Review Article

Interventions to Promote Resilience in Cancer Patients

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Summary

Background: Resilience is the ability to maintain or rapidly regain mental health during or after stressful life experiences. Cancer is a major risk factor for stress-associated mental illness. In this review, we attempt to identify effective resilience-promoting interventions in adults with cancer.

Methods: The analysis was restricted to randomized, controlled trials of resilience-promoting interventions in adults with cancer in which training was provided for at least one psychosocial resilience factor. A selective search, with systematic components, for relevant publications was carried out in the PubMed and CENTRAL databases. Effect sizes (Hedges' g) were calculated wherever a fully reported dataset for resilience or post-traumatic growth was available.

Results: Twenty-two trials with a total of 2,912 patients were included in the analysis; the intervention was provided in an individual setting in five trials and in group format in 17. Beneficial effects on resilience and post-traumatic growth, some of them large, were observed in patients who were acutely ill with cancer and after interventions that were provided in more than 12 sessions. The effect size ranged from $g = 0.33$ to $g = 1.45$. Largely beneficial effects were achieved by interventions based on the concepts of positive psychology, supportive-expressive group therapy, behavioral therapy, or mindfulness, with considerable variation in individual effect sizes.

Conclusion: Interventions that promote resilience should be made available to interested and motivated cancer patients. These interventions should be provided, in parallel with somatic treatment, as soon as the diagnosis is made and should extend over more than 12 sessions whenever possible.

Cite this as:

Ludolph P, Kunzler AM, Stoffers-Winterling J, Helmreich I, Lieb K: Interventions to promote resilience in cancer patients. *Dtsch Arztebl Int* 2019; 116: 865–72. DOI: 10.3238/arztebl.2019.0865

In Germany, around four million people are currently living with the diagnosis of cancer (1). Having been diagnosed with cancer, more than one third of patients develop symptoms of depression, an adjustment disorder, or an anxiety disorder in the course of the next 5 years (2). Besides the loss of quality of life, these stress-related mental health problems have a negative impact on the prognosis of the oncological disease, as they lead to poorer adherence to the planned treatment and other unfavorable effects (3, 4).

One way of promoting health in this risk group is to strengthen resilience. Resilience can be defined as the maintenance or fast recovery of mental health during or after exposure to significant stressors (5). Resilience is regarded as the result of adaptation to stressors and increasingly understood as a dynamic (learning) process that can be trained (6–8). Resilience as the outcome of such adaptation is presumably influenced to some extent by multiple resilience factors, such as self-esteem, realistic optimism, or cognitive flexibility; thus, strengthening these factors can have a positive effect on the development and preservation of resilience (9). During this process, people change due to one or more of the following (5):

- New attitudes and views
- Newly acquired strengths and competencies
- Partial immunization to the effects of future stressors
- Epigenetic modifications.

A positive correlation ($r = 0.43$, 95% confidence interval [0.39; 0.48], $p < 0.001$) between resilience (measured using the Wagnild and Young resilience scale [10]) and mental health in the somatically ill has recently been demonstrated in a meta-analysis (11).

Posttraumatic growth is defined as positive personal development resulting from critical or traumatic exposure to a stressor (12). This growth is explained not by the exposure itself, but rather by the subsequent process of coming to terms with the stressor and coping with the problematic situation (12). Especially in cancer patients, it is assumed that the frequently observed post-traumatic growth results from coping with the disease (13).

Resilience and post-traumatic growth are closely related concepts, above all in terms of reconfiguration (14), because numerous resilience factors are also associated with post-traumatic growth (15). While

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The Clinical Perspective

The clinical relevance of resilience-enhancing interventions in cancer patients is explained by the following facts: The incidence of cancer in Germany in 2020 is expected to be around 519,000 cases, almost double the figure 20 years ago (1). The prevalence of mental illness in cancer patients is between 32% and 38% (2, 35). The prevalence rates of stress-related mental disorders peak in the interval between diagnosis and treatment, fall during treatment, and rise again after completion of treatment (36). There is a two- to three-fold increase in the risk of suicidal behavior, especially among younger patients (37, 38). Resilience is considered a key indicator of the ability to sustain mental health in stressful circumstances and at times of personal crisis (6). In the work context it has been shown that resilience-enhancing interventions tailored to a specific target group are more effective than universal programs (19). This review shows selected examples of effective interventions that are based on diverse theoretical foundations: cognitive behavioral therapy and mindfulness (39); positive psychology (40); supportive-expressive group therapy (e5). To date, no randomized controlled trials on resilience-enhancing interventions for cancer patients have been published in German.

resilience involves a return to the baseline level, post-traumatic growth involves a positive change going beyond the earlier level of psychological functioning (15). In this paper, resilience and post-traumatic growth are treated as equivalent.

