An Intervention Study of Mindfulness-Based Cancer Rehabilitation on Illness Uncertainty and Post-Traumatic Growth in Cancer Patients

Authors: Xie Minghui, Zhao Hanmei, Yang Zhihui, Xie Minghui

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Abstract

Objective: To investigate the intervention effects of Mindfulness-Based Cancer Recovery (MBCR) on illness uncertainty and post-traumatic growth (PTG) in cancer patients. Methods: A total of 117 cancer patients from departments of two tertiary hospitals in Beijing and Shanghai were selected as study subjects and divided into three groups through voluntary selection or matching. The experimental groups participated in online MBCR courses and completed mindfulness practice exercises of different durations: Experimental Group A practiced mindfulness for 15 minutes daily, and Experimental Group B practiced mindfulness for 30 minutes daily. The control group received no intervention. The Five Facet Mindfulness Questionnaire (FFMQ), Mishel Uncertainty in Illness Scale-Adult (MUIS-A), and Posttraumatic Growth Inventory (PTGI) were administered three times before MBCR intervention, after intervention, and at 4 weeks post-intervention to compare changes at different time points among the experimental groups and control group. Results: (1) Mindfulness level: Experimental Groups A and B showed a gradual upward trend over time, while the control group showed no significant change, with Group A' s improvement being better than Group B' s. The total FFMQ scores of the three groups showed significant differences across time points and in the time × group interaction ($p<0.01$). In pairwise comparisons between groups at each time point, only at T3 stage was the comparison between Experimental Group A and the control group statistically significant ($p<0.05$). (2) Illness uncertainty level: All three groups showed a gradually decreasing trend, but the control group' s change was relatively moderate. The total MUIS-A scores showed significant differences across time points ($p<0.01$), but there were no significant differences between groups or in the time × group interaction ($p>0.05$). (3) Changes in PTG before and after intervention: All three groups showed a gradually increasing trend, but the experimental groups improved more significantly than the control group, with Group A performing better than Group B. The total PTGI scores of the

three groups showed significant differences across time points ($p<0.01$). Conclusion: MBCR can improve mindfulness levels in cancer patients, reduce illness uncertainty, and promote the emergence or enhancement of PTG, which has positive effects on maintaining physical and mental health and promoting disease recovery in cancer patients. Additionally, mindfulness interventions have sustained effects and possible dose-response effects. It is recommended that cancer patients maintain long-term mindfulness practice habits to achieve better practice outcomes.

Full Text

Intervention Study of Mindfulness-Based Cancer Recovery on Illness Uncertainty and Post-Traumatic Growth in Cancer Patients

Minghui Xie[1], Hanmei Zhao[1], Liying Liu[2], Yuying Ye[3], Zhihui Yang[3]*

[1] Department of Interventional Radiology, First Affiliated Hospital of Naval Medical University, Shanghai 200433, China
[2] Fifth Medical Center, Chinese PLA General Hospital, Beijing 100039, China
[3] School of Humanities and Social Sciences, Beijing Forestry University, Beijing 100084, China

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Abstract

Objective: To explore the intervention effect of Mindfulness-Based Cancer Recovery (MBCR) on illness uncertainty and post-traumatic growth (PTG) in cancer patients. **Methods:** A total of 117 cancer patients from two tertiary hospitals in Beijing and Shanghai were selected as research subjects and divided into three groups through voluntary selection or matching. The experimental groups participated in online MBCR courses and completed mindfulness practice assignments of different durations: Experimental Group A practiced mindfulness for 15 minutes daily, while Experimental Group B practiced for 30 minutes daily. The control group received no intervention. The Five Facet Mindfulness Questionnaire (FFMQ), Mishel' s Uncertainty in Illness Scale-Adults (MUIS-A), and Post-Traumatic Growth Inventory (PTGI) were administered at three time points: pre-intervention, post-intervention, and four weeks after intervention completion, to compare changes across groups at different time points. **Results:** (1) Mindfulness levels: Both experimental groups showed a gradual upward trend over time, while the control group showed no significant change, with Group A demonstrating superior improvement compared to Group B. The total FFMQ scores showed significant differences across time points and significant time-by-group interaction effects ($p<0.01$). Pairwise comparisons revealed that only at the T3 stage did Group A differ significantly from the control group ($p<0.05$). (2) Illness uncertainty levels: All three groups showed a grad-

