

The Efficacy and Mechanism of Positive Psychological Intervention on Well-Being for Colostomy Patients: A Randomized Controlled Trial

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Abstract

Aims

To evaluate the efficacy and mechanism of positive psychological intervention (PPI) on the psychological capital, psychological distress, and life satisfaction among colostomy patients.

Methods

Patients (n=120) with permanent stomas were recruited and randomly assigned into two groups. Patients in the experimental group (n=60) received standard care and PPI, whereas patients in the control group (n=60) only received standard care. The psychological capital, psychological distress, and life satisfaction were measured and compared between two groups before the intervention, the immediate post-intervention, and follow-up.

Results

All 120 patients completed the study. The hope, optimism, resilience, psychological distress, and life satisfaction score of the experimental group were significantly higher than those of the control group at T1 and T2 ($P < 0.05$). Self-efficacy score of the experimental group had no significant difference at the two-time points after the intervention than the control group ($P > 0.05$). Changes in hope and resilience which belong to psychological capital mediated the intervention's efficacy on changes in PPI on life satisfaction ($\beta = 0.265, P = 0.005$; $\beta = 0.686, P = 0.002$).

Conclusions

PPI could effectively improve psychological capital, psychological distress, and life satisfaction among patients with stomas. Besides, our findings add novel support that increased hope and resilience are the active ingredients that promote intervention change.

Introduction

Colorectal cancer (CRC) ranks third in world wide cancer incidence and second in cancer-related mortality [1, 2]. Permanent colostomy removes the tumor and creates a stoma on the abdominal wall to provide a new artificial pathway for waste elimination [3, 4]. Despite the obvious clinical benefits of a stoma, it still impairs the patient's physical, psychological, and social functioning, leading to stoma-related problems [5]. Physical changes, such as damage of self-image, incontinence, leakage, and uncomfortable clothing make it difficult for patients to adjust [1]. In the psychological aspect, patients are faced with multiple impacts of appearance, touch, vision, and smell associated with the stoma, causing psychological distress [6]. And in the social aspect, the relationships with family members and friends may be damaged, self-awareness seems to be challenged [7].

As a positive psychological structure, psychological well-being is always used to measure the overall state of life [8]. It is the personal understanding and affective values of life events, including emotional reactions to events, good judgment, and awareness of satisfaction [9]. With the deepening of research on well-being, its positive effects on health outcomes have been explored. Previous studies have shown that well-being was related to more healthy coping tendencies, better disease prognosis, improved quality of life, and healthy longevity [10, 11, 12]. Obviously, interventions that promote well-being to improve health outcomes and reduce the negative effects of the disease are undoubtedly an important issue.

The Positive Psychology Intervention (PPI) is an effective therapy developed in psychology, which can promote well-being and reduce ill-being [13, 14]. Compared with other therapies (e.g., cognitive behavioral therapy, interpersonal therapy, and problem-solving therapy) for dealing with mental health issues, PPI focuses less on psychological defects and more on identifying and establishing on positives (e.g., positive experiences, factors, and scenarios). Besides, such intervention is less complex and applicable in a shorter time range, which has attracted much attention in recent years [15, 16]. Currently, PPI has been successfully applied to the general populations and clinical patients, and has shown its effect on improving mental health status and well-being [17, 18, 19, 20]. Although evidence-based PPI that can improve positive aspects has been developed and widely disseminated, it has not been used among patients with a permanent stoma in China and many other countries.

In the existing literature, in addition to the lack of examination of the effect of PPI in the context of patients with a permanent stoma, there is also insufficient research on the mechanism of PPI promoting well-being. Although numerous studies showed that PPI could promote health outcomes and well-being by improving positive states, few studies have used parallel mediation models to test the mechanism by which PPI increases well-being [21]. Several mechanisms may account for PPI effects, including changes in attentional deployment and cognitive reappraisal during the processes of emotion regulation [21]. Additionally, PPI may increase positive emotions, thoughts, and behaviors as well as psychological personal resources [22]. Psychological capital is generally defined as an individual's positive psychological development state, which is characterized by: (1) Strive to complete challenging tasks and always keep confident (self-efficacy); (2) Adhere to the goal and redirect the path to success for the goal if necessary (hope); (3) Maintain a positive attitude towards the present and future success (optimism); and (4) Persevere and surpass to achieve success when troubled by difficulties and adversity (resilience) [23].

The Build and Broaden Theory [24] proposed that positive effects broaden the scopes of cognition, attention, and action, and established individual psychosocial resources. Psychological capital is interpreted as a positive perception of events that stimulates success based on unremitting effort and persistence [23, 25]. The positive activities contained in PPI could increase psychological capital. In turn, these positive effects of psychological capital can mediate the effect of PPI on individual's well-being [22, 25]. Given the PPI is a conscious and positive activity focusing on goals, which facilitates participation

in thinking about a person's positive future and formulating ways to achieve goals, we believe it makes sense that increased psychological capital, including self-efficacy, hope, optimism, and resilience, mediates the effects of PPI on well-being. And these mediating variables may occur simultaneously with changes in well-being.

Therefore, the main purpose of our study is to examine the efficacy of PPI on improving well-being (i.e., increasing life satisfaction and decreasing psychological stress) among patients with a stoma. In addition, we considered that psychological capital is the mediating active ingredient of PPI to improve life satisfaction and reduce psychological stress, thus, our secondary purpose is to examine the efficacy of the PPI in increasing psychological capital (self-efficacy, hope, optimism, and resilience). Finally, in order to better understand the psychological processes that make a PPI efficacious, this study would use Structural Equation Modeling (SEM) to explore the action mechanism of a specific intervention in increasing well-being.

Methods

Design

We conducted a single-blinded, double-arm parallel, randomized controlled trial in a general hospital in northern China from 1 January 2019– 1 January 2020. This trial was approved by the human research ethics committee of the hospital, and it was registered at Chinese Clinical Trials Registry (Registration No. ChiCTR2100052179).

Sample size

G*Power 3.1.3 was employed to estimate the sample size. Referencing a study on the effect of PPI on the well-being of breast cancer patients [18], we took the power of 0.8 with an alpha value of 0.05, and an effect size of 0.60, considering a 30% attrition rate, approximately 120 samples were required.