Resilience-enhancing interventions aim at promoting individual resilience in the context of a significant stressor. Thus, they can be implemented in cancer patients immediately after acute stressor exposure in terms of the initial cancer diagnosis or the discovery of a recurrence, but also during (chronic) stressor exposure over the course of the disease and with treatment (16–19). As they seek to strengthen one or more resilience factors, i.e., internal or external psychosocial resources, resilience interventions are generally resource-oriented. These factors include, for example, problem-solving skills, self-efficacy, optimism, or acceptance of negative situations and emotions (20).

To date, the effect of resilience-enhancing interventions on mental health and wellbeing has been evaluated in two systematic reviews and three meta-analyses, none of which focused specifically on cancer patients (21–25). The aim of this paper is to provide a narrative review of resilience-enhancing interventions in adult cancer patients. The two key questions evaluated were:

- To what extent do the following potential moderators influence the effects on resilience/post-traumatic growth:
 - the individual cancer disease
 - mental disorder comorbidities
 - the theoretical foundation
 - the dose of the interventions?
- How stable are the effects of the interventions over time?

Methods

A detailed description of the methods used is provided in the *eMethods*. Studies meeting the criteria listed in *Table 1* were included in this review. We carried out a selective search of the literature with systematic components in the PubMed database and the Cochrane

Library (CENTRAL) for publications between January 1990 and May 2018. Study selection and data extraction was performed by one assessor (PL).

Results

Selection of studies

The initial search of the literature identified 1178 studies. Of these, 22 studies with $i = 22$ reported samples met the inclusion criteria and were thus included in this narrative review (*Figure*). In 15 of the 22 studies, a quantitative analysis with calculation of effect sizes could be performed, including 5 studies with several follow-up measurements after the end of the interventions.

Study characteristics

An overview of the included studies is provided in *Table 2* and in *eTables 1 to 5*. Altogether, studies from 12 countries with 2912 patients, published between 2010 and 2018, were taken into account. The following types of cancer were treated:

- Breast cancer (11×)
- Colorectal cancer (3×)
- Gastric cancer (1×)
- Prostate cancer (1×)
- Mixed forms of cancer (6×).

Twelve studies included only female patients, 1 study only male patients, and the remaining 9 studies both male and female patients. While 2 studies included patients with mental disorders, 7 studies excluded patients with any kind of mental disorder. In the remaining 13 studies, only specific mental illnesses, such as psychotic or affective disorders, were listed among the exclusion criteria. Since some studies did not report age and gender data, it was not possible to calculate mean age and gender distribution (*eTables 1 and 4*).

In 20 studies, the interventions were provided face-to-face, in 1 study over the phone, and in 1 study online. Group interventions were used in 17 studies and individual interventions in 5 studies. Seventeen studies used a waiting-list control group or treatment

TABLE 1

Inclusion criteria	
Criterion	Description
Population	Adults (≥ 18 years), stressor exposure (cancer disease)
Intervention	Psychological intervention, defined as an intervention to increase/enhance resilience, hardiness, or posttraumatic growth. Training of at least one of the specific resilience factors: self-efficacy, optimism, active coping, social support, cognitive flexibility, religiosity/spirituality, positive emotions, hardiness, self-esteem, sense of coherence, and/or meaning/purpose in life (20)
Comparison intervention	Waiting-list control, treatment as usual, active control group
Outcomes	Resilience (e.g., determined using the Connor–Davidson Resilience Scale, CD-RISC) and/or post-traumatic growth (determined using the Posttraumatic Growth Inventory, PTGI)
Study design	RCTs (including cluster RCTs)
Publication date	1 January 1990 to 24 May 2018
Publication language	All
Publication formats	All

RCT, randomized controlled trial

FIGURE

Study selection flowchart

as usual, 3 studies an active control group and 1 study an active control group as well as a comparison group with treatment as usual. One study provided no detailed description of the control group. No subgroup analysis was performed for these groups.

As the outcome measure, 14 studies used the Posttraumatic Growth Inventory (PTGI) (26) and 8 studies employed various forms of the Connor–Davidson Resilience Scale (CD-RISC). The original 25-item version of the CD-RISC (27) was used in 4 of these studies, while the version reduced to 10 items by Campbell-Sills and Stein (28) was used in 3 studies. One study used the two-item version (29).

Sample sizes

In seven studies, the sample size was less than 50 patients; in six studies, 50 to 99 patients; in four studies, 100 to 149 patients; and in five studies, 150 or more patients. Among the samples with fewer than 50 patients, one of five studies demonstrated a significantly positive effect after the end of the intervention (Hedges' $g = 1.27$); among the samples with 100 to 149 patients, one of three studies ($g = 0.69$); and among the samples with 150 or more patients, three of four studies ($g = 0.33$ – 0.88). Looking at all studies included in this review, the study by O'Brien (2017), with a sample size of less than 50 patients, was the

