checked with the participants. Subsequently, the questionnaires were coded and the data were double-entered.

3.4. Ethical considerations

Following the ethical guidelines outlined in the 1964 Declaration of Helsinki and its later amendments, data collection was carried out with the approval of the Ethics Committee of Hangzhou Normal University (approval number: 20190022). During the survey, each participant gave informed consent and understood the purpose and methods of the study. Due to the principle of privacy protection, this study stated that participants' information will only be used for research purposes.

3.5. Statistical analysis

3.5.1. Preliminary analyses

Statistical packages including Analysis of Moment Structure (Amos) version 24.0, Statistical Product and Service Solutions (SPSS) version 26.0 and the macro PROCESS procedure for SPSS version 4.1 were applied to analyze the data in this research. Normal distribution, outliers, and multicollinearity were evaluated through the following standards: first, normal distribution was examined by kurtosis (ku) and coefficients of skewness (sk); second, the presence of outliers was determined by Mahalanobis Distance; third, multicollinearity was measured through the variance inflation factor (VIF) and tolerance rate; fourth, correlations of main variables were reported by Spearman correlations (shown as values of r).

3.5.2. Mediation and moderation analyses

We used SEM to analyze the mediating effect of supportive resources and achievement motivation. To evaluate the reliability of the questionnaire, we employed composite reliability (CR) and internal consistency (Cronbach's coefficient). To assess the validity of the questionnaire, we employed convergent validity (average variance extracted, AVE) and discriminant validity (heterotrait-monotrait, HTMT). Additionally, we implemented the maximum-likelihood method in the SEM to assess and validate the effecting path from positive leadership, supportive resources and achievement motivation to QWL. In succession, we applied 5,000 replicate samplings of the percentile bootstrap method at the 95% confidence level (CI) to measure the mediating effect, and if the value of CI did not include 0, the difference in effect had statistical significance. In addition, we employed hierarchical linear regression analysis in SPSS to examine the moderating effect of culture on the impact of positive leadership on achievement motivation, positive leadership on QWL and positive leadership on supportive resources. To further test the positive moderating effect, we applied a straightforward slope test. Ultimately, Model 85 in the SPSS PROCESS macro was used in the model with positive moderating effect to test the moderated mediation effect of culture in the path of positive leadership on QWL, with supportive resources and achievement motivation as two mediators. When the culture score was the sample mean and at plus or minus 1 SD, we tested the indirect moderated mediation of positive leadership on QWL through supportive resources and achievement motivation.

4. Results

4.1. Demographic characteristics

The results of descriptive analysis and QWL scores are shown in Table 3. Among the 473 total participants, 353 (74.6%) were female, and 120 (25.4%) were male. In terms of age, the participants were concentrated in the age group of 25–35 (34.9%), followed by those in the age group of 35–45 (38.1%). In terms of marital status, 293 (61.9%) respondents were married. For education level, 328 (69.3%) respondents had a college degree, and 84 (17.8%) respondents had a junior college degree. Regarding posts, the respondents were mainly Western medicine doctors (49.7%) and nurses (9.1%). In terms of income, the respondents were mainly in the high-income group (62.6%). For working shifts, 256 (54.1%) of the respondents were on regular shifts, and 217 (45.9%) were on shifts. Finally, 120 (25.4%) had worked 20 years or more. The QWL of family doctors was assessed by scale scores. There were significant differences in respondents' QWL scores across age ($F = 10.60$, $p < 0.01$), marital status ($F = 51.89$, $p < 0.01$), educational background ($F = 9.20$, $p < 0.01$), post ($F = 10.28$, $p < 0.01$), and income ($F = 96.60$, $p < 0.01$). Youthful (<25) family doctors ($M = 5.89$, SD = 0.98) had the highest score. Married ($M = 5.29$, SD = 1.05) family doctors had the highest score. The participants with a high school degree and below ($M = 5.30$, SD = 1.00) scored highest; however those with a master's degree and above ($M = 3.17$, SD = 1.19) had the lowest score. High-income (≥50,000) respondents ($M = 5.36$, SD = 1.01) had the highest score, and low-income (≤10,000) respondents ($M = 3.41$, SD = 0.82) scored the lowest. Medical technicians ($M = 5.50$, SD = 0.79) had the highest score, while western medicine doctors ($M = 4.45$, SD = 1.34) scored the lowest. Except for those aforementioned, gender ($t = 0.695$, $p = 0.60$), work shift ($t = 1.07$, $p = 0.65$) and work seniority ($F = 2.81$, $p = 0.25$) were not significant in the difference in QWL score.

TABLE 3 Comparison of family doctors' mean QWL scores on the questionnaire based on different demographic variables (N =473).

Characteristic	Categorization	Total score
Gender	Male (120)	4.87 ± 1.33
	Female (353)	4.77 ± 1.29
	t (p)	0.695 (0.60)
Age (years)	<25 (35)	5.89 ± 0.98
	25- (165)	4.85 ± 1.26
	35- (180)	4.60 ± 1.34
	45- (93)	4.68 ± 1.20
	F (p)	10.60 (<0.01)
Marital status	Unmarried (163)	3.98 ± 1.26
	Married (293)	5.29 ± 1.05
	Divorced (9)	3.35 ± 0.77
	Other (8)	4.80 ± 1.30
	F (p)	51.89 (<0.01)
Educational background	High school and below (38)	5.30 ± 1.00
	Junior college (84)	5.08 ± 1.23
	College (328)	4.74 ± 1.30
	Master and above (23)	3.71 ± 1.19
	F (p)	9.20 (<0.01)
Post	Western doctor (235)	4.45 ± 1.34
	Chinese traditional medicine doctor (43)	4.57 ± 1.36
	Public health doctor (26)	5.33 ± 0.86
	Nurse (118)	5.16 ± 1.18
	Medical technician (36)	5.50 ± 0.79
	Others (15)	5.49 ± 0.98
	F (p)	10.28 (<0.01)
Income	low (131)	3.41 ± 0.82
	lower–middle (5)	3.97 ± 1.16
	middle (8)	5.13 ± 1.16
	upper–middle (33)	5.31 ± 1.00
	high (296)	5.36 ± 1.01
	F (p)	96.60 (<0.01)
Work shift	Regular (256)	4.86 ± 1.31
	Shift (217)	4.73 ± 1.28
	t (p)	1.07 (0.65)
Work seniority	<5 (53)	5.31 ± 1.41
	5- (111)	4.78 ± 1.26
	10- (104)	4.84 ± 1.26
	15- (75)	4.65 ± 1.31
	20- (130)	4.65 ± 1.26
	F (p)	2.81 (0.25)

Means, standard deviations, and Spearman correlations among the variables are presented in Table 4, since the data are non-normally distributed. An examination of the correlations indicates that the correlations among all variables ($p < 0.01$) were significant, which includes positive leadership, supportive resources, achievement motivation, QWL and culture.

4.2. Construction and fit of the SEM

In this study, SEM was established with positive leadership, supportive resources and achievement motivation as independent variables and QWL as the dependent variable. We applied the maximum-likelihood method to evaluate the initial model. The C.R. value in essence represents the normalized estimation of multivariate kurtosis (Mardia, 1970). According to Bentler (2005), values >5.00 shown in practice, are usually a symbol that the data are non-normally distributed. The z-statistic was 292.505, which indicates non-normality of the data. Thus, to accommodate the lack of multivariate normality, we applied the Bollen-Stine bootstrap method to adjust the model and parameters (Bollen and Stine, 1992). Table 5 shows the results of the acceptable fit for the measurement model with the modified index.