Participant criteria

Inclusion criteria included the following: (1) diagnosed of CRC and had a permanent stoma with stable postoperative conditions; (2) were at least 18 years old; and (3) were willing to participate. Exclusion criteria included: (1) had a known history of, or currently had psychiatric disorders; and (2) suffered from other severe physical disorders or metastatic cancer. Dropout criteria included: (1) unable to complete the psychological intervention; and (2) loss to follow-up.

Recruitment

Participants were enrolled from the stoma outpatient and anorectal inpatient departments of a general hospital. The recruitment was carried out by trained staff who made contact with the potential participants when patients came to the outpatient or inpatient department. In both locations, the research staff introduced the research content and purpose to potential participants, screened for inclusion and exclusion criteria, and ensured that participation was voluntary.

Randomization, allocation concealment, and blinding

Participants who fully met the criteria formally participated in the trial after providing written informed consent. After the participants completed the baseline assessments, the researchers randomly assigned the participants to the experimental group and the control group according to random numbers generated by the random number generator. Allocation was made by a third party using sealed and opaque sequentially numbered envelopes. In addition, since it is impossible for psychological intervention to be completely blinding (e.g., blinding for the intervention implementers and the participants). We can only achieve single blinding, that is, the research data were collected and subsequently analyzed by another researcher who did not know the grouping allocation.

Intervention

The control group only received standard care, including stoma care and diet guidance, while the experimental group received both standard care and PPI (the intervention outline is shown in Supplementary Table). The specific content of our PPI was carried out in accordance with the previously published and empirically validated Moskowitz's Trail curriculum [26, 27, 28]. The PPI consisted of 5 sessions (once a week), each of which lasted approximately 45 to 60 minutes and was taught by two trained facilitators. In addition to the face-to-face intervention in the first session, participants can also choose to be taught the skills by phone or video call depending on their situation in the next 4 sessions. A detailed overview of the intervention procedures and content can be found in Moskowitz et al. (2017).

Measures

Psychological capital

The Positive Psychological Capital was used to measure psychological capital [29]. The scale consists of 26 items that distributed in 4 factors: (1) self-efficacy; (2) hope; (3) optimism; and (4) resilience. All items were rated on a 7-point Likert scale ranging from 1 to 7 ("strongly disagree" to "strongly agree"). Based on the reliability test conducted for our study, this scale had a Cronbach's alpha of 0.941 for T1, 0.905 for T2, and 0.964 for T3.

Psychological distress

The 10-item Kessler psychological distress scale was used to measure psychological distress [30]. The scale consists of 10 items on a 5-point scale (1= "almost none" to 5= "all the time") with total scores ranging from 10 to 50 and higher total scores indicating higher levels of psychological distress. Based on the reliability test conducted for our study, this scale had a Cronbach's alpha of 0.819 for T1, 0.878 for T2, and 0.888 for T3.

Life Satisfaction

Life satisfaction was measured with the 5-item Satisfaction with Life Scale [31]. The scale consists of 5 items on a 7-point scale (1= “strongly disagree” to 7= “strongly agree”) with total scores ranging from 5 to 35 and higher total scores indicating higher levels of life satisfaction. Based on the reliability test conducted for our study, this scale had a Cronbach’s alpha of 0.767 for T1, 0.838 for T2, and 0.918 for T3.

Data collections

A trained research assistant collected data through face-to-face questionnaire surveys with patients at the following three time points (see Figure 1): baseline (T0), the immediate post intervention (T1, 5 weeks post baseline), follow-up (T2, 1 month post intervention). Generally, the patients filled out the questionnaires in 15–20 min.

Statistical analysis

IBM SPSS Statistics Version 22.0 and IBM SPSS Amos Version 22.0 were employed for statistical analysis.

(1) Intervention effect analysis: Chi-square test, Independent Sample t-test and Mann–Whitney U tests were used to compare the variables between the two groups. The changes or differences of variables between the groups (experimental VS. control groups), within-group (time), and interaction (group*time) effects were analyzed by Methods Repetitive Measure Analysis of Variance (ANOVA).

(2) Intervention mechanism analysis: SEM was used to analyze of active ingredients of the intervention. The comparison of experimental group versus control group was represented by a two-valued dummy variable (scored 0 = control group ,1 = intervention group) under the two intervention conditions. We included potential mediators that significantly improved during the intervention into the model. All the intermediate variables and outcome variables at T1 and T2 were adjusted according to the baseline value at T0.

Results

Patient recruitment and characteristics

The CONSORT flow diagram is illustrated in Figure 1. A total of 214 patients were enrolled in this study and assessed for eligibility, of which 120 completed the T0 assessment and were randomly allocated to the PPI and control groups. 60 patients in both the PPI and control group completed the study, underwent post-intervention T1 and T2 assessments. Table 1 presented patients’ demographic and clinical information. No significant difference existed between the two groups in the baseline data ($P > 0.05$), which was comparable.

Table 1
Demographic and clinical characteristics of the patients (N=120).

Variable	Experimental (n=60)	Control (n=60)	t/ χ^2	P
Age (Mean \pm SD)	53.25 \pm 1.988	52.92 \pm 4.216	0.307	0.581
Gender				
Male	45(75.00)	43(71.70)	0.170	0.837
Female	15(25.00)	17(28.30)		
Education				
Primary school or below	35(58.33)	32(53.33)	0.446	0.800
Middle and high school	19(31.67)	20(33.33)		
College and above	6 (10.00)	8(13.33)		
Marital status				
Single	1(1.70)	0(0.00)	1.676	0.642
Married	52(86.67)	51(85.00)		
Divorced	5(8.33)	5(8.33)		
Widowed	2(3.33)	4(6.67)		
Religion				
Yes	2(3.30)	1(1.70)	0.342	0.559
No	58(96.70)	59(98.30)		
Residence				
City	25(41.67)	28(46.67)	0.304	0.581
Rural areas	35(58.33)	32(53.33)		
Living situation				
With parents	40(66.67)	39(65.00)	4.798	0.187
With child	8(13.33)	6(10.00)		
With parents and child	9(15.00)	15(25.00)		
Living alone	3(5.00)	0(0.00)		
Monthly income (yuan)				
<3000	6(10.00)	7(11.67)	0.313	0.855
3001~5000	31(51.67)	28(46.67)		
>5000	23(38.33)	25(41.66)		
Family history of CRC				
Yes	6(10.00)	8(13.33)	0.323	0.777
No	54(90.00)	52(86.67)		
Comorbidities				
Yes	48(80.00)	49(81.67)	0.054	0.817
No	12(20.00)	11(18.33)		
Complications of stoma				
Yes	13(21.67)	15(25.00)	0.186	0.666
No	47(78.33)	45(75.00)		
Stoma type				
Colostomy	50(83.33)	49(81.67)	0.058	0.810
Ileostomy	10(16.67)	11(18.33)		