TABLE 2

Overview of the studies included in the analysis with outcome

Studies	Participants	Intervention	Outcome ^{*1}
1. Study 2. Outcome instrument	1. Treatment period 2. Exclusion of mental disorders 3. No. of patients (randomized) 4. No. of patients (last FU)	1. Delivery format 2. Theoretical foundation 3. Duration 4. Control group	1. Post-test ([95% CI]; p value) 2. ≥ 4-week FU ([95% CI]; p value) 3. ≥ 3-month FU ([95% CI]; p value) 4. ≥ 6-month FU ([95% CI]; p value)
1. Cerezo 2014 (40) 2. CD-RISC	1. AP 2. All 3. IG 101/ CG 106 4. IG 87/ CG 88	1. F2F; group 2. Positive psychology 3. 8x @ 120 min, 1x/week 4. Waiting list	1. 0.88 ([0.57; 1.19]; 0.00)
1. Hamidian 2018 (32) 2. PTGI	1. AP 2. All 3. IG 45/ CG 45 4. IG 43/ CG 42	1. F2F; group 2. CBT, mindfulness, EW 3. 8x @ 60–90 min, 2x/week 4. TAU	3. 1.78 ([1.27; 2.28]; 0.00)
1. Hong 2016 (16) 2. CD-RISC	1. AP 2. All 3. IG 62/ CG 61 4. IG 50/ CG 53	1. F2F and phone; individual 2. No specific type 3. 3x @ 30 min, phone calls possible 4. TAU, 1x psychoeducation	1. 0.07 ([−0.31; 0.46]; 0.71)
1. Loprinzi 2011 (e1) 2. CD-RISC	1. CP 2. Partly 3. IG 12/ CG 12 4. IG 12/ CG 8	1. F2F and phone; individual 2. Mindfulness 3. 3x @ 90 min, 3x FU phone call 4. Waiting list	3. −0.08 ([−1.01; 0.85]; 0.86)
1. May 2016 (e2) 2. CD-RISC-10	1. AP 2. None 3. IG 13/ CG 9 4. IG 11/ CG 8	1. F2F; group 2. CBT, mindfulness 3. 8x @ 90 min, 1x/week 4. AC	1. −0.08 ([−0.93; 0.77]; 0.85)
1. Mousavi 2015 (e3) 2. CD-RISC	1. AP 2. Partly 3. IG 15/ CG 15 4. IG 15/ CG 15	1. F2F; group 2. Positive psychology 3. 8x @ 90 min, 3x/week 4. TAU	1. 0.53 ([−0.20; 1.26]; 0.15)
1. Norouzi 2017 (e4) 2. PTGI	1. AP 2. All 3. IG 12/ CG 12 4. IG 10/ CG 10	1. F2F; group 2. CBT, mindfulness 3. 8x @ 150 min, 1x/week 4. TAU	1. 1.27 ([0.31; 2.23]; 0.01) 3. 1.17 ([0.22; 2.12]; 0.01)
1. O'Brien 2017 (30) 2. CD-RISC-2	1. AP 2. Partly 3. IG 15/ CG 13 4. IG 14/ CG 13	1. F2F; individual 2. CBT 3. 3x @ 30 min 4. TAU	2. −0.97 ([−1.77; −0.18]; 0.02)
1. Ramos 2018 (39) 2. PTGI	1. ACP 2. Partly 3. IG 58/ CG 147 4. IG 55/ CG 90	1. F2F; group 2. CBT, mindfulness, EW 3. 8x @ 90 min, 1x/week 4. TAU	1. 0.69 ([0.36; 1.02]; 0.00) 4. 1.19 ([0.83; 1.56]; 0.00)
1. van der Spek 2017 (17) 2. PTGI	1. CP 2. Partly 3. IG 57/ CG1 56/ CG2 57 4. IG 45/ CG1 46/ CG2 35	1. F2F; group 2. Logotherapy and existential analysis 3. 8x @ 120 min, 1x/week 4. CG1 AC, CG2 TAU	1. −0.05 ([−0.45; 0.35]; 0.81) 3. −0.15 ([−0.57; 0.27]; 0.48) 4. −0.26 ([−0.70; 0.19]; 0.25)
1. Ye 2016 (e5) 2. CD-RISC-10	1. AP 2. Partly 3. IG 101/ CG 103 4. IG 93/ CG 82	1. F2F; group 2. SEGT 3. 8x 1x/week; 3x FU @ 180 min 4. TAU	2. 0.25 ([−0.02; 0.53]; 0.07) 4. 0.78 ([0.48; 1.08]; 0.00) 5. 1-year FU: 0.90 ([0.59; 1.22]; 0.00)
1. Ye 2017 (34) 2. CD-RISC-10	1. CPF 2. Partly 3. IG 113 / CG 113 4. IG 94/ CG 89	1. F2F; group 2. SEGT 3. 53x @ 120 min, 1x/week 4. TAU	1. 0.66 ([0.34; 0.97]; 0.00)
1. Yun 2017 (e6) 2. PTGI	1. CP 2. Partly 3. IG 166/ CG 82 4. IG 117/ CG 57	1. F2F; group and Individual 2. Transtheoretical model 3. Among others 2x WS and 16x @ 30 min 4. TAU	4. 0.33 ([0.01; 0.65]; 0.04)
1. Zernicke 2014 (e7) 2. PTGI	1. CP 2. Partly 3. IG 30/ CG 32 4. IG 25/ CG 32	1. Online; group 2. Mindfulness 3. 8x @ 120 min, 1x/week. 4. Waiting list	1. 0.24 ([−0.26; 0.74]; 0.34)