Figure 2 is the demonstration of the definitive model, which indicates the standardized path coefficients for the whole model. The results of the causal model proved that: (1) the effects of positive leadership on QWL, achievement motivation and supportive resources were significant, with standardized path coefficients of 0.29,

TABLE 4 Mean, standard deviation, and correlation coefficient of each variable (N=473).

Variable	1	2	3	4	5
1. Positive leadership					
2. Supportive resources	0.755**				
3. Achievement motivation	0.746**	0.768**			
4. QWL	0.858**	0.874**	0.869**		
5. Culture	0.852**	0.741**	0.755**	0.873**	
Mean value	5.125	4.451	4.853	4.7985	5.153
Standard deviation	1.4308	1.5050	1.3751	1.2972	1.332

**$p < 0.01$, two-tailed test.

TABLE 5 Fitting results of the structural equation model.

Fitting index	Fitting standard	Model	
		Initial model	Modified model
Chi-square freedom ratio χ^2/df	$1 < \chi^2/df < 3$ Good	3.620	1.612
Root mean square error of approximation RMSEA (90%CI)	<0.05 Good	0.053	0.036
Goodness of fit index, GFI	>0.90 Good	0.844	0.964
Adjusted goodness of fit index, AGFI	>0.90 Good	0.799	0.950
Normed fit index, NFI	>0.90 Good	0.920	0.964
Confirmatory fit index, CFI	>0.90 Good	0.940	0.986
Bentler and Bonett's non-normed fit index, TLI	>0.90 Good	0.930	0.984

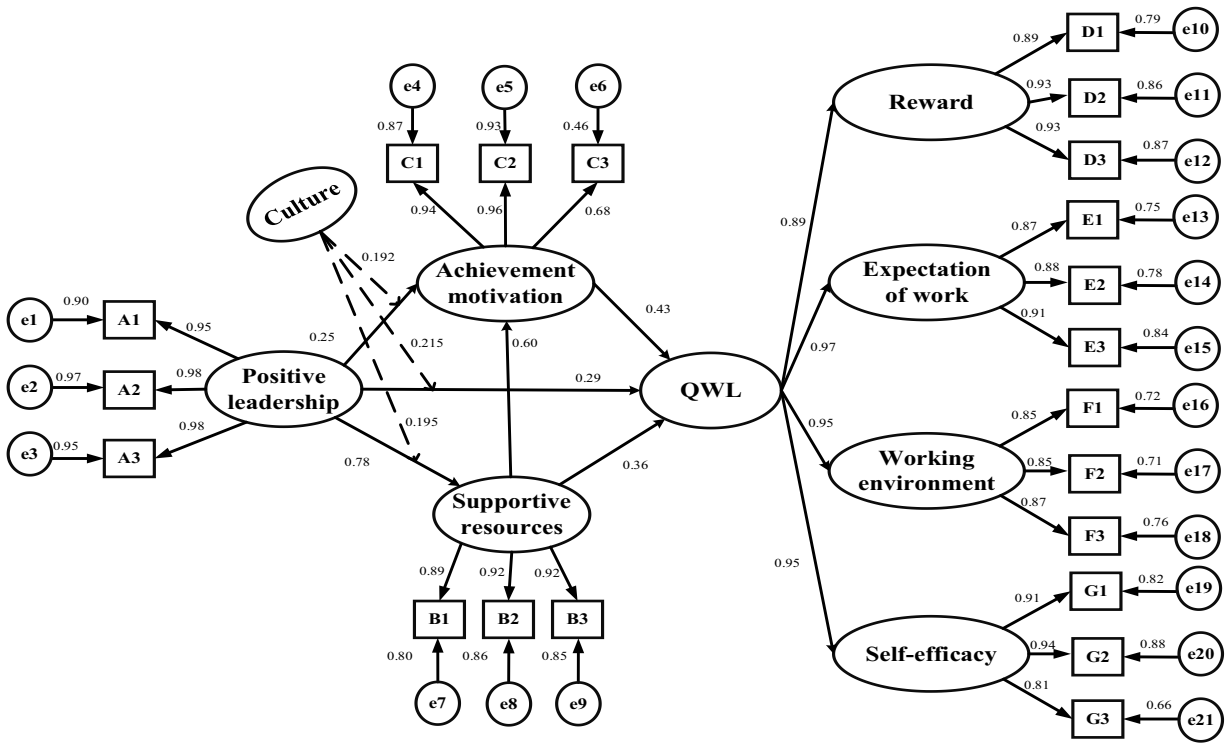

FIGURE 2
Model diagram of the influence of positive leadership promoting QWL.

0.25 and 0.78 ($p < 0.001$), respectively; therefore, H1, H2 and H4 were verified; (2) the effects of supportive resources on QWL and achievement motivation were significant, with standardized path coefficients of 0.29 and 0.60 ($p < 0.001$), respectively; thus, H3 and H6 were supported; and (3) the effect of supportive resources on QWL was significant, with a standardized path coefficient of 0.43 ($p < 0.001$); accordingly, H5 was supported.

4.3. Analysis of simple mediating effect

We employed a percentile bootstrap approach to assess whether the three mediating effects demonstrated in the SEM were significant, which is concretely reflected in Table 6. First, the significant indirect effect of positive leadership on QWL *via* the mediation of supportive resources was 49.2% of the total effect (the 95% CI was 0.192–0.350). Because the 95% CI did not include 0, the direct effect of this path was as well as prominent (the 95% CI was 0.200–0.353), showing that supportive resources partially mediated the effect of positive leadership on QWL. In line with this result, the mediation of achievement motivation was significant (the 95% CI was 0.043–0.173) and occupied 27.1% of the total effect, revealing that achievement motivation also incompletely mediated the effect of positive leadership on QWL. Additionally, the significant indirect effect of positive leadership on QWL *via* the chain mediation of supportive resources and achievement motivation accounted for 40.7% of the total effect (the 95% CI was 0.011–0.051). This result revealed that supportive resources and achievement motivation partially mediate the effect of positive leadership on QWL.

4.4. Analysis of moderating effect

We adopted hierarchical linear regression analysis with three steps in this section to, respectively, test the moderating effect of culture on the relationship between positive leadership and achievement motivation (route a), the relationship between positive leadership and QWL (route b), and the relationship between positive leadership and supportive resources (route c). Step 1 employed control variables in the univariate analysis, and step 2 added independent variables (positive leadership) and moderating variables (culture) based on the former. Then, with the foundation of step 1 and step 2, step 3 drew into the interaction of independent variables and moderating variables (positive leadership*culture). Additionally, multicollinearity between the variables was asserted by giving all variables centered before testing. In the three steps of each moderation route, the maximum variance expansion factor is 4.619, which is lower than 10, suggesting that no multicollinearity existed. Thus, the results of the research are credible.

In step 1, the influence of the control variables on the dependent variable can be observed. Educational level and income had positive effects on QWL among the three routes. In terms of step 2, the influence of the independent variable (positive leadership: $\beta_{(a)} = 0.238$, $p_{(a)} < 0.001$; $\beta_{(b)} = 0.349$, $p_{(b)} < 0.001$; $\beta_{(c)} = 0.454$, $p_{(c)} < 0.001$) and moderating variable (culture: $\beta_{(a)} = 0.443$, $p_{(a)} < 0.001$; $\beta_{(b)} = 0.500$, $p_{(b)} < 0.001$; $\beta_{(c)} = 0.333$, $p_{(c)} < 0.001$) on the three dependent variables were significant. For step 3, the interaction of positive leadership and culture had a positive effect on achievement motivation ($\beta_{(a)} = 0.192$, < 0.001), QWL ($\beta_{(b)} = 0.215$, $p_{(b)} < 0.001$) and supportive resources

TABLE 6 Bootstrap confidence interval estimation results of the simple mediating effect.