ual downward trend, though the control group' s change was relatively modest. The total MUIS-A scores differed significantly across time points ($p<0.01$), but neither between-group differences nor time-by-group interactions were statistically significant ($p>0.05$). (3) PTG changes: All three groups showed gradual improvement, but the experimental groups improved more markedly than the control group, with Group A outperforming Group B. The total PTGI scores differed significantly across time points ($p<0.01$). **Conclusion:** MBCR can enhance mindfulness levels, reduce illness uncertainty, and promote the generation or improvement of PTG in cancer patients, playing a positive role in maintaining their physical and mental health and facilitating disease recovery. Additionally, mindfulness interventions exhibit carry-over effects and potential dose-response effects, suggesting that cancer patients should maintain long-term mindfulness practice habits to achieve better outcomes.

Keywords: mindfulness; cancer patients; mindfulness-based cancer recovery; uncertainty about illness; post-traumatic growth

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Cancer has become one of the major threats to human health globally. According to the 2020 World Cancer Report, cancer ranks as the second leading cause of death among major diseases [**?**]. Characterized by high recurrence and mortality rates, cancer poses significant challenges to patients. In 2021, China' s National Health Commission issued the "Action Plan for Improving the Quality of Cancer Diagnosis and Treatment," emphasizing the need to address the psychosocial needs of cancer patients and provide psychological support [**?**]. Consequently, attention to the mental health of cancer populations has gained shared importance among clinicians and psychologists. Mindfulness-Based Cancer Recovery (MBCR) is a group intervention specifically designed for cancer patients that integrates psychological principles with cancer knowledge [**?**]. In 2016, Dr. Sun Yujing introduced MBCR to China through the translation of "Mindfulness-Based Cancer Recovery" [**?**], and since 2020, MBCR has been implemented in Chinese cancer populations. Studies have demonstrated its benefits in improving anxiety and depression symptoms, alleviating cancer-related fatigue (CRF), and reducing stress levels in cancer patients [**?**, **?**]. However, MBCR has not yet been widely promoted or validated in China, necessitating further dissemination and verification.

Post-traumatic growth (PTG), first conceptualized by Tedeschi, refers to positive psychological changes that exceed previous functioning levels as individuals struggle with traumatic or highly challenging life events [**?**]. PTG is widely recognized for its ability to reduce negative emotions, promote active disease coping, and improve quality of life [**?**], making it clinically significant to enhance PTG levels in patients. Illness uncertainty is a common experience among patients with chronic diseases, particularly cancer patients. Loss of control, uncertainty, and constant change represent the most challenging aspects of the cancer experience [**?**, **?**], underscoring the clinical importance of reducing illness uncertainty in this population.

Therefore, this study reconstructed the MBCR curriculum to accommodate cancer patients' susceptibility to fatigue and to address their questions about disease treatment through health education, aiming to validate the intervention effects of MBCR on PTG levels.