Studies	Participants	Intervention	Outcome* ¹
1. Study 2. Outcome instrument	1. Treatment period 2. Exclusion of mental disorders 3. No. of patients (randomized) 4. No. of patients (last FU)	1. Delivery format 2. Theoretical foundation 3. Duration 4. Control group	1. Post-test ([95% CI]; p value) 2. ≥ 4-week FU ([95% CI]; p value) 3. ≥ 3-month FU ([95% CI]; p value) 4. ≥ 6-month FU ([95% CI]; p value)
1. Zhang 2017 (e8) 2. PTGI	1. AP 2. Partly 3. IG 30/ CG 30 4. IG 28/ CG 30	1. F2F; group 2. Mindfulness 3. 8× @ 120 min, 1×/week 4. TAU	1. 1.45 ([0.87; 2.03]; 0.00) 3. 2.03 ([1.40; 2.67]; 0.00)

*¹ Effect size in Hedges' g

AC, Attention control; ACP, acute and chronically ill patients; AP, acute patients; CD-RISC, Connor–Davidson Resilience Scale; CD-RISC-2, two-item CD-RISC; CD-RISC-10, 10-item CD-RISC; CP, chronic patients; CPA, chronic patients with advanced disease; individual, individual setting; EW, expressive writing; FU, follow-up; F2F, face-to-face; group, group setting; IG, intervention group; CG, control group; CBT, cognitive behavioral therapy; PTGI, Posttraumatic Growth Inventory; SEG, supportive-expressive group therapy; TAU, treatment as usual; WS, workshop; CI, confidence interval

only study to report a significantly negative effect ($g = -0.97$) (30)

Treatment period/stage of the disease

Patients with “chronic cancer” were investigated in 8 studies, patients of the category “chronic cancer, advanced stage” in 3 studies, and patients meeting the criteria for “acute cancer” in 10 studies. One study with a very heterogeneous patient population could not be allocated to any of these groups. One of four studies in the “chronic cancer” group found a significantly positive effect on resilience ($g = 0.33$). In one study of cancer survivors with advanced disease, a significantly positive effect was found ($g = 0.66$). In the group with acute cancer patients, the effect sizes found in four of nine studies were in the significantly positive range ($g = 0.88$ – 1.78). When only the studies with more than 50 analyzed acute cancer patients were considered, all calculated effect sizes were positive, and in three of the five studies they were in the significantly positive range ($g = 0.88$ – 1.78).

Intervention intensity

Five studies evaluated short interventions (<8 sessions and <12 h), 13 investigated medium-length interventions (≥ 8 <12 sessions or ≥ 12 <24 h), and 3 analyzed long interventions (≥ 12 sessions or ≥ 24 h) for resilience enhancement. One study did not provide information about the number and duration of sessions. While a significantly positive effect size ($g = 1.78$) was observed in only one of four studies evaluating short interventions, this was the case in four of nine studies with medium-length interventions ($g = 0.41$ – 1.45) and in two studies with long interventions ($g = 0.66$ – 0.88). Positive effect sizes were found in seven of eight studies with more than 50 analyzed patients and at least medium-length interventions, and in five of these the results were in the significant range ($g = 0.33$ – 1.45).

The theoretical foundation

Six studies evaluated interventions combining cognitive behavioral therapy (CBT) with mindfulness-based psychotherapy. Five studies used mindfulness-based interventions alone. Three resilience training programs

were based on the positive psychology approach and two on supportive–expressive group therapy. The other six interventions used a variety of theoretical foundations (e.g., logotherapy, existential analysis, transtheoretical model). The effect sizes of the interventions that were based on a combination of CBT and mindfulness or on mindfulness alone were significantly positive in four of eight studies ($g = 0.69$ – 1.78). Two studies using interventions with techniques of positive psychology ($g = 0.53$ – 0.88) and two studies using supportive–expressive group therapy (eMethods) found positive effect sizes. One study in each of the two types of theoretical foundation was significantly positive (positive psychology $g = 0.88$, supportive–expressive group therapy $g = 0.9$).

Time of measurement

With regard to the time of measurement, we differentiated between data obtained immediately ($n = 10$), more than 4 weeks ($n = 2$), more than 3 months ($n = 5$), more than 6 months ($n = 4$), or more than 1 year ($n = 1$) after the intervention. Immediately after the intervention, positive effect sizes for resilience were found in 5 out of 10 measurements ($g = 0.66$ – 1.45). In four of the five studies with several follow-up measurements, the effect sizes at the later measurement times were within the significantly positive range and remained stable or continued to increase ($g = 0.78$ – 2.03).