Effectiveness of the PPI

Positive psychological capital

At baseline, it was found no differences in self-efficacy, hope, optimism, and resilience scores between the PPI and control groups ($t=0.623$, $P=0.534$; $t=-0.268$, $P=0.789$; $t=0.801$, $P=0.255$; $t=-0.808$, $P=0.140$). The PPI group had significantly higher scores than that of the control group at the immediate post-intervention ($t=4.727$, $P<0.001$; $t=10.055$, $P<0.001$; $t=12.591$, $P<0.001$) and follow-up ($t=7.389$, $P<0.001$; $t=12.112$, $P<0.001$; $t=14.136$, $P<0.001$) in hope, optimism, and resilience. Although the self-efficacy score of the PPI group was also higher than that of the control group at the two time points after the intervention, there was no significant difference ($t=1.155$, $P=0.250$; $t=1.257$, $P=0.211$).

Table 2 showed that the time factor had a significant significance, indicating that the difference in self-efficacy, hope, optimism, and resilience between the two groups at different intervention time points were statistically significant. The overall between-group difference was only statistically significant in hope, optimism, and resilience, indicating that there were still differences between patients in the two groups without considering the time factor, however, no significant between-group difference in self-efficacy was found, suggesting that there was no difference between patients in two groups without considering the time factor. The interaction between time and group showed statistically significant in self-efficacy, hope, optimism, and resilience, indicating that the two groups of patients had different trends change over time ($F=0.241$, $P=0.004$; $F=35.883$, $P<0.001$; $F=68.473$, $P<0.001$; $F=267.123$, $P<0.001$) (Table 2 and Figure 2).

Table 2
A comparison of the outcome variables between the two groups before and after the intervention.

Variable	T0 (Mean ± SD)		T1 (Mean ± SD)		T2 (Mean ± SD)		F1(<i>p</i>)	F2(<i>p</i>)	F3(<i>p</i>)
	EG	CG	EG	CG	EG	CG			
Self-efficacy	28.83±6.808	28.15±5.078	29.93±5.371	28.82±5.219	30.27±5.336	29.08±4.972	3.793	1.513	0.241
<i>t</i>	0.623		1.155		1.257		(0.025)	(0.224)	(0.004)
<i>p</i>	0.534		0.250		0.211				
Hope	23.58±4.767	23.82±4.767	30.63±4.923	26.45±4.771	33.87±4.497	27.90±4.348	195.518	24.650	35.883
<i>t</i>	-0.268		4.727		7.389		(0.000)	(0.000)	(0.000)
<i>p</i>	0.789		0.000		0.000				
Optimism	22.98±6.066	22.13±5.549	31.47±4.331	22.92±4.962	34.53±5.007	23.37±5.092	122.117	99.133	68.473
<i>t</i>	0.801		10.055		12.112		(0.000)	(0.000)	(0.000)
<i>p</i>	0.255		0.000		0.000				
Resilience	21.72±5.567	22.47±4.545	32.90±4.613	22.42±4.507	36.45±4.820	23.65±5.095	310.408	114.218	267.123
<i>t</i>	-0.808		12.591		14.136		(0.000)	(0.000)	(0.000)
<i>p</i>	0.140		0.000		0.000				
Psychological distress	28.48±6.223	28.77±6.163	19.70±5.500	28.58±6.082	16.82±5.054	26.32±5.658	356.594	49.779	154.624
<i>t</i>	-0.251		-8.391		-9.699		(0.000)	(0.000)	(0.000)
<i>p</i>	0.803		0.000		0.000				
Life satisfaction	17.72±3.508	17.72±3.641	21.97±3.901	17.28±3.627	25.43±3.610	16.08±3.572	55.013	80.503	108.053
<i>t</i>	0.000		6.810		14.263		(0.000)	(0.000)	(0.000)
<i>p</i>	0.728		0.000		0.000				

Note: T0: Baseline; T1: The immediate post intervention; T3: 1 month post-intervention; EG: Experimental group; CG: Control group; F1: Time; F2: Group; F3: Time and group; SD standard deviation.

Psychological distress

No difference was found in psychological distress at baseline ($t=-0.251$, $P=0.803$) between the two groups. At the immediate post-intervention and follow-up, the psychological distress scores of the PPI group were significantly decreased than that of the control group ($t=-8.391$, $P < 0.05$; $t=-9.699$, $P < 0.05$). Both the PPI and control groups showed reductions in psychological distress over time, and there was significant within-group improvement in psychological distress ($F=356.594$, $P<0.001$). There was also a significant between-group difference ($F=49.779$, $P<0.001$) and interaction effect of group and time in psychological distress ($F=154.624$, $P<0.001$) (Table 2 and Figure 3).

Life satisfaction

There was no significant difference in life satisfaction scores between the PPI and control groups at baseline ($t=0.000$, $p=0.728$). The life satisfaction of the two groups after the intervention varied with the time, and the life satisfaction of the PPI group was significantly higher than that of the control group at the immediate post-intervention and follow-up ($t=6.810$, $P < 0.05$; $t=14.263$, $P < 0.05$). The ANOVA results of repeated-measures showed significant time effect ($F=55.013$, $P<0.001$) and interaction effect (group \times time) ($F=80.503$, $P<0.001$). The overall between-group difference was also statistically significant ($F=108.058$, $P<0.001$) (Table 2 and Figure 3).