Variable relationship	Effect type	Effect value	LLCI	ULCI	Supported hypothesis
Positive leadership→ Supportive resources→QWL	Total effect	0.545	0.458	0.635	H2, H3
	Direct effect	0.277	0.200	0.353	
	Indirect effect	0.268	0.192	0.350	
Positive leadership→ Achievement motivation→QWL	Total effect	0.380	0.287	0.475	H4, H5
	Direct effect	0.277	0.200	0.353	
	Indirect effect	0.103	0.043	0.173	
Positive leadership →Supportive resources →Achievement motivation→ QWL	Total effect	0.467	0.375	0.562	H4,H6,H3
	Direct effect	0.277	0.200	0.353	
	Indirect effect	0.190	0.137	0.252	

LLCI represents lower limit 95% confidence intervals; ULCI represents upper limit: 95% confidence intervals.

($\beta_{(c)} = 0.195$, $p_{(c)} < 0.001$), proving that culture has a moderating effect on all three paths (see Tables 7–9 for details).

In addition, we used a simple slope test to further explore the moderating roles of culture in the three paths. First, it is verified that culture has a considerable impact on the relationship between positive leadership and achievement motivation, the relationship between leadership and QWL, and the relationship between positive leadership and supportive resources. Second, the interaction diagram (Figure 3) apparently reports the moderation effects of culture on the three routes, which indicates the interaction of positive leadership and culture at high (mean + 1SD) and low (mean – 1SD) levels of the culture. The slope values delegate the impact of positive leadership on achievement motivation (shown in Figure 3A), QWL (shown in Figure 3B) and supportive resources (shown in Figure 3C). The results indicated that the moderating effects were more significant and active if the respondents perceived a higher culture in the organization.

In summary, the moderating effect of culture was significant on the route of positive leadership-supportive resources (route c) in the high-culture perception group ($\beta_{(c)} = 0.721$, $t_{(c)} = 10.230$, $p_{(c)} < 0.001$) and low-culture perception group ($\beta_{(c)} = 0.201$, $t_{(c)} = 2.901$, $p_{(c)} = 0.004$). However, in route a (positive leadership – achievement motivation) and route b (positive leadership – QWL), the moderating effect was positive in the high-culture perception group ($\beta_{(a)} = 0.501$, $t_{(a)} = 7.717$, $p_{(a)} < 0.001$; $\beta_{(b)} = 0.643$, $t_{(b)} = 15.887$, $p_{(b)} < 0.001$), but had no positive effect in the low-culture perception group ($\beta_{(a)} = -0.011$, $t_{(a)} = -0.169$, $p_{(a)} = 0.866$; $\beta_{(b)} = 0.071$, $t_{(b)} = 1.771$, $p_{(b)} = 0.077$).

4.5. Analysis of moderated mediation effect

We applied Model 85 in the PROCESS macro with 5,000 bootstrap samples to test moderated mediation analysis. The moderated mediation effect of positive leadership on QWL *via* achievement motivation and supportive resources at distinct scores of culture was examined. As shown in Table 10, the moderated mediation effects were positive in all of the high level (mean + 1 SD), mean and low level (mean – 1 SD) respondents, as confirmed by the bootstrap 95% CI. Furthermore, the index was statistically significant ($\beta = 0.013$), and the bootstrap 95% CI (0.007–0.020) excluded 0, revealing that culture had a positive moderated mediation effect on the relationship between positive leadership and QWL through achievement motivation and supportive resources.

5. Discussion

5.1. Practice implications and future prospects

This study proves the influence of positive leadership in promoting the QWL of family doctors, in the context of PCIC practice. The interactions of environmental factors, psychological factors and culture in the PCIC model are explored. SEM, hierarchical linear regression analysis, and simple slope test are adopted to analyze the data from 473 family doctors in representative counties of Zhejiang Province. The results of SEM indicate that positive leadership has a direct effect on QWL and a mediating effect on QWL through supportive resources and achievement motivation. The hierarchical linear regression analysis shows that culture has a positive moderating effect on the relationship between three pairs of variables: positive leadership and achievement motivation, positive leadership and QWL, and positive leadership and supportive resources. The simple slope test proves that culture has a moderated mediating effect on the relationship between positive leadership and QWL *via* supportive resources and achievement motivation.

When analyzing demographic characteristics, we found significant differences in the QWL of different groups of family doctors. First, the younger group has a better experience of QWL, which is consistent with existing research, such as Klaghofer et al. (2010) and Penberthy et al. (2018), showing that younger doctors are more likely to maintain higher levels of professional enthusiasm and self-confidence, with less emotional burnout. In other words, among older family doctors, perceiving a high level of QWL is more difficult, suggesting that the psychological traits of older staff need to be considered when promoting QWL. In addition, married family doctors had the highest QWL score, which is in line with the extant literature: for instance, Tawfik et al. (2021) proved that married doctors had better work-life integration. Therefore, more attention should be given to family doctors to improve their work-life balance. However, there is an interesting finding that family doctors with lower education levels had better QWL, which is contrary to the findings of many studies on the correlation between high education levels and good QWL (Golubic et al., 2009). This phenomenon may be caused by the special professional environment of family doctors in China. Influenced by marketization since the 1980s, the CHCs in China has gradually been

TABLE 7 Moderating effect of culture on the relationship between positive leadership and achievement motivation.

Variable	Step 1			Step 2			Step 3		
	Dependent variable for steps 1–3: Achievement motivation								
	β	SE	*t*	*β*	SE	*t*	*β*	SE	*t*
Control variables									
Gender	−0.089	0.124	−2.271*	−0.063	0.102	−1.948	−0.065	0.099	−2.088*
Age	−0.091	0.107	−1.355	−0.024	0.088	−0.435	−0.008	0.085	−0.155
Marital status	−0.013	0.103	−0.3	−0.024	0.085	−0.67	−0.024	0.082	−0.684
Education level	−0.063	0.081	−1.566	0.001	0.067	0.042	−0.001	0.065	−0.027
Post	0.109	0.036	2.632**	0.052	0.029	1.519	0.056	0.029	1.691
Income	0.542	0.035	12.098***	0.114	0.036	2.452*	0.143	0.035	3.144**
Work shift	−0.108	0.104	−2.886**	−0.075	0.085	−2.413*	−0.068	0.083	−2.256*
Work seniority	−0.09	0.066	−1.36	−0.03	0.054	−0.555	−0.039	0.053	−0.752
Independent variables									
Positive leadership				0.238	0.06	3.815***	0.245	0.058	4.053***
Culture				0.443	0.064	7.089***	0.518	0.064	8.359***
Positive leadership × Culture							0.192	0.021	5.613***
R^2	0.392			0.591			0.617		
$\triangle R^2$	0.392			0.2			0.026		
F	37.338***			66.832***			67.633***		
VIF_{max}	3.462			4.404			4.619		

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$; VIF_{max}, maximum variance expansion factor.

at a disadvantage in competition with hospitals; therefore, adverse selection of medical personnel in CHCs has gradually formed (Hsieh and Tang, 2019). Medical staff with lower educational levels and lower job expectations may be recruited in CHCs, while those with higher educational level are more eager to work in hospitals rather than in CHCs. Therefore, improving the professional identity of highly educated family doctors is an entry point for improvement. Since demographic sociological characteristics form the basis of the intrinsic psychological characteristics of individuals, it suggests to some extent that psychological characteristics need to be taken into account in QWL improvement.