Discussion

This article is the first narrative review of resilience interventions in cancer patients. Primarily in studies with larger sample sizes, positive effects in terms of increased resilience or post-traumatic growth were achieved. Particularly in the larger studies, the effect sizes were in the significantly positive, small to medium range (Hedges' g ; evaluation of effect size [31]: 0.2 = small, 0.5 = medium, 0.8 = large). Especially the five studies with less than 50 analyzed patients, including one study with a negative effect (30), contributed to the variance of the results in this analysis. These observations are consistent with those reported from previous studies on resilience-enhancing interventions (21–25).

TABLE 3

Examples of resilience factor training exercises

Resilience factor	Exercise examples
Cognitive flexibility	Positive reevaluation by identifying and reappraising dysfunctional thoughts and replacing these with more functional/positive thoughts (39)
Self-efficacy	Improvement of the ability to handle expectations and fears of future events (such as recurrences, treatments, social and financial problems) using exercises from rational emotive behavior therapy (39)
Social support	Communication exercises to improve the expression of emotions and experiences related to the disease (e.g., communication cards) (39); establishment of non-hierarchical, reciprocal relationships with mentors (34)
Active coping	Supporting symptom control (e.g., pain, fatigue, intrusions) by education and training of, for example, breathing exercises and meditation (34)
Positive emotions	Exercises to increase attention to positive moments from attention and interpretation therapy (34)
Optimism	Increasing optimism through group discussions and role plays, promotion of a positive attribution style (40)
Hardiness	Imagination of future stress situations related to the disease and how to cope with them (39)
Sense of coherence	Building an individual narrative to integrate the disease experience into the life story, e.g., using expressive writing (39)
Meaning/purpose in life	Discussions about changes in values/basic attitudes since the onset of the disease (39)
Self-esteem	Identifying personal strengths (40)
Religiosity/spirituality	Meditation exercises (40)

With regard to possible moderators of the effects of resilience interventions on resilience and post-traumatic growth, it was found that, especially in studies on acute cancer patients, the size of the observed effects on resilience and post-traumatic growth was typically large. Consequently, cancer patients can benefit from resilience-enhancing interventions, especially in the period immediately after the diagnosis and in parallel with somatic treatment.

This review found larger effect sizes for resilience and post-traumatic growth with increasing duration of the interventions. This finding suggests that preferably more intense training should be clinically recommended to cancer patients. However, it must be taken into account that some short interventions also achieved good effects (32).

This review was the first to perform a subgroup analysis of different theoretical foundations of resilience-enhancing interventions in patients with cancer. The only systematic review to date that has evaluated resilience interventions in somatically ill patients did not perform such an analysis (23). We found promising results especially for training interventions based on positive psychology, supportive-expressive group therapy, CBT, and mindfulness.

With regard to the duration of the effects on resilience and post-traumatic growth, lasting effects were demonstrated in the follow-up periods. In the studies evaluating several follow-up measurements, the increase in resilience/post-traumatic growth remained

largely stable for up to 1 year, or both outcomes improved further. Several studies have already shown that resilience interventions in patient populations at risk for mental illness have positive long-term effects (24, 33). In previous reviews, only limited follow-up data were available for periods more than 3 to 6 months after the end of the intervention. Thus, this review adds new knowledge to the literature on this topic (21–23).

Clear conclusions on the benefits of resilience interventions for cancer patients with or without comorbid mental illness cannot be drawn from this narrative review. Since only two of the studies analyzed included patients with severe mental illness, no subgroup analysis was performed. From a clinical point of view, resilience training appears to be a useful preventive intervention, especially for cancer patients at risk for mental disorder comorbidity. In addition to treatment with psychotherapy and psychiatric medications, cancer patients with severe comorbid mental illness may benefit from resilience training.

Since most interventions were provided face-to-face and in individual sessions, it is difficult to draw concrete conclusions regarding the superiority of a particular delivery type of these interventions from the available studies. However, according to a previous review, face-to-face individual and group sessions achieved better effect sizes—and also better treatment adherence—than online interventions (24).

The majority of studies used groups receiving treatment as usual or waiting-list control groups for

comparison; thus, no subgroup analysis was performed. However, the two systematic reviews on resilience interventions that have been published so far indicate that the choice of control group has a considerable impact on the effect size. It was noted, when comparing studies with resilience training versus active control group design with studies with resilience training versus waiting-list control group design, that the effect sizes of the former were at times only half as large (23, 24).

Limitations

The pronounced heterogeneity of the included studies is a weakness of this review. This can partly be explained by the fact that interventions to enhance resilience and interventions to promote post-traumatic growth were treated equally. Furthermore, there were great differences in how resilience was defined and measured among the various studies included in this review. While the CD-RISC as a quantitative measure of resilience has satisfactory psychometric properties, it does not allow determination of resilience according to the currently prevailing definition as a result or process and it is too strongly correlated with individual resilience factors (21). Hard endpoints, such as the survival rate of cancer patients, were evaluated in only one of the included studies, the results of which were not significant (34).