Active Ingredients of PPI

As we did not find a significant intervention effect for self-efficacy, only hope, optimism, and resilience were included for further mediation analysis. Our data relatively fitted the structural model after appropriate modification according to modification index and empirical evidence ($\chi^2/df = 3.792$; CFI = 0.896; TLI = 0.898).

Table 3 and Supplementary Figure illustrated how PPI translated its effect on mediators into the effect on life satisfaction. At T1, PPI increased hope ($\beta = 0.418$, $P=0.001$), and the increase in hope positively predicted an increase in life satisfaction ($\beta = 0.291$, $P=0.001$). Meanwhile, PPI decreased psychological distress ($\beta=-0.629$, $P=0.002$), which in turn positively predicted an increase in life satisfaction ($\beta = 0.614$, $P=0.001$). Additionally, PPI also directly and positively increase optimism ($\beta = 0.686$, $P=0.002$), resilience ($\beta = 0.784$, $P=0.001$) and life satisfaction ($\beta = 0.819$, $P=0.001$). At T2, we also observed that the PPI had a sustained effect on the outcome, which could increase life satisfaction by strengthening the patient's resilience ($\beta = 0.766$, $P=0.001$). Life satisfaction in T1 also had a direct positive impact on life satisfaction in T2 ($\beta = 0.137$, $P=0.048$). Besides, the indirect effect of PPI on life satisfaction (T1) and life satisfaction (T2) were both significant (T1: $\beta = 0.265$, $P=0.005$; T2: $\beta = 0.686$, $P=0.002$).

Table 3
Path coefficient of variables in intervention mechanism analysis.

Path	β	95% CI	P
Total effects:	0.555+0.686=1.241		
Direct effects:			
Intervention condition \rightarrow Life Satisfaction (T1)	0.819	(0.657, 0.966)	0.001
Life Satisfaction (T1) \rightarrow Life Satisfaction (T2)	0.137	(-0.007, 0.270)	0.066
Indirect effects:	-0.265+0.686=0.421		
Intervention condition \rightarrow Life Satisfaction (T1)	-0.265	(-0.425, -0.100)	0.005
Intervention condition \rightarrow Hope (T1) \rightarrow Life Satisfaction (T1)	0.418*0.291=0.122		
Intervention condition \rightarrow Psychological distress (T1) \rightarrow Life Satisfaction (T1)	-0.629*0.614=-0.386		
Intervention condition \rightarrowLife Satisfaction (T2)	0.686	(0.632, 0.733)	0.002
Intervention condition \rightarrow Hope (T1) \rightarrow Life Satisfaction (T1) \rightarrow Life Satisfaction (T2)	0.017		
Intervention condition \rightarrow Psychological distress (T1) \rightarrow Life Satisfaction (T2)	-0.053		
Intervention condition \rightarrow Life Satisfaction (T1) \rightarrow Life Satisfaction (T2)	0.112		
Intervention condition \rightarrow Resilience (T1) \rightarrow Resilience (T2) \rightarrow Life Satisfaction (T2)	0.610		
Note: T1: The immediate post intervention; T3: 1month post-intervention; β : standardized regression coefficients; CI: confidence intervals.			

Discussion

To our knowledge, this study is the first randomized controlled trial of PPI in people living with permanent stoma, which aims to increase psychological capital and thus affect well-being. The methodological quality of this study was high, as it met five of the six Cochrane collaboration criteria for high-quality trials [32]: 1) randomization concealment; 2) appropriate measurement of the outcome; 3) complete outcome data; 4) report of all pre-set indicators; 5) baseline comparability of groups. The 6th criteria, blinding of participants and intervention implementers, could not be realized once they started sessions under their specified conditions.

Our results showed that the PPI significantly increased the psychological capital (hope, optimism, and resilience) and life satisfaction, while also significantly reducing the psychological distress in patients with a permanent stoma. The nature of psychological capital makes it suitable for intervention that focuses on stimulating the individual positive characteristics and promoting positive growth (i.e., PPI). Its working mechanism confirms the positive and direct effect of PPI, including that positive belief could help individuals to intentionality and motivation under negative situations, positive cognition and positive emotion facilitate to maintain hope and optimism to the future, and positive personal resources to bring effort and persistence. Based on the assumption that the PPI could promote individual's positive characteristics and ability to grow their resources, our results are consistent with previous research, which confirms that interventions related to positive psychology provide the perfect conditions and environment for the development of psychological capital [33, 34, 35]. It should be noted that in psychological capital, although the self-efficacy score of the intervention group was increased compared with the control group, we did not find that the effect of PPI on self-efficacy is as significant as the effect of PPI on hope, optimism, and resilience. The possible reason we speculated was that self-efficacy, as an individual's belief in achieving goals, was less likely to improve in a short period of time, especially when the individual was facing major traumatic events such as cancer and permanent stoma. In addition, the sessions of PPI in this study may not be sensitive enough to the target of self-efficacy. In view of the above speculations, the intervention session specifically for strengthening self-efficacy can be added to the existing PPI and the intervention period can be appropriately extended in future research.

The intervention mechanism analysis revealed that psychological capital was the active ingredient of change. Specifically, the increase of hope and resilience which belong to psychological capital is the active agent of PPI. This result was similar to the previous studies, that is, hope and resilience predicted the psychological status and life satisfaction among cancer patients [36, 37, 38, 39]. It is generally believed that a high ratio of positive to negative effects is characteristic of an individual's mental health [40] and that these positive effects (e.g., positive belief: self-efficacy; positive cognition: hope; positive emotion: optimism; positive personal resource: resilience) have highly adaptive value, enabling individual to achieve a more vigorous life, a healthier lifestyle and even a better immune system [41, 42, 43]. It should be noted that hope and resilience were the effective components of the intervention to promote life satisfaction at the two-time points after the intervention, respectively. This may be related to the different evocations of positive effects of PPI on colostomy patients as the intervention and time continue. For example, in the initial stage of the intervention, increased hope could enable patients to think more broadly and see longer-term perspectives, while, in the follow-up stage after the intervention, increased resilience could make patients more motivated and courageous to achieve their postoperative survival goals.