In this study, the SEM proved that positive leadership has positive effects on the QWL of family doctors, through the mediating effect of supportive resources. Positive leadership may provide family doctors with better rewards such as higher compensation, more career promotion opportunities and personal development opportunities; however, among these rewards, the resources supporting family doctor service play an indispensable role. These findings are supported by some existing research. For example, Luo et al. (2022) demonstrated that sufficient resources are needed in staff motivation for active engagement. In addition, the working environment may also be improved by positive leadership through supportive resources. For instance, sufficient drug supply and doctor–patient relationship-friendly policies and rules will provide family doctors with a more relaxed doctor–patient cooperative environment. de Oliveira Vasconcelos Filho et al. (2016) argued that available resources will be able to motivate health care teams to achieve better healthcare outcomes. All the aforementioned findings highlight the necessity of sectorial collaboration in resource delivery, such as the financial department, medical insurance system, education and training system, etc. Positive leadership is key in such collaboration, which plays the role of reasonable allocation, coordination and utilization of resources for QWL promotion.

The SEM also proved that individual psychological factors mediate the effect of positive leadership on the QWL of family doctors. Positive leadership may stimulate the achievement motivation of family doctors to pursue valuable goals, achieve high performance, and strive for success. A possible explanation is that, first, positive leadership may promote the satisfaction of working expectations by highlighting the strengths of each participant and emphasizing the value of the work. This is consistent with previous research results, that is, the positive leadership of the family doctor team will be able to create a value-driven organizational environment, promote integration and coordination among team members, and ultimately achieve high-quality family doctor services (Jenkins et al., 2021; Mathews et al., 2022). In addition, positive leadership may also foster working competence and increase self-efficacy by encouraging interprofessional collaboration among team members, such as multiple disciplinary team service. In addition, the working environment may also be improved, since positive leadership may stimulate the internal motivation of family doctors to pursue friendly interpersonal interactions. This result corresponds to a study on maternal care; that is, positive leadership has created a patient-centered collaborative nursing model in family doctor care, which emphasizes harmonious interpersonal interaction to achieve efficient family doctor care (Pecci et al., 2007). Furthermore, there are complex interactions of supportive resources-achievement distant mediating effects. Available resources such as funding may stimulate the

TABLE 8 Moderating effect of culture on the relationship between positive leadership and QWL.

Variable	Step 1			Step 2			Step 3		
	Dependent variable for steps 1–3: QWL								
	β	SE	*t*	*β*	SE	*t*	*β*	SE	*t*
Control variables									
Gender	−0.074	0.107	−2.058*	−0.042	0.067	−1.879	−0.045	0.062	−2.182*
Age	−0.116	0.092	−1.881	−0.033	0.058	−0.849	−0.015	0.053	−0.429
Marital status	0.018	0.089	0.452	0.003	0.056	0.102	0.003	0.051	0.125
Education level	−0.085	0.069	−2.341*	−0.005	0.044	−0.203	−0.007	0.04	−0.34
Post	0.085	0.031	2.243*	0.013	0.019	0.547	0.018	0.018	0.805
Income	0.613	0.03	14.98***	0.081	0.024	2.476*	0.112	0.022	3.746***
Work shift	−0.086	0.089	−2.511*	−0.045	0.056	−2.09*	−0.037	0.052	−1.885
Work seniority	−0.068	0.057	−1.13	0.006	0.036	0.155	−0.005	0.033	−0.133
Independent variables									
Positive leadership				0.349	0.04	8.012***	0.357	0.036	8.941***
Culture				0.5	0.043	11.446***	0.584	0.04	14.250***
Positive leadership × Culture							0.215	0.013	9.480***
R^2	0.492			0.8			0.833		
$\triangle R^2$	0.492			0.308			0.033		
F	56.113***			184.780***			208.469***		
VIF_{max}	3.462			4.404			4.619		

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$; VIF_{max}, maximum variance expansion factor.

TABLE 9 Moderating effect of culture on the relationship between positive leadership and supportive resources.

Variable	Step 1			Step 2			Step 3		
	Dependent variable for steps 1–3: Supportive resources								
	β	SE	*t*	*β*	SE	*t*	*β*	SE	*t*
Control variables									
Gender	−0.052	0.142	−1.272	−0.027	0.111	−0.83	−0.029	0.107	−0.937
Age	−0.137	0.122	−1.939	−0.062	0.096	−1.128	−0.046	0.093	−0.864
Marital status	0.038	0.118	0.81	0.019	0.092	0.517	0.019	0.089	0.543
Education level	−0.132	0.092	−3.143**	−0.054	0.073	−1.651	−0.057	0.07	−1.778
Post	0.08	0.041	1.841	0.012	0.032	0.34	0.016	0.031	0.477
Income	0.455	0.04	9.699***	−0.035	0.039	−0.76	−0.006	0.038	−0.14
Work shift	−0.077	0.119	−1.963	−0.042	0.093	−1.369	−0.035	0.09	−1.176
Work seniority	−0.049	0.076	−0.706	0.019	0.059	0.351	0.009	0.057	0.18
Independent variables									
Positive leadership				0.454	0.065	7.325***	0.461	0.063	7.689***
Culture				0.333	0.07	5.362***	0.409	0.069	6.651***
Positive leadership × Culture							0.195	0.023	5.735***
R^2	0.332			0.597			0.623		
$\triangle R^2$	0.332			0.264			0.027		
F	28.887***			68.303***			69.369***		
VIFmax	3.462			4.404			4.619		

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$; VIF_{max}, maximum variance expansion factor.

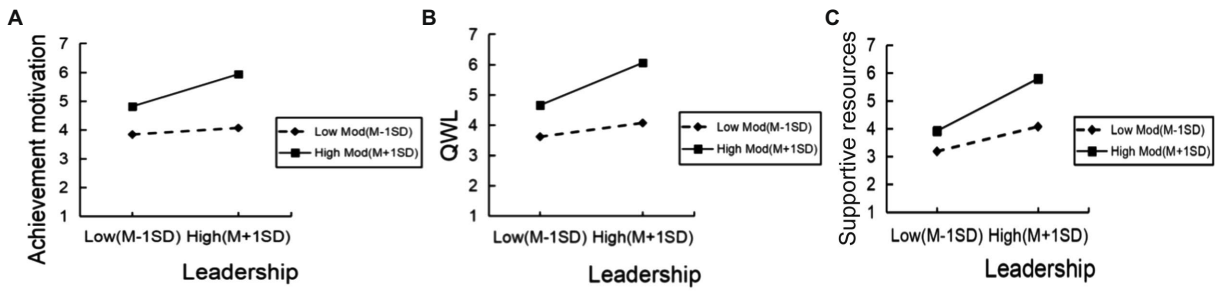

FIGURE 3
Moderating effect diagram of culture.

TABLE 10 Bootstrap confidence interval estimation results of moderated mediating effect: specific conditional values of culture and the index of moderated mediation.

Culture	β	SE	LLCI	ULCI
−1SD	0.030	0.009	0.012	0.049
Mean	0.047	0.010	0.028	0.068
+1SD	0.063	0.013	0.040	0.090
	Index	SE	LLCI	ULCI
Culture	0.013	0.004	0.007	0.020

LLCI represents lower limit 95% confidence intervals; ULCI represents upper limit: 95% confidence intervals.

achievement motivation of family doctors under a reasonably value-oriented compensation system guided by positive leadership, thus further improving the QWL of family doctors.