Since this is a narrative, not a systematic review, study selection and data extraction were carried out by one reviewer only (rather than by two independent reviewers). Furthermore, the risk of bias of the included studies was not evaluated. With regard to the effect sizes and subgroup differences, it has thus to be taken into account that bias may have influenced certain aspects (e.g., selection bias, attrition bias). These limitations could be addressed in a future systematic review on this target population according to international standards.

In addition, for seven studies that met all of the inclusion criteria, it was not possible to calculate effect sizes because missing data could not be obtained despite our attempts to contact the authors.

Conclusion

Despite the limitations mentioned above, the results of this review justify the recommendation that every interested and motivated cancer patient be offered the opportunity to participate in a resilience-enhancing intervention. Especially the period immediately after the diagnosis appears to be conducive to the success of the intervention, in parallel with somatic treatment. This narrative review indicates that longer interventions, with at least 12 therapeutic sessions and a cumulative duration of at least 24 h, achieve the greatest effects on resilience and post-traumatic growth. The currently available evidence does not allow reliable statements to be made on the particular advantages of a specific theoretical foundation or of hard endpoints such as survival. Further research on this topic is therefore needed.

Key messages

- Resilience refers to the ability to maintain or quickly recover to a healthy mental state during or after exposure to stressful life circumstances.
- Resilience is defined as the result of adaptation to stressors and is determined, at least partially, by multiple factors, such as self-esteem, realistic optimism, and cognitive flexibility.
- In this review, resilience-enhancing interventions that were provided in the period immediately after the diagnosis and in parallel with somatic treatment had the greatest effect on resilience or post-traumatic growth in adult cancer patients.
- The enhancement of resilience or post-traumatic growth remained stable for up to 1 year after the end of the intervention or continued to increase even further.
- The largest effect sizes were achieved with longer interventions of more than 12 sessions and a cumulative duration of at least 24 h.

Based on the studies that achieved the greatest individual effects on resilience and post-traumatic growth in this review, Table 3 gives an overview of trainable resilience factors and provides examples of exercises for everyday clinical work with cancer patients. Looking forward, there is a need to develop resilience interventions specifically designed for this patient population in a German-language format.

Conflict of interest

The authors declare that no conflict of interest exists.

Received on 24 June 2019, revised version accepted on 30 July 2019

Translated from the original German by Ralf Thoene, MD

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Cite this as:

Ludolph P, Kunzler AM, Stoffers-Winterling J, Helmreich I, Lieb K: Interventions to promote resilience in cancer patients. *Dtsch Arztebl Int* 2019; 116: 865–72. DOI: 10.3238/arztebl.2019.0865

► Supplementary material

For eReferences please refer to:

www.aerzteblatt-international.de/ref5119

eMethods, eTables, eBox:

www.aerzteblatt-international.de/19m0865

Supplementary material to:

Interventions to Promote Resilience in Cancer Patients

by Paul Ludolph, Angela M. Kunzler, Jutta Stoffers-Winterling, Isabella Helmreich, and Klaus Lieb

Dtsch Arztebl Int 2019; 116: 865–72. DOI: 10.3238/arztebl.2019.0865

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eMETHODS

Definitions

Positive psychology

Positive psychology, a branch of psychology founded by Martin Seligman, studies the processes responsible for an individual person's strengths and positive emotions. In the past, the focus was commonly on the pathogenic perspective, i.e., the study of human weakness and disorders. By contrast, the positive psychology approach focusses on human strengths and uses the positive resources of individuals to develop interventions that have a positive effect on life satisfaction. These positive resources include: optimism, creativity, humor, or hope, as well as numerous other positive qualities and strengths, enabling individuals to successfully adapt to new situations (e16).

Supportive–expressive group therapy

The aim of supportive–expressive group therapy for cancer patients is to reduce the psychological burden associated with the disease, boost the patient's coping mechanisms, and improve their quality of life. The therapy model is particularly anchored in the existential psychotherapy of Irvin Yalom and is characterized by a non-prestructured, process-oriented approach. By establishing supportive relationships among group participants and dealing with the central topics and existential questions in connection with cancer, it is attempted to achieve emotion-centered coping. Topics include existential fears, a changed body image and self-image, and the loss of roles and responsibilities, as well as death and dying (e17).

Supplementary information on methods

Inclusion criteria

Studies meeting the criteria listed in *Table 1* were included in this review. For each included study, the effect sizes for the two endpoints—resilience (e.g., using the Connor–Davidson Resilience Scale, CD-RISC [26]) or post-traumatic growth (e.g., using the Posttraumatic Growth Inventory, PTGI [27])—were calculated immediately after the end of the intervention and at various follow-up visits, depending on the availability of data, and collectively referred to as “effects on resilience”. The properties of the two measuring instruments will be detailed in the following. Standardized mean differences were chosen to measure effect size. The included studies were split into subgroups (clustering) to evaluate and examine the variation of effect sizes, depending on

- Specific moderator variables in patients with cancer (treatment period, comorbid mental disorder)
- Resilience interventions (e.g., theoretical foundation, intervention intensity)
- Study design (study size, measurement time points).