Overall, our results confirmed the proposed hypothesis. Patients in the intervention group showed a significant increase in well-being overtime after receiving PPI. In addition, results in our study highlighted the important role of psychological capital in well-being during cancer and enterostomy stressful events. Finally, in addition to exploring the effects of PPI on well-being, our study also addresses a gap in the literature related to the few empirical control trial studies with a longitudinal design [44], such as the efficacy of PPI in specific populations and its mechanism of action.

However, several limitations of our study must be recognized. First, due to material resources and time constraints, we only included patients from a single site, so that the results may not be generalized. Thus, the effect of this intervention on other settings should be examined in future trials to compare the results. Second, the intervention implementation time and follow-up time were not sufficient; therefore, adequately powered trials with longer intervention and follow-up time are needed in the future. Third, this study relied entirely on patients' self-report measures, which may be biased and thus influence our results, the inclusion of objective health outcomes could be considered in future research. Future researchers may consider including some objective health results (i.e. immunological or hormonal markers). Finally, in the analysis of the intervention mechanism, the goodness of fit of the SEM only reached an acceptable critical value, which limited the generalization of the result of this study. The reason for this result may be related to the small sample size, suggesting that the sample size needs to be expanded in the future analysis of the PPI mechanism.

To conclude, our study demonstrated the clinically significant benefits of PPI such as improvement in psychological capital and life satisfaction, and reduction in psychological distress, which provide preliminary evidence for clinical practitioners to consider integrating PPI into standard care to improve well-being in patients with a permanent stoma. Moreover, our study found that psychological capital may be an active ingredient of intervention outcome, studies with larger sample size and longer intervention period are warranted to replicating the finding.

Declarations

Funding :

There is no funding in our study.

Conflicts of interest:

There are no conflicts of interest on the part of any named author.

Availability of data and material:

Data transparency

Code availability:

Not applicable

Authors' contributions:

Y.J and Y.W were involved in the study's conception and design, Y.W, H.M and X.T were involved in data collection and analysis and Y.J and H.W drafted the manuscript.

Ethics approval

Owing to the fact that our study was a review, the ethics approval was not applicable.

Consent to participate

All participants in this study agreed to participate and provided written informed consent.

Consent for publication

All authors of this manuscript agreed to publish.

References

1. GLOBOCAN 2020 (2020) : New Global Cancer Data. <https://www.uicc.org/news/globocan-2020-new-global-cancer-data>
2. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, Bray F (2021) Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries CA: A Cancer. *Journal for Clinicians* 71:209–249. <https://doi.org/10.3322/caac.21660>
3. Matsubara T, Kasagi Y, Ogaki K, Nakaji Y, Nakanishi R, Nakashima Y, Sugiyama M, Sonoda H, Saeki H, Oki E, Maehara Y (2017) Recurrence with pagetoid spread arising 17 years after surgery for intramucosal rectal cancer: a case report *Surgical case reports*. 3:85. . doi.org/10.1186/s40792-017-0356-5
4. Wang JH, Xu JH, Ye F, Xu XM, Lin JJ, Chen WB (2015) Malone Antegrade Continence Enema in Patients with Perineal Colostomy After Rectal Resection. *The Indian journal of surgery* 77:650–656. <https://doi.org/10.1007/s12262-013-0960-y>
5. Näsvalld P, Dahlstrand U, Löwenmark T, Rutegård J, Gunnarsson U, Strigård K (2017) Quality of life in patients with a permanent stoma after rectal cancer surgery. *Qual Life Res* 26:55–64. <https://doi.org/10.1007/s11136-016-1367-6>
6. Zhang JE, Wong FK, You LM, Zheng MC, Li Q, Zhang BY, Huang MR, Ye XM, Liang MJ, Liu JL (2013) Effects of enterostomal nurse telephone follow-up on postoperative adjustment of discharged colostomy patients *Cancer nursing*. 36:419–428. <https://doi.org/10.1097/NCC.0b013e31826fc8eb>
7. Smith JA, Spiers J, Simpson P, Nicholls AR (2017) The psychological challenges of living with an ileostomy: An interpretative phenomenological analysis *Health psychology: official journal of the Division of Health Psychology. American Psychological Association* 36:143–151. <https://doi.org/10.1037/hea0000427>
8. Dodge R, Daly A, Huyton J, Sanders L (2012) The challenge of defining wellbeing *International Journal of Wellbeing* 2(3):222–235. <https://doi.org/10.5502/ijw.v2i3.4>
9. Diener E, Suh E, Oishi S (1997) Recent findings on subjective well-being. *Indian Journal of Clinical Psychology* 24:25–41
10. Diener E, Wirtz D, Tov W, Kim-Prieto C, Choi D-w, Biswas-Diener OS R (2010) New Well-being Measures: Short Scales to Assess Flourishing and Positive and Negative Feelings *Social Indicators Research*. 97:143–156. <https://doi.org/10.1007/s11205-009-9493-y>
11. Lamers SMA, Bolier L, Westerhof GJ, Smit F, Bohlmeijer ET (2012) The impact of emotional well-being on long-term recovery and survival in physical illness: a meta-analysis. *J Behav Med* 35:538–547. <https://doi.org/10.1007/s10865-011-9379-8>
12. Van Cappellen P, Rice EL, Catalano LI, Fredrickson BL (2018) Positive affective processes underlie positive health behaviour change *Psychology & Health* 33:77–97 <https://doi.org/10.1080/08870446.2017.1320798>
13. Krentzman AR (2013) Review of the application of positive psychology to substance use, addiction, and recovery research *Psychology of Addictive Behaviors*. 27:151–165. <https://doi.org/10.1037/a0029897>
14. Bolier L, Haverman M, Westerhof GJ, Riper H, Smit F, Bohlmeijer E (2013) Positive psychology interventions: a meta-analysis of randomized controlled studies. *BMC Public Health* 13:119. <https://doi.org/10.1186/1471-2458-13-119>
15. Carr A, Cullen K, Keeney C, Canning C, Mooney O, Chinseallaigh E, O'Dowd A (2020) Effectiveness of positive psychology interventions: a systematic review and meta-analysis. *The Journal of Positive Psychology* 1–21. <https://doi.org/10.1080/17439760.2020.1818807>
16. Ferrandez S, Soubelet A, Vankenhove L (2021) Positive interventions for stress-related difficulties: A systematic review of randomized and non-randomized trials *Stress and Health*. <https://doi.org/10.1002/smi.3096>
17. Ayeung L, Mo PKH (2019) The Efficacy and Mechanism of Online Positive Psychological Intervention (PPI) on Improving Well-Being Among Chinese University Students: A Pilot Study of the Best Possible Self (BPS). *Intervention Journal of Happiness Studies* 20:2525–2550. <https://doi.org/10.1007/s10902-018-0054-4>
18. Cerezo MV, Ortiz-Tallo M, Cardenal V, de la Torre-Luque A (2014) Positive Psychology Group Intervention for Breast Cancer Patients: A Randomised Trial *Psychological Reports*. 115:44–64. <https://doi.org/10.2466/15.20.PR0.115c17z7>
19. Jiao M, Chen W, Gu J, Li J, Liu D, Lau JTF, Mo P, Zhang X, Du X, Hao Y (2020) Efficacy of a positive psychological intervention in improving mental health status among methadone maintenance treatment users in guangzhou, china—a randomized controlled trial *International Journal of Mental Health and Addiction: No Pagination Specified*. <https://doi.org/10.1007/s11469-019-00206-x>. -No Pagination Specified
20. Quan L, Zhang L (2021) The effects of positive psychological intervention on obstetric surgery patients' mental states, pain levels, and quality of life. *American journal of translational research* 13:3819–3825