In addition, the moderating model provided a more detailed explanation of the influence by which positive leadership promotes QWL among family doctors. We found significant positive mediating effects of supportive resources and achievement motivation between positive leadership and QWL, which can be moderated by culture. This suggests that culture is conducive to helping leaders to better coordinate resources and motivate staff engagement. The better the culture-shaping in the family doctor team, the more effective promotion of QWL will be gained. This is consistent with Kim et al.'s finding that a supportive culture changes employees' attitudes and self-efficacy and ultimately has a positive impact on work and quality of life (Kim and Jang, 2018). It is also worth mentioning that on the pathway mediated by achievement motivation, there was a significant positive moderating effect only for high culture subgroup, but not low culture subgroup. This result demonstrated that a certain high level of people-centered culture is required to moderate QWL.

5.2. Strengths and limitations

This study proves the effects of positive leadership on family doctor QWL, with the interactions of environmental factors, organizational factors and individual psychological factors. It provides a theoretical basis for the co-governance of multiple participants in family doctor services with stakeholders of the government, healthcare organizations, family doctor teams and individuals. The study also explores the role of culture in the context of PCIC, which may provide evidence for the potential influences of PCIC practice on the positive leadership and QWL of medical staff.

A series of measurements have been taken to improve the research quality. First, an extensive search of multiple databases was conducted in the literature study to ensure that existing developed measurement scales in the published literature were adequately included. Second, informed interviews and Delphi consultations were also used to revise the measurement scale to ensure that the QWL of family doctors could be accurately evaluated by measurement in the context of the local sociocultural environment. Third, multiple statistical analysis methods were adopted to mutually confirm the effect of positive leadership on family doctor QWL; for example, the moderating effect of culture was verified by hierarchical regression and a simple slope test.

The possible limitations in this study are as follows. First, response bias cannot be excluded due to data collection with self-report measures, and the measurements were based on personal experience rather than objective data, although we installed control variables to avoid individual interference. Second, there is a bias in the average annual income of individuals. This is because the reference base we used is based on the overall level of China, while most medical staff in Zhejiang Province belong to the high-income group. Third, the questionnaire used in this study was self-designed, and the quality of measurement needs special evaluation. However, the indicators were derived from a series of questionnaires validated by several studies and with reference to interview results and the Delphi method, so the questionnaire has good reliability and validity. Fourth, this study is cross-sectional and does not measure the impact of change over time. However, family doctor service policies were relatively stable during this period. Last, the results may not be representative of other regions because all participants were sampled in Zhejiang Province in China. However, since Zhejiang Province is the pilot area of PCIC, family doctor teamwork, positive leadership and culture in such an environment will still provide a reference for other countries facing similar challenges of primary health care failure and low enthusiasm of family doctors in similar settings.

It is worth further discussing that extended research aspects could focus on the influencing factors of positive leadership rather than just the role of positive leadership. Clearly, the main reason for poor QWL is inadequate positive leadership, but which factors influence positive leadership can be explored in subsequent studies. Additionally, in this study, we can also combine the positive leadership of primary healthcare with the relevant theories of different leadership styles to further explore whether different leadership styles promote inspirational motivation in the family doctor team and explore the

changes in the QWL of family doctors under different leadership styles. This means it could ensure that the impact of act motivation related to family doctors on perceived QWL can be tested. Ultimately, this study would be able to expand the sample size in domestic regions and then conduct multiple group analyses and comparisons to determine if the influence of QWL differs across regions.

6. Conclusion

This study proved the influence of positive leadership on the QWL of family doctors. QWL can be significantly improved by positive leadership in the context of PCIC practice, among which supportive resources and achievement motivation mediate the positive correlation between positive leadership and QWL. In addition, people-centered culture has a moderate mediating influence on the relationship between positive leadership and QWL through supportive resources and achievement motivation. Moreover, positive leadership had a significant effect on QWL for the high-culture perception group, but had no effect for the low-culture perception group. In summary, the interaction among multiple factors, including environmental factors, individual physiological features and culture, may influence the positive effects of positive leadership on the QWL of family doctors in the context of PCIC.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving human participants were reviewed and approved by Hangzhou Normal University Scientific Research Ethics Committee (approval number: 20190022). The patients/participants provided their written informed consent to participate in this study.

Author contributions

WS: formal analysis, writing—original draft preparation, and validation. XH: conceptualization, methodology, and software. XY and YW: writing—original draft preparation and validation. ZH: investigation and data collection. YC, CP, and YJ: review and data collection. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2023.1139341/full#supplementary-material

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The influence of stressful life events on procrastination among college students: multiple mediating roles of stress beliefs and core self-evaluations

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Introduction: Few studies have documented the relationship between stressful life events and procrastination, which is a prevalent and troubling problem among college students. In this regard, the current study examined the association between stressful life events and procrastination through potential mediating effects of stress beliefs and core self-evaluations.

Methods: A cross-sectional design was carried out and data were collected from a total of 794 Chinese college students with measures of stressful life events, core self-evaluations, stress beliefs, and procrastination.

Results: Stressful life events was positively associated with procrastination in college students. Stress beliefs and core self-evaluations played multiple mediating roles in this relationship.

Discussion: The study provided a novel perspective of finding the possible causes of procrastination in college students and highlighted the roles of stress beliefs and core self-evaluations.

KEYWORDS

stressful life events, procrastination, core self-evaluations, stress beliefs, college students

1. Introduction

Procrastination, a maladaptive behavior that individuals delay an intended course of action regardless of possible negative consequences, is often characterized by voluntariness, avoidance and irrationality (Steel, 2007). Research interest in procrastination is increasing as it becomes more prevalent and exhibits high stability across time and context, as well as universality across cultural (Steel and Ferrari, 2013). Procrastination is also a challenging phenomenon among college students due to relatively independent yet complex external environment and immature mental development (Zhao et al., 2021). For college students, procrastination has been found to prevent success in academic learning, cause short-and long-term negative experience, and largely impair physical and mental health (Chen et al., 2020; Hong et al., 2021; Peixoto et al., 2021). While procrastination has been most investigated in the domain of academic behavior, it has also been transferred to work activities, as well as to various life domains such as health behaviors. However, knowledge regarding the processes that contribute to general procrastination of college students is not well established. Research needs to examine factors predicting procrastination among college students and the detailed mechanisms should be further elucidated for designing interventions.

1.1. Stressful lifer events and procrastination

According to ecological systems theory, individuals' psychological development and behaviors are shaped by a variety of personal characteristics as well as environmental factors (Bronfenbrenner, 1977). A growing body of research has demonstrated that procrastination is shaped by personal factors such as conscientiousness (Gao et al., 2021), future time perspective (Liu and Feng, 2019), and self-control (Xu et al., 2021), as well as environmental factors such as parenting dimensions (Amani and Arbabi, 2020). As an environmental factor closely related to personal experience, stressful life events refer to the traumatic events and negative life changes in family, school and social life environment. In general, the evaluation of stressful life events relies on the objective situation, but is still affected by the lens through which the situation is perceived. The more stressful life events a person perceives, the worse they are likely to perform. It has been verified that stressful life events can result in psychological maladjustment, including individual well-being damage (Ouyang et al., 2021), depressive symptoms (Toyoshima et al., 2021), and externalizing problems (March-Llanes et al., 2017), like Internet gaming addiction (Sung et al., 2020), gambling (Wang et al., 2020), and even self-injury and suicide (Liu et al., 2019; Mo et al., 2019). Additionally, college students who have limited psychological resources are more likely to adopt negative coping methods such as withdrawal when exposed to more stressful life events (Li et al., 2009). Thus, perceived stressful life events may induce general negative implications for procrastination that are not limited to the academic domain. It is important to further explore whether stressful life events is associated with general procrastination in college students, and if so, what factors could be responsible for their association.