1.1 Participants

Cancer patients treated at two tertiary hospitals in Beijing and Shanghai between November 2022 and December 2022 were selected as research subjects. Prior to the study, researchers informed participants online about the study' s purpose, significance, potential risks, and benefits. **Inclusion criteria:** (1) Age $ $18 years, voluntarily participating cancer patients; (2) Commitment to complete the entire course and mindfulness practice assignments according to group requirements; (3) Not participating in any other psychological intervention groups during the study period; (4) Clear consciousness with language expression and literacy abilities. **Exclusion criteria:** (1) Non-cancer patients willing to participate; (2) Non-voluntary or uncooperative participants; (3) Those unable to complete the course due to physical or psychological reasons or who withdrew midway. Among 128 individuals who registered, 117 eligible patients were selected and assigned to Experimental Group A, Experimental Group B, or the control group through voluntary selection or matching. The grouping principle involved asking participants during the online T1 survey: "Which course would you like to participate in?" Those selecting "Complete the full mindfulness course, committing to 15 minutes of daily practice" or "Complete the full mindfulness course, committing to 30 minutes of daily practice" were assigned to Group A or Group B, respectively. Those indicating "Complete the full mindfulness course, either 15 or 30 minutes daily is acceptable" were matched into either experimental group. Participants selecting "I want to learn more but cannot complete the full course" were assigned to the control group. Hypothesis testing ensured balance across groups, resulting in 38 patients in Group A, 36 in Group B, and 43 in the control group. The study adhered to principles of voluntary participation, fairness, and non-maleficence, with all participant data kept confidential. Although Shapiro et al. reported that mindfulness practitioners experienced anxiety and discomfort potentially related to excessive practice intensity [**?**], credible evidence for mindfulness side effects remains lacking [**?**]. Therefore, this study intentionally shortened the course duration from the original MBCR protocol and retained participants' right to withdraw freely. Ethics approval number: BJFUPSY-2023-012.

1.2 Intervention Methods

The control group received routine nursing care, while the experimental groups received mindfulness intervention in addition to routine care, including participation in online MBCR courses and completion of mindfulness practice assignments of specified durations.

1.2.1 Mindfulness-Based Cancer Recovery Intervention Protocol Establishment of the mindfulness intervention team: The research team comprised one nationally certified psychological counselor with mindfulness teaching qualifications from the California Institute of Health (CIH) and four years of personal mindfulness practice, two senior oncology nurse managers, and two oncology nurses trained in mindfulness who served as course assistants. The assistants maintained WeChat groups for experimental group patients, supervised daily mindfulness practice homework, organized online check-ins, and ensured completion of three survey administrations across both experimental and control groups.

Revision of the MBCR curriculum: The mindfulness intervention curriculum was adapted from the course outline in "Mindfulness-Based Cancer Recovery" by Linda Carlson and Michael Speca, translated by Sun Yujing [**?**], consisting of eight MBCR sessions. Additionally, two cancer health self-care knowledge sessions were designed to address questions about disease health knowledge collected online. Courses were delivered via Tencent Meeting, twice weekly for 60 minutes each session, over four consecutive weeks, following the principle of not interfering with cancer patients' treatment, care, or rest. Group A practiced mindfulness for 15 minutes daily, Group B for 30 minutes daily, and the control group received no intervention. The mindfulness course implementation plan is shown in Table 1 .

Implementation of the mindfulness intervention: Courses were conducted via Tencent Meeting for 60 minutes each session, scheduled for Monday or Thursday evenings from 20:00-21:00, following the principle of not interfering with patients' treatment or rest. Each week introduced and practiced one mindfulness theme with homework assignments. Researchers distributed mindfulness practice audio files via WeChat groups, with different durations (15-minute and 30-minute versions) for each group. Experimental group patients were required to complete one practice session daily, at least four times per week. Each online live session included a 10-minute Q&A segment addressing questions from the week' s practice.

Quality control: Participants were selected strictly according to inclusion and exclusion criteria. Intervention implementers (course assistants) received unified professional technical training to familiarize themselves with questionnaire instructions and content at each study phase, ensuring intervention consistency. Live instruction and post-class discussions were conducted via Tencent Meeting, with recorded videos available for review. Weekly homework was distributed through course WeChat groups, with assistants encouraging and supervising daily practice check-ins, promoting question-asking and sharing of personal practice experiences, and collecting group questions for centralized Q&A in subsequent online sessions.