21. Heintzelman SJ, Kushlev K (2020) Emphasizing scientific rigor in the development, testing, and implementation of positive psychological interventions. *The Journal of Positive Psychology* 15:685–690. [https:// doi.org/10.1080/17439760.2020.1789701](https://doi.org/10.1080/17439760.2020.1789701)
22. Lyubomirsky S, Layous K (2013) How Do Simple Positive Activities Increase Well-Being? *Curr Dir Psychol Sci* 22:57–62 [https:// doi.org/10.1177/0963721412469809](https://doi.org/10.1177/0963721412469809)
23. Luthans F, Youssef CM, Avolio BJ (2007) *Psychological Capital: Developing the Human Competitive Edge*. Oxford University Press., Oxford. [https:// doi.org/10.1111/j.1744-6570.2007.00083.x](https://doi.org/10.1111/j.1744-6570.2007.00083.x)
24. Fredrickson BL (2001) The role of positive emotions in positive psychology: The broaden-and-build theory of positive emotions *American Psychologist*. 56:218–226. [https:// doi.org/10.1037/0003-066X.56.3.218](https://doi.org/10.1037/0003-066X.56.3.218)
25. Youssef-Morgan CM, Luthans F (2015) Psychological Capital and Well-being. *Stress and Health* 31:180–188. [https:// doi.org/10.1002/smi.2623](https://doi.org/10.1002/smi.2623)
26. Cheung EO, Addington EL, Bassett SM, Schuette SA, Shiu EW, Cohn MA, Leykin Y, Saslow LR, Moskowitz JT (2018) A Self-Paced, Web-Based, Positive Emotion Skills Intervention for Reducing Symptoms of Depression: Protocol for Development and Pilot Testing of MARIGOLD. *JMIR Res Protoc* 7:e10494. [https:// doi.org/10.2196/10494](https://doi.org/10.2196/10494)
27. Cohn MA, Pietrucha ME, Saslow LR, Hult JR, Moskowitz JT (2014) An online positive affect skills intervention reduces depression in adults with type 2 diabetes. *The Journal of Positive Psychology* 9:523–534. [https:// doi.org/10.1080/17439760.2014.920410](https://doi.org/10.1080/17439760.2014.920410)
28. Moskowitz JT, Carrico AW, Duncan LG, Cohn MA, Cheung EO, Batchelder A, Martinez L, Segawa E, Acree M, Folkman S (2017) Randomized controlled trial of a positive affect intervention for people newly diagnosed with HIV. *J Consult Clin Psychol* 85:409–423. [https:// doi.org/10.1037/ccp0000188](https://doi.org/10.1037/ccp0000188)
29. Zhang K, Zhang C, Yinghong D (2010) 积极心理资本: 测量及其与心理健康的关系 [Positive psychological capital: measurement and its relationship to mental health] *心理学与行为科学* [Studies of Psychology and Behavior] 8: 58-64.
30. Kessler RC, Andrews G, Colpe LJ, Hiripi E, Mroczek DK, Normand SLT, Walters EE, Zaslavsky AM (2002) Short screening scales to monitor population prevalences and trends in non-specific psychological distress *Psychological Medicine*. 32:959–976. [https:// doi.org/10.1017/S0033291702006074](https://doi.org/10.1017/S0033291702006074)
31. Diener E, Emmons RA, Larsen RJ, Griffin S (1985) The Satisfaction With Life Scale. *J Pers Assess* 49:71–75
32. Higgins JPT, Savović J, Page MJ, Elbers RG, Sterne JAC (2019) Assessing risk of bias in a randomized trial. 205–228. [https:// doi.org/10.1002/9781119536604.ch8](https://doi.org/10.1002/9781119536604.ch8)
33. Corbu A, Zuberbuhler MJP, Salanova M (2021) Positive Psychology Micro-Coaching Intervention: Effects on Psychological Capital and Goal-Related Self-Efficacy (vol 12, 566293, 2021) *Frontiers in Psychology* 12. [https:// doi.org/10.3389/fpsyg.2021.669283](https://doi.org/10.3389/fpsyg.2021.669283)
34. Harty B, Gustafsson JA, Bjorkdahl A, Moller A (2016) Group intervention: A way to improve working teams' positive psychological capital *Work-a. Journal of Prevention Assessment & Rehabilitation* 53:387–398. [https:// doi.org/10.3233/wor-152227](https://doi.org/10.3233/wor-152227)
35. Song RJ, Sun NN, Song XH (2019) The Efficacy of Psychological Capital Intervention (PCI) for Depression From the Perspective of Positive Psychology: A Pilot Study *Frontiers in Psychology* 10. [https:// doi.org/10.3389/fpsyg.2019.01816](https://doi.org/10.3389/fpsyg.2019.01816)
36. Dunn J, Ng SK, Breitbart W, Aitken J, Youl P, Baade PD, Chambers SK (2013) Health-related quality of life and life satisfaction in colorectal cancer survivors: trajectories of adjustment *Health and Quality of Life Outcomes* 11:46. [https:// doi.org/10.1186/1477-7525-11-46](https://doi.org/10.1186/1477-7525-11-46)
37. Li MY, Yang YL, Liu L, Wang L (2016) Effects of social support, hope and resilience on quality of life among Chinese bladder cancer patients: a cross-sectional study. *Health Qual Life Outcomes* 14:73. [https:// doi.org/10.1186/s12955-016-0481-z](https://doi.org/10.1186/s12955-016-0481-z)
38. Mahdian Z, Ghaffari M (2016) The mediating role of psychological resilience, and social support on the relationship between spiritual well-being and hope in cancer patients
39. Seiler A, Jenewein J (2019) Resilience in Cancer Patients *Front Psychiatry*. 10:208. [https:// doi.org/10.3389/fpsyg.2019.00208](https://doi.org/10.3389/fpsyg.2019.00208)
40. Fredrickson BL, Losada MF (2005) Positive Affect and the Complex Dynamics of Human Flourishing *American Psychologist*. 60:678–686. [https:// doi.org/10.1037/0003-066X.60.7.678](https://doi.org/10.1037/0003-066X.60.7.678)
41. Catalano LI, Fredrickson BL (2011) A Tuesday in the life of a flourisher: The role of positive emotional reactivity in optimal mental health *Emotion*. 11:938–950. [https:// doi.org/10.1037/a0024889](https://doi.org/10.1037/a0024889)
42. Lyubomirsky S, Dickerhoof R, Boehm JK, Sheldon KM (2011) Becoming happier takes both a will and a proper way: an experimental longitudinal intervention to boost well-being *Emotion*. 11:391–402. [https:// doi.org/10.1037/a0022575](https://doi.org/10.1037/a0022575)
43. Pressman SD, Cohen S (2005) Does positive affect influence health? *Psychol Bull* 131:925–971. [https:// doi.org/10.1037/0033-2909.131.6.925](https://doi.org/10.1037/0033-2909.131.6.925)
44. Heintzelman S, Kushlev K (2020) Emphasizing scientific rigor in the development, testing, and implementation of positive psychological interventions. *The Journal of Positive Psychology* 15:1–6. [https:// doi.org/10.1080/17439760.2020.1789701](https://doi.org/10.1080/17439760.2020.1789701)