1.2. Stress beliefs as a mediator

Besides exerting a direct effect on procrastination, stressful life events may also affect procrastination through cognition, personality and other mediating factors. We first focused on a possibly crucial cognitive process in pathways from stressful life events to procrastination, namely one's general attributes and expectations for stress, that is, stress beliefs (Crum et al., 2013). Stress beliefs are lay beliefs or lay theories about stress held by an individual, which can be formed by past experience of situations both empirically and vicariously, and influence how a person copes with stress (Kilby et al., 2020). According to theory of stress mindset, higher-level belief systems can explain interindividual differences in evaluations, reactions and results of stressful life events (Kilby et al., 2020). Previous findings have suggested that individuals with a positive stress beliefs showed higher cognitive flexibility and amplifying attentional bias to positive information (Crum et al., 2017). Again, negative stress beliefs have been linked to health- and performance-related problems, such as higher subjective stress appraisal, physiological stress responses and physical symptoms, and reduced academic performance in stressful situations (Fischer et al., 2016; Keech et al., 2018; Laferton et al., 2020). More importantly, the association between threat stress mindset and avoidance-motivated responses has been established (Jamieson et al., 2018). A recent study further indicated that exposure to stressful life events is related to avoidant coping strategies through the role of threat stress mindset (Chen and Qu, 2021). Based on prior theoretical and empirical grounds, we speculated that stress beliefs might also mediate the stressful life events–procrastination relationship.

1.3. Core self-evaluations as a mediator

Self-belief system model argues that risk factors exhibit an impact on adaptive consequences through self-system beliefs (Sandler, 2001), so core self-evaluations might also be a mediating variable worth considering. It is commonly accepted that core self-evaluations is a high-order, stable personality trait that manifests itself in at least four characteristics: self-esteem, generalized self-efficacy, neuroticism, and locus of control, representing a comprehensive appraisal of one's own worth (Judge, 2009). Studies have proven that stressful life events can threaten positive self-schemas and increase the level of fatalism, thereby resulting in lower core self-evaluations (Orth and Luciano, 2015; Zuo et al., 2020). Furthermore, core self-evaluations reflect one's response to self, others, environment and events, and play an important role in the process of adaptation to internal and external environment (Judge et al., 2003). For instance, individuals with low core self-evaluations are more likely to adopt inadequate coping styles like procrastination rather than proactive approach to solve problems (Geng et al., 2018). A longitudinal study further demonstrated that individuals with low self-esteem tend to avoid failure and maintain self-worth through procrastination, which is also known as self-handicapping (Yang et al., 2021). Thus, we proposed that core self-evaluations could also mediate the link between stressful life events and procrastination.

1.4. Stress beliefs and core self-evaluations as mediators

It is also logical to predict that stress beliefs and core self-evaluations have a sequential mediating role between stressful life events and procrastination. As a cognitive process, positive stress beliefs can function as a mediation mechanism in the prediction of family support on ones' positive self-evaluations and psychological changes (Luu, 2022). Some researchers provided evidence that negative effect of beliefs about adversity, which was regarded as a type of cognitive heuristic that are related to appraisal or responses to stress, could be transmitted through self-esteem (Crum et al., 2017; Wang and Liu, 2022). Therefore, another aim of the present study is to confirm that stressful life events would result in negative stress beliefs, and then impair core self-evaluations, which increase the risk of procrastination.

1.5. Current study

Existing studies provide support for exploring the relationship between stressful life events and college students' procrastination as well as the role of stress beliefs and core self-evaluations. Combined with the aforementioned ecological systems theory and self-system belief model, we constructed a multiple mediating model to test the following hypotheses: stressful life events relate with procrastination (H1) and stress beliefs and core self-evaluations mediate (H2).

2. Materials and methods

2.1. Participants and procedures

An anonymous cross-sectional sample were recruited through the network from several cities in China and a total of 876 college students completed the measurements. After deleting invalid questionnaires such as regular answers, self-report data were collected from 794 college students aged from 17 to 24 years ($M \pm SD = 19.81 \pm 1.35$ years) with an effective rate of 90.6%. The respondents include 306 males (38.54%; $M = 19.65$, SD = 1.59) and 488 females (61.46%; $M = 19.90$, SD = 1.17). Freshmen accounted for 37.5% ($n = 298$; male: $n = 151$), sophomores accounted for 30.9% ($n = 245$; male: $n = 55$), juniors accounted for 17.5% ($n = 139$; male: $n = 47$) and seniors accounted for 14.1% ($n = 112$; male: $n = 53$). The current study was approved by first author's university ethics committee (No. SXULL2021082). The principle of confidentiality were explained and informed consent was provided by all the participants.

2.2. Measures

2.2.1. Stressful life events

The 26-item version of Adolescent Self-rating Life Events Check-List was used to measure stressful life events (ASLEC; Xin and Yao, 2015). The scale described the following five aspects of life stress including interpersonal relationships (e.g., "I was misunderstood"), academic pressure (e.g., "I failed in the examination"), being punishment (e.g., "I was criticized and punished"), bereavement (e.g., "A family member/close friend died"), and health and adaptation problem (e.g., I was away from family). Participants were asked to report the degree to which each life event was applicable to their lives in the past six months using a six-point Likert scale with 0 representing "it never happened" and 1–5 representing "occurred and not stressful" to "occurred and extremely stressful," respectively. The average score of all items was computed with a higher score indicating more perceived stressful experiences. In this study, the Cronbach's α for the scale was 0.94.

2.2.2. Stress beliefs

Stress beliefs was assessed using Beliefs about Stress Scale (BASS, Laferton et al., 2016; Pan et al., 2019). The scale consists of three subscales of negative stress beliefs ("being stressed makes me less resilient"), positive stress beliefs ("being stressed enables me to work in a more focused manner"), and control beliefs ("being stressed is something I am able to influence positively using my thoughts"). The questionnaire included 15 questions in total and seven of them were reversed scored. Participants were asked to rate the degree to which each item represented themselves on a five-point Likert scale from 1 ("completely disagree") to 5 ("definitely agree"). The average score of all items was computed with a higher score indicating more positive beliefs on stress. The Cronbach's α for this scale was 0.83.

2.2.3. Core self-evaluations

The Core Self-Evaluations Scale (CSES, Judge et al., 2003) was used to measure the core self-evaluations. The scale included 10 items (e.g., "I am confident I get the success I deserve in life."). A five-point Likert rating scale ranging from 1 ("strongly disagree") to 5 ("strongly agree") was employed to evaluate the score and six of them were reversed scored. The average score for all items was calculated and a higher score reflected higher level of self-evaluations. The Cronbach's α for this scale was 0.85.

2.2.4. Procrastination

The nine-item version of General Procrastination Scale (GPS-9, Sirois et al., 2019; Zhang et al., 2020) was used to measure procrastination in this study. Items included statements such as "I generally delay before starting work I have to do." Questions were answered on a five-point Likert rating scale (1 = "strongly disagree"; 5 = "strongly agree"). The responses were averaged and three items were reversed scored so that a higher score reflected a greater tendency towards procrastination. The Cronbach's α for this scale was 0.77.

2.3. Statistical methods

In the present study, all statistical analyses were conducted using SPSS 24.0. Descriptive statistics and Pearson correlations were calculated for the main variables. The difference between males and females were assessed for significance using an independent sample t-test and Cohen's d calculations. We first employed direction dependence analysis (DDA) in the PROCESS macro to assess the direction of the relationship among variables. DDA is a framework that is employed to confirm or disconfirm the ordering of a relationship by examining several properties of cross-sectional data (Wiedermann and Li, 2018). Stepwise linear regressions were then conducted to examine the independent associations between stressful life events and procrastination. Model 6 in the PROCESS macro (The model assumes that there are two mediation variables acting as sequential mediators) in SPSS developed by Hayes (2013) was adopted to examine the mediating effect. We used 5,000 bootstrapping samples to obtain the bootstrap confidence interval (CI) of parameter estimation and the effect was significant if the 95% CI does not include zero (see Figure 1).