If there were several measurements at different time points in a study, the first measurement after the end of the intervention was used for subgroup comparisons.

The search was limited to the period from 1 January 1990, since the development and systematization of the field of resilience research has occurred mostly in the past decade (6, 7). Since then, resilience has increasingly been defined as a modifiable outcome during or after stressful life circumstances, which has resulted in the development of various resilience-enhancing interventions. The selection of the survey period for this review is supported by the results of the search carried out by Macedo et al. for their 2014 review: without restricting the year of publication, they were only able to identify studies published after 1990 (21).

Literature search

A selective search was carried out for relevant studies in the databases PubMed and Cochrane Central Register of Controlled Trials (CENTRAL). The search strategy is detailed in the *eBox*. In addition, the references of existing reviews (21–24) and the included primary studies were searched for further relevant studies.

Study selection and extraction of relevant information

First, the titles and abstracts of the identified publications were assessed for eligibility, based on the predetermined inclusion criteria. The full texts of relevant papers were then reassessed with regard to the inclusion criteria. In the case of uncertainty about the eligibility of a given study, its authors were contacted. The study characteristics, potential limitations of study quality, and the data required for calculating effect sizes were extracted from the included publications. Study selection and extraction were performed by one assessor (PL); any discrepancies were resolved in consensus discussions (AMK, PL).

Instruments

The PTGI (26) was developed by the working group led by Tedeschi as an instrument to measure posttraumatic growth. This self-report instrument comprises 21 items and five subscales (new possibilities, relating to others, appreciation of life, personal strength, and spiritual change) which are evaluated on a 6-point Likert scale (from 0 = “I did not experience this change as a result of my crisis” to 5 = “I experienced this change to a very great degree as a result of my crisis”). Higher scores are indicative of greater post-traumatic growth as a result of a stressful event. The instrument’s reliability was tested in a study with 604 psychology students who reported having experienced a critical life event within the past 5 years (Cronbach’s $\alpha = 0.89$; for the various subscales $\alpha = 0.67$ – 0.85) (26).

The CD-RISC (27) is a self-report scale developed to quantify resilience. It measures five factors: personal competence and tenacity; tolerance of negative affect and strengthening effects of stress; positive acceptance of change and secure relationships; control; and spiritual influences. It consists of 25 items, which are evaluated on a 5-point Likert scale (from 0 = “not true at all” to 4 = “true nearly all of the time”), and measures how the participant felt in the past month; higher scores indicate higher resilience. The internal consistency of the instrument was tested in, among others, a study with a population sample of 577 participants (Cronbach’s $\alpha = 0.89$; for the various items $\alpha = 0.30$ – 0.70) (27).

The CD-RISC-10, a version of the measure abbreviated by Campbell-Sills and Stein to 10 items (28), was evaluated in 1023 students (Cronbach’s $\alpha = 0.85$; for the various subscales $\alpha = 0.44$ – 0.74) (28). The CD-RISC-2, a version of the test abbreviated by Vaishnavi et al. to two items (“able to adapt to change” and “tend to bounce back after illness or hardship”) achieved an intraclass correlation of 86.5% ($p < 0.0001$) in the test–retest reliability assessment, comparing a sample of 24 patients with generalized anxiety disorder and a sample of 141 patients with post-traumatic stress disorder (29). The two-item test showed a significant correlation ($r = 0.78$; $p < 0.001$) with the remaining 23 items of the 25-item version.

Subgroups

Sample sizes

We distinguished between samples of different sizes: less than 50 patients, 50 to 99 patients, 100 to 149 patients, and 150 patients or more. The included studies were divided into these subgroups after an initial exploration made it clear that this approach yielded four comparably large groups.

Treatment period/stage of disease

A distinction was made between patients with acute cancer, patients with chronic cancer, and patients with advanced chronic disease. Patients in the last two categories had completed their cancer treatment at least 1 year before the time of intervention, while patients with acute cancer had either not yet undergone curative treatment or had completed curative treatment less than 1 year beforehand. Patients with manifest metastasis and a life expectancy of less than 24 months were classed as having advanced disease.

Intervention intensity

A distinction was made between short interventions (<8 sessions and <12 h), medium-length interventions (≥ 8 <12 sessions or ≥ 12 <24 h) and long interventions (≥ 12 sessions or ≥ 24 h).

Theoretical foundation

Mindfulness, cognitive behavioral therapy in combination with mindfulness, positive psychology, supportive–expressive group therapy, and various theoretical foundations were distinguished. Studies based on a theoretical foundation that was used in only one study were combined in the subgroup “diverse theoretical foundations”.

Time of measurement

A distinction was made between post-test (immediately after the end of the intervention), ≥ 4 -week follow-up, ≥ 3 -month follow-up, ≥ 6 -month follow-up, and ≥ 1 -year follow-up.