Figures

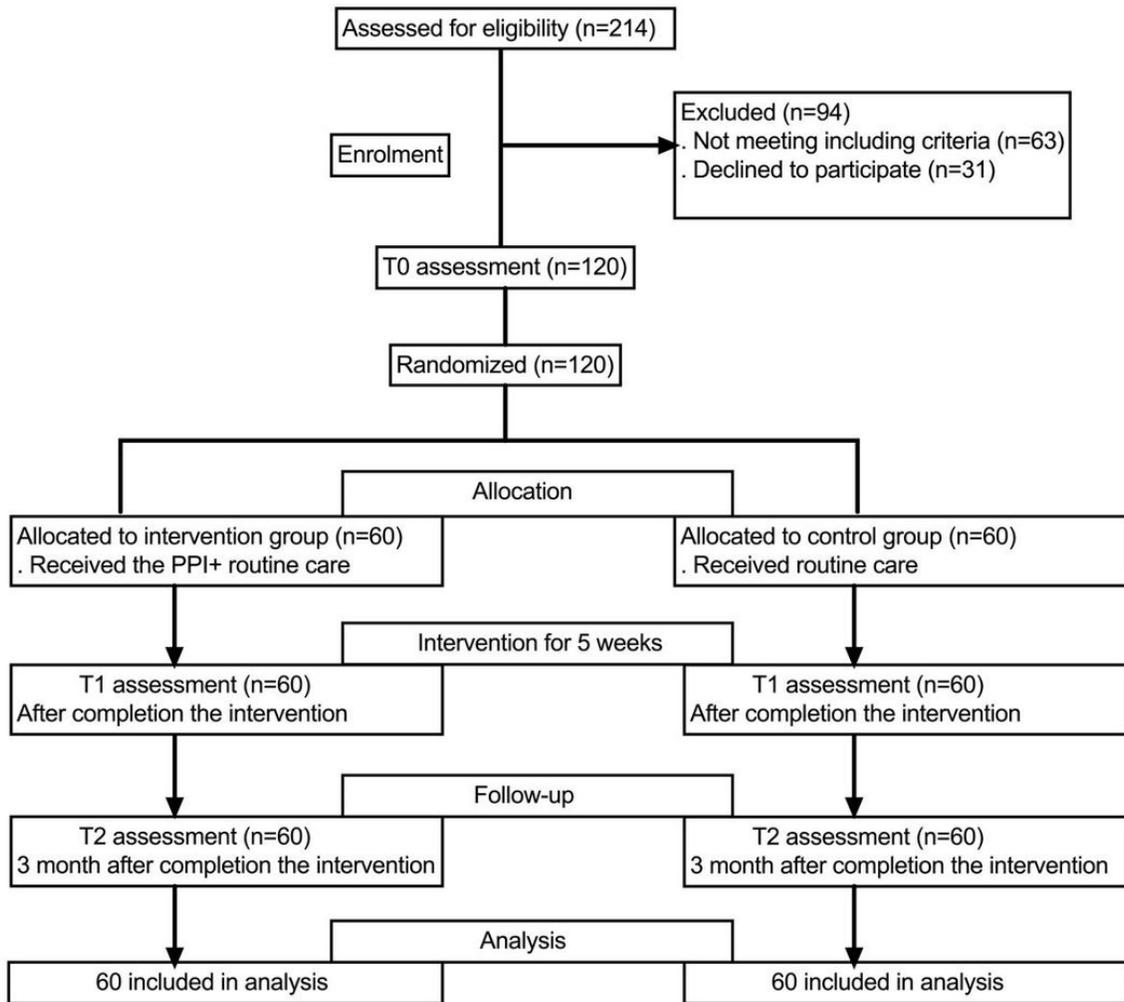


Figure 1

Participant CONSORT flow chart.