1.2.2 Evaluation Methods Evaluation instruments: (1) General information questionnaire: Developed by researchers, including demographic infor-

mation such as age, gender, occupation, education level, family monthly income, and medical insurance type, as well as lifestyle questions about diet, sleep, and mindfulness practice experience. (2) Five Facet Mindfulness Questionnaire (FFMQ) for measuring mindfulness levels [**?**]. This 39-item scale comprises five dimensions: Describing, Observing, Acting with awareness, Nonreactivity to inner experience, and Nonjudging of inner experience. Using a 5-point Likert scale from "never true" to "always true" (1-5 points), with 19 reverse-scored items indicated by R. Higher total scores indicate higher mindfulness levels. The scale' s internal consistency reliability exceeds 0.75 across dimensions [**?**]. (3) Mishel' s Uncertainty in Illness Scale-Adults (MUIS-A) for measuring illness uncertainty levels, using the Taiwanese version translated by Hsu [**?**]. The scale contains two dimensions– "ambiguity" and "complexity" –with 25 items total, including 5 reverse-scored items. Total scores range from 25-125 points using a 5-point Likert scale from "strongly agree" to "strongly disagree." Higher scores indicate greater illness uncertainty, categorized as low (25-58.3), medium (58.4-91.7), and high (91.8-125) levels. The overall Cronbach' s α coefficient is 0.865. (4) Post-Traumatic Growth Inventory (PTGI), developed by Tedeschi in 1996 [**?**], with 21 items across five dimensions reflecting different psychological change processes. This study used the revised version by Wang Ji [**?**], employing a 6-point Likert scale from "no change" to "very great change" (0-5 points), with total scores ranging 0-105. Higher scores indicate higher PTG levels. The scoring index = (actual score/maximum possible score) $\times$ 100%, categorized as high ($ $80%), medium (60-79%), and low (<60%) levels. The total scale Cronbach' s α coefficient is 0.874. All questionnaires were integrated into one online survey using Wenjuanxing, completable within 5-10 minutes.

Evaluation timing: All participants completed three survey administrations: T1: pre-intervention (week 0 of the total experimental period); T2: post-intervention (week 4); and T3: four weeks after intervention completion (week 8). Experimental and control groups were surveyed sequentially to avoid cross-contamination. Returned questionnaires were reviewed to eliminate those with false responses or incomplete data.

1.2.3 Statistical Methods Data were analyzed using SPSS 26 software. Surveys were collected at T2 (post-intervention) and T3 (four weeks post-intervention) and compiled with T1 (pre-intervention) baseline data. Statistical methods included descriptive analysis, chi-square tests, one-way ANOVA, and repeated measures ANOVA. $p<0.05$ indicated statistical significance. Hypothesis testing was two-tailed with α=0.05.

2.1 General Data Comparison

This study included 117 participants. No statistically significant differences were found among the three groups in gender, age, marital status, occupation type, monthly income, education level, diet, sleep, or disease stage ($p>0.05$), indicating comparability. See Table 2 .

Table 2: Comparison of General Information Among Three Groups of Cancer Patients Before Intervention

Characteristic	Experimental Group A (n=38)	Experimental Group B (n=36)	Control Group (n=43)
Gender (Male/Female)	17(44.7%)/21(55.3%)	16(44.4%)/20(55.6%)	19(44.2%)/24(55.8%)
Age <40 years	1(2.6%)	1(2.3%)	3(7.0%)
40-60 years	30(78.9%)	27(75.0%)	30(69.8%)
$ $60 years	7(18.4%)	9(25.0%)	12(27.9%)
Married (with spouse)	33(86.8%)	31(86.1%)	41(95.3%)
Occupation: Manual labor	12(31.6%)	9(25.0%)	12(27.9%)
Occupation: Mental labor	6(15.8%)	5(13.9%)	3(7.0%)
Monthly income <3500 yuan	11(28.9%)	10(27.8%)	16(37.2%)
Education: High school or below	17(44.7%)	13(36.1%)	18(41.9%)
Education: Bachelor' s degree	17(44.7%)	18(50.0%)	16(37.2%)
Sleep disturbance	11(28.9%)	10(27.8%)	12(27.9%)
Disease stage: Under treatment	18(47.4%)	16(44.4%)	17(39.5%)

2.1.1 Baseline Comparison No significant baseline differences were found among the three groups in mindfulness level (FFMQ total score, F=0.056, p>0.05), illness uncertainty level (MUIS-A total score, F=0.23, p>0.05), or PTG level (PTGI total score, F=0.15, p>0.05), indicating baseline comparability. See Table 3 .