3. Results

3.1. Preliminary analyses

As shown in Table 1, stressful life events was positively correlated with procrastination, negatively correlated with core self-evaluations and stress beliefs. Procrastination was also negatively correlated with

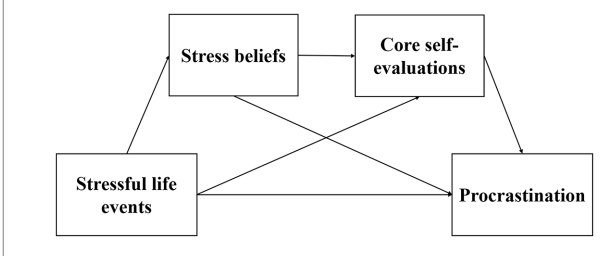

FIGURE 1
A hypothesized multiple mediating model.

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stress beliefs and core self-evaluations. Stress beliefs was positively correlated with core self-evaluations. The independent sample *t*-test also showed that males perceived more stressful life events than females ($t = 2.79$, $p < 0.01$, Cohen's $d = 0.203$). The DDA results were reported in supplementary materials. Briefly, the results at least partially supported pathway direction depicted in our model (Table 2, see details in Supplementary Tables S1–S3).

3.2. The multiple mediation effect testing

As displayed in Table 3, stressful life events was positively associated with procrastination, $\beta = 0.22$, $p < 0.001$, 95% CI = [0.15, 0.30] (total effect, model 1). The results also showed that stressful life events had a significant positive association with stress beliefs, $\beta = -0.24$, $p < 0.001$, 95% CI = [−0.31, −0.17] (model 2). Model 3 showed that stressful life events ($\beta = -0.18$, $p < 0.001$, 95% CI = [−0.23, −0.12]) and stress beliefs ($\beta = 0.55$, $p < 0.001$, 95% CI = [0.48, 0.61]) were significantly associated with core self-evaluations, respectively. Besides, after adding the mediating variables to the model, the direct effect of stressful life events on procrastination was still significant ($\beta = 0.08$, $p < 0.05$, 95% CI = [0.02, 0.14]). Stress beliefs ($\beta = -0.14$, $p < 0.001$, 95% CI = [−0.22, −0.06]) and core self-evaluations ($\beta = -0.36$, $p < 0.001$, 95% CI = [−0.44, −0.27]) were positively associated with procrastination (model 4; Figure 2).

As shown in Table 4, analysis of the mediating effect showed the 95% CI of the various path coefficients did not include 0, which indicated that the total effects, direct effects, total mediating effects, and the indirect effects of the three mediation paths were all significant. The direct effect (effect size = 0.08) and total indirect effect (effect size = 0.14) accounted for 36.36% and 63.63% of the total effect (effect size = 0.22), respectively. Specifically, the indirect effect consists of three paths and accounted for 13.64%, 27.27% and 22.73% of the total effects, respectively. No significant differences were found when the effects of these paths were compared ($p > 0.05$).

TABLE 1 Descriptive statistics and correlations among the variables (N=794).

	Variable	1	2	3	4
1	Stressful life events	1			
2	Procrastination	0.22***	1		
3	Core self-evaluations	−0.31***	−0.46***	1	
4	Stress beliefs	−0.24***	−0.37***	0.59***	1
	M	1.28	2.72	3.30	3.22
	SD	0.79	0.62	0.61	0.49

***$p < 0.001$.

4. Discussion

To our knowledge, the present study is the first demonstration that individual cognitive factors (e.g., stress beliefs) and personal factors (e.g., core self-evaluations) can play a multiple role in the relationship between stressful life events and procrastination among college students, supporting the ecological systems theory and self-system belief model.

4.1. Relationship between stressful life events and procrastination

The current study explored the relationship between stressful life events and procrastination among college students. Hypothesis H1

TABLE 2 Results of DDA analysis.

DDA properties	Target models					
	Stressful events → procrastination	Stressful events → stress beliefs	Stressful events → core evaluations	Belief in stress → procrastination	Belief in stress → core evaluations	Core evaluations → procrastination
Variable distributions						
Skewness diff (95% CI)	●			●		●
Kurtosis diff (95%CI)		○		●	●	
Residuals distributions						
Skewness diff (95% CI)	●	●	●			●
Kurtosis diff (95% CI)			●	●	●	
Independence						
Breusch–Pagan test			○		●	○
DDA decision	Target model	Target model (weak)	Target model (weak)	Target model	Target model	Target model (weak)

A solid dot indicates the hypothesized causal model (target model) is selected based on the test results. A circle indicates the reverse causal model is selected based on the test results.

TABLE 3 Results of the multiple mediation analysis.

Predictors	Model 1 (procrastination)		Model 2 (stress beliefs)		Model 3 (core self-evaluations)		Model 4 (procrastination)	
	β	*t*	*β*	*t*	*β*	*t*	*β*	*t*
Stressful life events	0.22	6.43***	−0.24	−7.02***	−0.18	−6.05***	0.08	2.41*
Stress beliefs					0.55	18.90***	−0.14	−3.59***
Core self-evaluations							−0.36	−9.10***
R^2	0.05		0.06		0.38		0.24	
F	41.37***		49.27***		238.63***		81.00***	

*$p < 0.05$, ***$p < 0.001$. Each variable in the model was standardized.

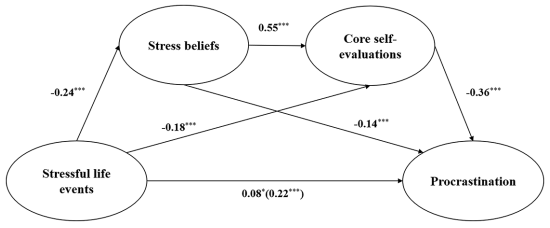

FIGURE 2
Mediating effect of stress beliefs and core self-evaluations on the relationship between stressful life events and procrastination. The total effect of stressful life events on procrastination was shown in parenthesis. ***p<0.001; *p<0.05.

was validated, that is, stressful life events was positively associated with procrastination among college students, which was consistent with previous studies indicating that stressful life events was associated with negative consequence and problematic behavior (Zuo et al., 2020; Geng and Lei, 2021).

According to the short-term mood regulation theory, stressful life events may lead to negative emotions so that individuals would give priority to short-term mood repair instead of long-term goal pursuit (Sirois and Pychyl, 2013). In addition, ego-depletion theoretical model posit that college students in a situation of high depletion caused by stressful life events prefer short-term satisfaction due to breakdown in self-control, which turn to a relatively stable, trait-like chronic tendency to delay (Gökalp et al., 2022). It reminds parents and schools to pay particular attention to college students experiencing more stressful life events so as to identify their difficulties and to improve their adjustment functions, which could eliminate the direct effect of stressful life events on procrastination. Some well-established interventions may also be applied in schools, concerning well-being and mindfulness, to reduce negative interpretation bias and favor positive attitudes (Gibb et al., 2022; Moè, 2022).