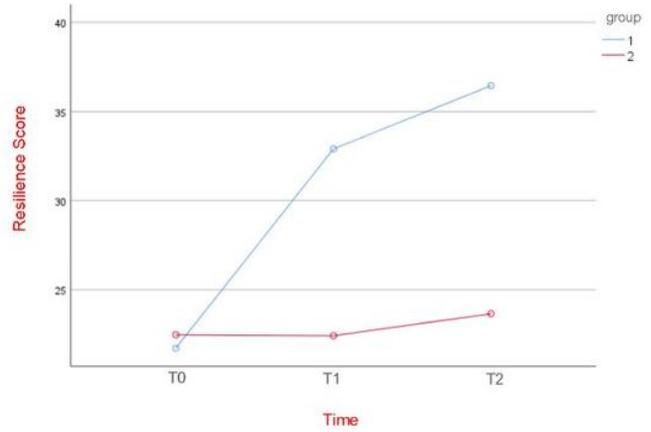
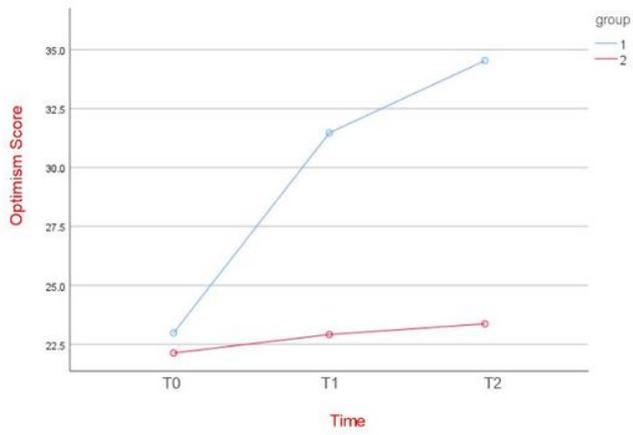
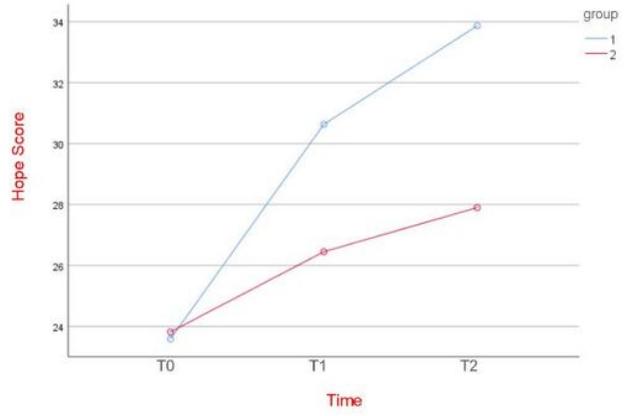
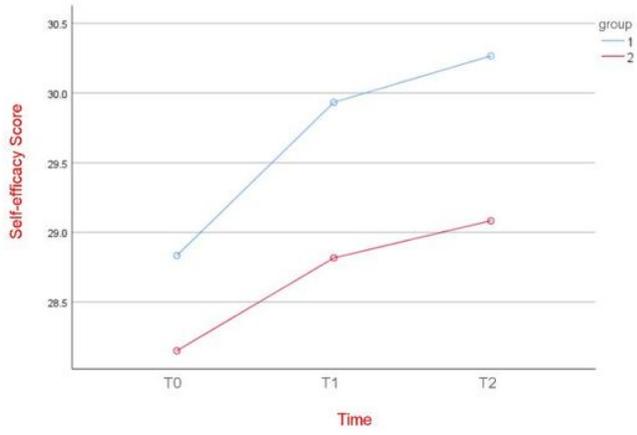


Figure 2

The trend of self-efficacy, hope, optimism, and resilience scores before and after intervention groups.

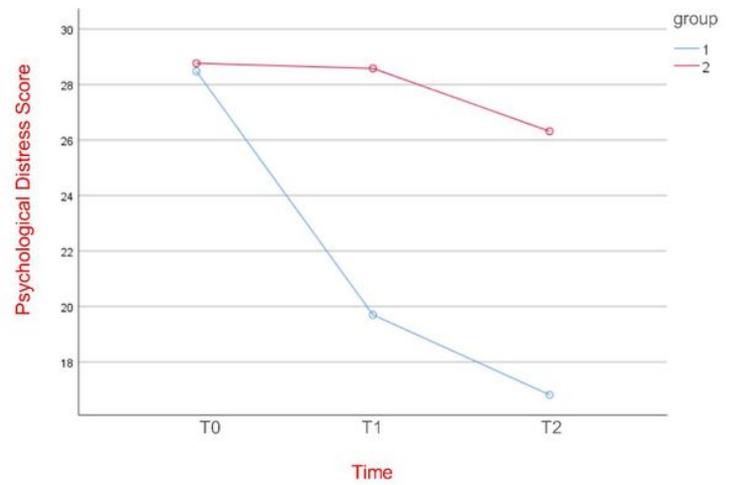
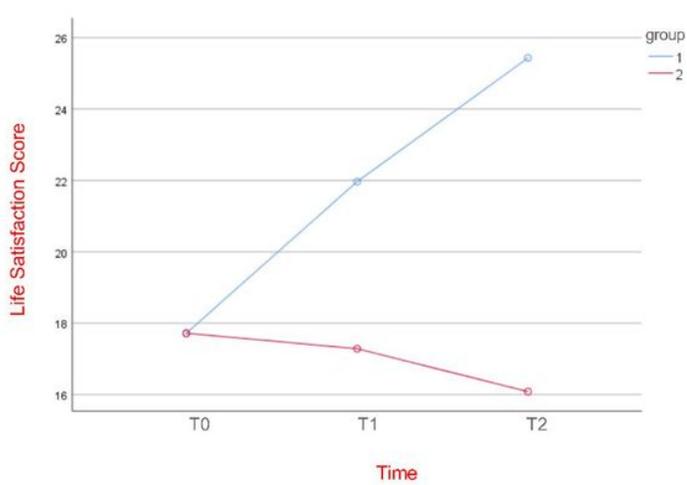


Figure 3

The trend of psychological distress and life satisfaction scores before and after intervention groups.

Supplementary Files

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