Table 3: Baseline Comparison Among Three Groups of Cancer Patients Before Intervention

Scale	Experimental Group A (n=38)	Experimental Group B (n=36)	Control Group (n=43)
FFMQ total score	64.53$±8.79|64.53±8.67|63.98±8.25||*MUIS−Atotalscore*|91.92±8.65|93.22±8.17|92.70±8.32||*PTGItotalscore*|59.89±8.20|59.58±8.10|58.95±$7.80		

2.2 Changes in Mindfulness Levels Among Three Groups

A five-factor repeated measures ANOVA (including group and time factors) compared FFMQ total scores across groups. Results showed significant effects for time (F=35.024, p<0.01) and time-by-group interaction (F=8.390, p<0.01), but no significant between-group differences (p>0.05). Pairwise comparisons revealed that only at T3 did Group A differ significantly from the control group (MD=4.046, p<0.05). See Table 4 .

Table 4: Comparison of FFMQ Scores Among Three Groups of Cancer Patients

Time Point	Experimental Group A (n=38)	Experimental Group B (n=36)	Control Group (n=43)
T1	64.53$±8.79|64.53±8.67|63.98±8.25||*T*2|65.68±7.25|65.67±7.04|64.35±7.63||*T*3|68.39±7.09|67.42±		

Overall Analysis (Repeated Measures ANOVA):
F_{between}=0.813, p_{between}=0.446; F_{time}=35.024, p_{time}<0.01; F_{interaction}=7.587, p_{interaction}<0.01

The mindfulness level trend graph showed that from T1 to T3, Group A increased most rapidly, followed by Group B, while the control group showed minimal change. See Figure 1 [Figure 1: see original paper].

Figure 1: Trend Chart of Mindfulness Level Changes in Cancer Patients

Within-group comparisons across time revealed that both experimental groups showed significant differences among all three time points. Specifically, Group A: T2 vs. T1 (MD=1.158, p<0.05), T3 vs. T1 (MD=3.868, p<0.01), and T3 vs. T2 (MD=2.711, p<0.01). Group B: T2 vs. T1 (MD=1.139, p<0.05), T3 vs. T1 (MD=2.889, p<0.01), and T3 vs. T2 (MD=1.750, p<0.01). The control group showed no significant differences among time points. See Table 5 .

Table 5: Within-Group Comparisons of FFMQ Total Scores at Different Time Points

Group	T2 vs. T1	T3 vs. T1	T3 vs. T2
Experimental Group A (n=38)	MD=1.158, p<0.05	MD=3.868, p<0.01	MD=2.711, p<0.01
Experimental Group B (n=36)	MD=1.139, p<0.05	MD=2.889, p<0.01	MD=1.750, p<0.01
Control Group (n=43)	p>0.05	p>0.05	p>0.05

2.3 Changes in Illness Uncertainty Levels Among Three Groups

A two-factor repeated measures ANOVA compared MUIS-A total scores across groups. Results showed significant time effects (F=12.376, p<0.01), but no significant between-group differences or time-by-group interactions (p>0.05). See Table 6 .

Table 6: Comparison of MUIS-A Scores Among Three Groups of Cancer Patients

Time Point	Experimental Group A (n=38)	Experimental Group B (n=36)	Control Group (n=43)
T1	91.92$±8.65\|93.22±8.17\|92.70±8.32\|\|$T2|90.89±7.22|92.28±7.11|90.50±7.53||$T3|89.47±7.09|92.06±		

Overall Analysis (Repeated Measures ANOVA):
F_{between}=0.379, p_{between}=0.685; F_{time}=12.376, p_{time}<0.01; F_{interaction}=0.451, p_{interaction}=0.771

The illness uncertainty trend graph showed that from T1 to T3, all three groups declined, with Group A decreasing most rapidly, followed by Group B, and the control group showing a modest decline. See Figure 2 [Figure 2: see original paper].