4.2. The multiple mediating effects

The results revealed that stress beliefs and core self-evaluations played multiple mediating effects in the relationship between stressful life events and procrastination, therefore, hypothesis H2 was validated. Stress belief had a mediating effect on the relationship between stressful life events and procrastination among university students. General frameworks regarding belief formation argue that beliefs are shaped by our personal context, upbringing, and lived and vicarious experiences (Kilby et al., 2020). Prior research, however, has shown no associations between stressful life events and stress beliefs in adolescents. These discrepancies could be due to the age difference that adolescence is a life stage of brain plasticity in which the beliefs about stress have not been shaped by the accumulation of stressful life events yet (Jiang et al., 2019). When stressful life events increases, individuals may repeatedly activate automatic negative thoughts, thereby tend to build up a belief that stress has a negative and threatening nature, which might lead to avoidance motivated responses (Chen and Qu, 2021). In this way, the intervention of stress beliefs in educational practice could be a method conducive to stress management, and change of irrational beliefs about stress can alleviate the adverse effects of stressful life events on procrastination (Keech et al., 2021). The results also indicated that core self-evaluations was a crucial explanatory mechanism in the association between stressful life events and procrastination, which supported hypothesis H3. Consistent with previous research, stressful life events made significant harmful impacts on core self-evaluations (Zuo et al., 2020). Exposure to stressful life events could make one develop the latent negative attributions and maladaptive schema, and generate cognitive biases that are associated with higher self-doubt and lower self-esteem (Han et al., 2018; Wong et al., 2021). According to the broaden-and-build theory of positive emotions, negative emotions caused by stressful life events would also hinder positive self-construction, thus leading to the reduction of core self-evaluations (Fredrickson, 2001).

This study also confirmed that core self-evaluations was negatively associated with procrastination. As a matter of fact, the damage of core self-evaluations leads to information processing bias, which inevitably affect individual coping process (Kammeyer-Mueller et al., 2009). Generally, lower self-esteem is associated with higher self-handicapping, which shares much in common with procrastination in terms of individual's emotions, thoughts, reasons, and motives (Barutçu Yıldırım and Demir, 2020). The temporal motivation theory also posited that individuals with low core self-evaluations tend to underestimate their coping ability and have lower confidence in obtaining a desired reward or outcome, and tend to put things off (Steel, 2007; Zhang et al., 2019). This study further support the self-belief system model, namely the external risk factors (i.e., stressful life events) influence the adaptive consequences (i.e., procrastination) through individual self-belief system (i.e., core self-evaluations; Sandler, 2001). College students should improve their capacity to resist

TABLE 4 Bootstrap analysis of multiple mediation effects.

Path	Effect size	Boot SE	Boot LLCI	Boot ULCI	Relative effect
Total effects	0.22	0.03	0.15	0.30	
Direct effects	0.08	0.03	0.02	0.14	36.36%
Total indirect effects	0.14	0.02	0.11	0.18	63.63%
Stressful life events → stress beliefs → procrastination	0.03	0.01	0.01	0.06	13.64%
Stressful life events → core self-evaluations → procrastination	0.06	0.01	0.04	0.09	27.27%
Stressful life events → stress beliefs → core self-evaluations → procrastination	0.05	0.01	0.03	0.07	22.73%

Boot SE, Boot LLCI and Boot ULCI refer to the standard error, lower limit and upper limit of 95% CI of the effect estimated by percentile bootstrap method.

stressful life events, and adjust their non-adaptive self-cognition in difficulties and setbacks, so as to reduce procrastination. Meanwhile, schools can attach importance to psychological intervention for college students with low core self-evaluations to help them form a positive self-evaluation and obtain knowledge of self-leadership strategies, which may also be an effective way to reduce procrastination (Wang et al., 2021).

Stressful life events could be also associated with procrastination through a sequential mediating effect involving stress beliefs and core self-evaluations. These results provide a specific psychological elucidation for how stressful life events affect procrastination from both cognitive and personal perspective (Zuo et al., 2020). When college students are faced with amounts of stressful life events, they tend to hold negative stress beliefs that stress is threatening, negative and uncontrollable, thus leading to a reduction in the senses of self-evaluations, which make individuals prone to adopt a passive attitude and lead to an increased risk of procrastination ultimately (Chen and Qu, 2021). The results further extend the existing frameworks and verified a multiple path to procrastination.

4.3. Limitations and further directions

Despite the aforesaid implications, several limitations can be addressed in future research. First, given the cross-sectional design used in this study, the possibility of drawing causal conclusions was limited. Thus, a longitudinal approach to test the conclusion and effective intervention methods should be adopted to provide a deeper understanding. Second, college students volunteered to participate in the study online, which may be influenced by personality of participants and weaken the representativeness of the sample. Third, this study only surveyed Chinese college students, which poses a limitation in the generalizability of the present results to other cultures. Studies showed that people from different cultural backgrounds react differently to stress in respect of stress appraisal and support seeking (Tweed et al., 2004). At the same time, stress beliefs are correlated with optimism, which have distinctive cultural characteristics. It is reasonable to believe that culture affects the outcome of stress beliefs, and that the close relationship between stress beliefs and core self-evaluations may be affected by environmental and cultural factors (Jiang et al., 2014). Therefore, future studies may examine the model of this study by collecting data from different cultural background groups. Finally, the self-reported measures used in this study may not explain the problem in terms of objectivity and may be subject to social desirability response bias. Data was then collected anonymously to reduce this risk. Future research could benefit from repeated measurements, or non-self-reported measurements, as well as experiments with objective indicators and the combination of multiple measures.

5. Conclusion

In conclusion, this study identified the associations between stressful life events, stress beliefs, core self-evaluations, and procrastination. Specifically, stressful life events was directly associated with procrastination, or indirectly via the parallel mediating effects of stress beliefs and core self-evaluation, or via the sequential mediating effects of stress beliefs and core self-evaluations. The present study contributes to an understanding of mechanisms through which exposure to stressful life events predicts procrastination among college students and has certain theoretical and practical implications to understand the intervention of procrastination.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by Shanxi University. The patients/participants provided their written informed consent to participate in this study.

Author contributions

XM conceived the experimental design and drafted the manuscript. XM and ZL contributed to the data collection and preparation of the statistical analyses. FL was mainly responsible for the language polishing and proofreading. All authors contributed to the article and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2023.1104057/full#supplementary-material

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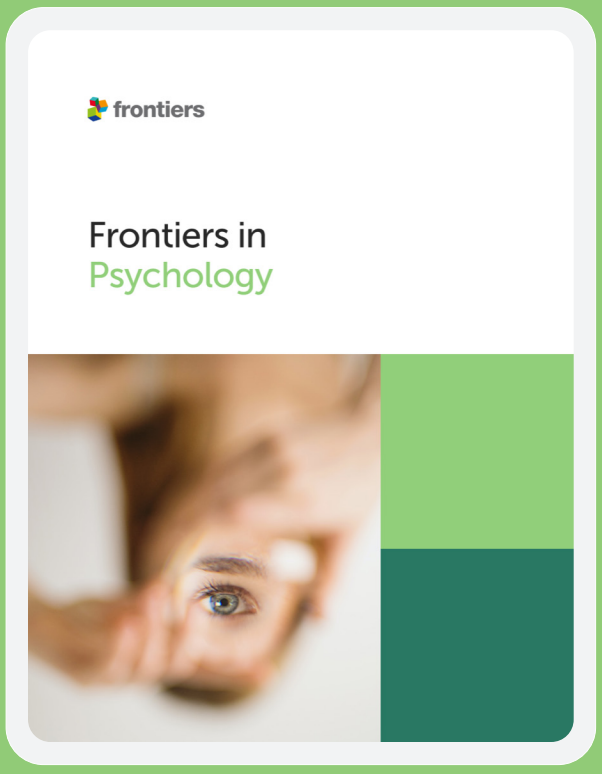

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