Figure 2: Trend Chart of Illness Uncertainty Level Changes in Cancer Patients (N=117)

Within-group comparisons revealed that both experimental groups showed significant differences when comparing T2 and T3 with T1. Specifically, Group A: T2 vs. T1 (MD=-1.026, p<0.05) and T3 vs. T1 (MD=-1.421, p<0.01), but not T3 vs. T2 (p>0.05). Group B: T2 vs. T1 (MD=-0.944, p<0.05) and T3 vs. T1 (MD=-1.167, p<0.05), but not T3 vs. T2 (p>0.05). The control group showed no significant differences across time points. See Table 7 .

Table 7: Within-Group Comparisons of MUIS-A Total Scores at Different Time Points

Group	T2 vs. T1	T3 vs. T1	T3 vs. T2
Experimental Group A (n=38)	MD=-1.026, p<0.05	MD=-1.421, p<0.01	p>0.05
Experimental Group B (n=36)	MD=-0.944, p<0.05	MD=-1.167, p<0.05	p>0.05
Control Group (n=43)	p>0.05	p>0.05	p>0.05

2.4 Changes in Post-Traumatic Growth Levels Among Three Groups

A two-factor repeated measures ANOVA compared PTGI total scores across groups. Results showed significant time effects (F=5.803, p<0.01), but no significant between-group differences or time-by-group interactions (p>0.05). See Table 8 .

Table 8: Comparison of PTGI Scores Among Three Groups of Cancer Patients

Time Point	Experimental Group A (n=38)	Experimental Group B (n=36)	Control Group (n=43)
T1	59.89$±8.20\|59.58±8.10\|58.95±7.80\|\|$T2|60.32±7.08|60.56±7.22|59.19±7.69||$T3|61.00±7.40|60.64±		

Overall Analysis (Repeated Measures ANOVA):
F_{between}=0.346, p_{between}=0.708; F_{time}=5.803, p_{time}=0.003; F_{interaction}=0.890, p_{interaction}=0.471

The PTG trend graph showed that from T1 to T3, all three groups exhibited gradual improvement, with both experimental groups showing clear upward trends while the control group' s change was minimal. See Figure 3 [Figure 3: see original paper].

Figure 3: Trend Chart of PTG Level Changes in Cancer Patients

Within-group comparisons revealed that both experimental groups showed significant differences only between T3 and T1. Specifically, Group A: T3 vs. T1 (MD=1.105, p<0.05), but not T2 vs. T1 or T3 vs. T2 (p>0.05). Group B: T3 vs. T1 (MD=1.056, p<0.05), but not other comparisons. The control group showed no significant differences. See Table 9 .

Table 9: Within-Group Comparisons of PTGI Total Scores at Different Time Points

Group	T2 vs. T1	T3 vs. T1	T3 vs. T2
Experimental Group A (n=38)	$p>0.05$	MD=1.105, $p<0.05$	$p>0.05$
Experimental Group B (n=36)	$p>0.05$	MD=1.056, $p<0.05$	$p>0.05$
Control Group (n=43)	$p>0.05$	$p>0.05$	$p>0.05$

3.1 Effects on Mindfulness Levels

The significant time and interaction effects for FFMQ total scores indicated that both experimental groups showed gradual improvement, with Group A improving most rapidly, while the control group showed minimal change. This demonstrates that MBCR significantly enhanced cancer patients' mindfulness levels, which continued to increase over time, confirming both the intervention' s effectiveness and its carry-over effect. However, between-group comparisons at each time point revealed that only Group A differed significantly from the control group at T3 ($p<0.05$), while Group B did not, suggesting a potential dose-response relationship where 15 minutes of daily practice may be more effective than 30 minutes for improving mindfulness levels.

3.2 Effects on Illness Uncertainty Levels

All three groups showed gradual declines in illness uncertainty post-intervention, though the control group' s change was modest. This indicates that mindfulness intervention can improve illness uncertainty in cancer patients. Notably, the control group also showed positive changes, possibly because patients could access health knowledge through other channels such as hospital education, peer learning, and online resources. The significant time effect for MUIS-A total scores ($p<0.01$) suggests that mindfulness intervention effects on illness uncertainty amplify over time, indicating a carry-over effect. These findings align with previous research by Zhao and Lu [**?**, **?**].

3.3 Effects on Post-Traumatic Growth Levels

The significant time effect for PTGI total scores indicated that both experimental groups differed significantly from baseline at T3 ($p<0.05$), while the control group showed no differences, demonstrating that mindfulness intervention not only improves PTG but also exhibits carry-over effects. PTG enhancement appears to be a time-accumulative process requiring sustained intervention for optimal results. Additionally, 15 minutes of daily practice may be superior to 30 minutes, suggesting a dose-response relationship in PTG improvement. Notably, the control group showed a slow upward PTG trend, indicating that cancer patients may develop PTG through other means even without mindfulness intervention, though mindfulness significantly accelerates this process.

PTG represents positive psychological qualities developed through struggle with traumatic events and serves as an important indicator of quality of life and mental health. However, PTG does not emerge directly but rather through

"rumination" [?], and mindfulness practice may help practitioners change their perspectives and coping strategies, potentially explaining its effectiveness. Previous research has focused more on MBCR' s effects on psychological symptoms like depression and anxiety [?], with few studies examining its impact on PTG in cancer patients. This study' s conclusions align with limited existing research by Liu and Shen [?, ?].

3.4 Carry-Over and Dose-Response Effects of Mindfulness

The carry-over effect (legacy effect) refers to whether mindfulness benefits accumulate over time [?]—whether positive impacts persist beyond the intervention period. Most previous studies have involved short-term interventions with limited observation of duration effects, and findings on carry-over effects remain controversial. However, this study' s significant time effects for mindfulness levels, illness uncertainty, and PTG (all $p<0.01$) confirm that mindfulness intervention effects do persist, consistent with Sun et al.'s finding that mindfulness training effects can be maintained four weeks post-intervention [?], but inconsistent with Qin, who suggested that while mindfulness promotes PTG short-term, long-term effects are unclear [?].

The dose-response relationship refers to the association between mindfulness practice duration and outcomes [?], which has been rarely explored. This study found Group A outperformed Group B across all measures, suggesting a potential dose-response effect where 15 minutes of daily practice may be optimal for cancer patients. This may be because cancer-related fatigue makes shorter practice durations more sustainable.

4. Limitations

This study demonstrates that MBCR reduces illness uncertainty and promotes PTG, positively impacting cancer patients' physical and mental health and recovery. We recommend MBCR as a psychological rehabilitation approach for cancer populations in clinical settings. The study also confirms carry-over effects, with benefits accumulating over time, suggesting that sustained practice yields better outcomes. Additionally, a dose-response relationship may exist, though the relatively small sample size and only two experimental groups limit certainty. Future research should further investigate mindfulness dose-response effects.

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Author Information

Minghui Xie (1983-), female, from Hengyang, Hunan, holds a bachelor' s degree, Deputy Chief Nurse, and Head Nurse. Her research focuses on nursing management, nursing psychology, and military nursing. Phone: 13761264349, E-mail: 18019083580@163.com, Postal Code: 200430. Affiliation: Department of Interventional Radiology, First Affiliated Hospital of Naval Medical University, Shanghai, China.

Corresponding Author: Zhihui Yang, E-mail: zhihuiyang2OO8@126.com

Note: Figure translations are in progress. See original paper for figures.