Effect sizes

Standardized mean differences (Hedge’s g) were chosen to measure effect size. Hedge’s g can be used to calculate the effect size for different group sizes by taking the size of the group into account when calculating the pooled standard deviation. The approach is largely comparable to Cohen’s d , except that the pooled standard deviation is corrected by a small, positive bias to reduce the estimation error in small samples (e18). For each effect size, the corresponding 95% confidence interval (CI) was calculated. Taking into account the variability of empirical results, the probability that the population parameter is contained within the CI is 95% (e18). For the calculation of the effect sizes, only the intergroup differences between intervention group and control group at the respective time point were used, regardless of the baseline values. This approach was used on the assumption that the baseline values of the subjects in different conditions of a randomized controlled trial vary only randomly. The interpretation of the effect sizes was based on the conventions of Cohen (28), where effect sizes from 0.20 were interpreted as a small effect, those from 0.50 as a medium effect, and those above 0.80 as a large effect.

eBOX

Search strategies

● Search strategy CENTRAL:

1. Resilience [Title, Abstract, Keywords]
2. meaning-centered [Title, Abstract, Keywords]
3. hardiness [Title, Abstract, Keywords]
4. posttraumatic growth [Title, Abstract, Keywords]
5. post-traumatic growth [Title, Abstract, Keywords]
6. personal growth [Title, Abstract, Keywords]
7. psychological well-being [Title, Abstract, Keywords]
8. coping behavior [Title, Abstract, Keywords]
9. emotional stress [Title, Abstract, Keywords]
10. or/1–9
11. intervention [Title, Abstract, Keywords]
12. group therapy [Title, Abstract, Keywords]
13. or/10–11
14. cancer [Title, Abstract, Keywords]
15. 10 and 13 and 14

● Search strategy PubMed:

1. randomized controlled trial [pt]
2. controlled clinical trial [pt]
3. randomized [tiab]
4. randomized [tiab]
5. placebo* [tiab]
6. randomly [tiab]
7. trial [tiab]
8. groups [tiab]
9. or/1–8
10. Neoplasms [mh]
11. Cancer [tiab]
12. Oncology [tiab]
13. or/10–12
14. resilience, psychological [mh]
15. resilience [tiab]
16. hardiness [tiab]
17. posttraumatic growth [tiab]
18. post-traumatic growth [tiab]
19. personal growth [tiab]
20. psychological well-being [tiab]
21. stress related growth [tiab]
22. coping behavior [tiab]
23. emotional stress [tiab]
24. or/14–23
25. 9 and 13 and 24
26. limit 25 to yr = "1990 –Current"

eTABLE 1

Supplementary overview of studies with quantitative analysis 1

Studies	Gender	Age	Exclusion of mental disorders
Cerezo 2014 (40)	Female	Average age in years (SD): 50.71 (9.44) IG; 49.4 (9.9) CG	Previous mental illness (e.g. schizophrenia, personality disorder)
Hamidian 2018 (32)	Female	Average age in years (SD): 43.9 (8.4) IG; 40.3 (10.8) CG	All mental illnesses
Hong 2016 (16)	27.2% (28/103) female	Average age in years (SD): 55.1 (10.8) IG; 55.3 (11.1) CG	History of mental illness or use of psychiatric medications
Loprinzi 2011 (e1)	Female	Median in years (range): 61 (48–72) IG; 61 (46–75) CG	Psychotic episode in the past 6 months
May 2016 (e2)	Female	Average age in years (SD): 55.4 (9.5) IG; 55.4 (8.5) CG	No exclusion
Mousavi 2015 (e3)	Female	Not stated	Mental illnesses that interfere with study participation
Norouzi 2017 (e4)	Female	Average age in years (SD): 38.8 (5.6)	All mental illnesses
O'Brien 2017 (30)	40.7% (11/27) female	Age 30–39 years 2 (7.4%), 40–49 years 2 (7.4%), 50–59 years 4 (14.8%), 60–69 years 12 (44.4%), 70–79 years 3 (11.1%), 80–89 years 3 (11.1%), 90–99 years 1 (3.7%)	Mental illnesses that interfere with study participation
Ramos 2018 (39)	Female	Average age in years (SD): 52.2 (8.7) IG; 55.2 (10.4) CG	Mental illnesses that interfere with study participation (e.g. schizophrenia, severe depression, personality disorder)
van der Spek 2017 (17)	82.4% (140/170) female	Average age in years (SD): 58.6 (10.7) IG; 55.5 (9.6) CG1; 57.3 (10.4) CG2	Severe cognitive impairment or currently undergoing psychological treatment (inclusion criteria: depressed mood, anxiety, relationship problems, or similar conditions)
Ye 2016 (e5)	Female	IG: ≤ 30 years 17 (18.3%), 31–50 years 35 (37.6%), >50 years 4 (4.1%); CG: ≤ 30 years 12 (14.6%), 31–50 years 12 (14.6%), >50 years 4 (33.3%)	History of suicidality
Ye 2017 (34)	Female	IG: ≤ 40 years 27.4%, >40 and ≤ 60 years 49.5%, >60 years 23.1%; CG: ≤ 40 years 28.2%, >40 and ≤ 60 years 41.2%, >60 years 30.6%	History of repeated suicidality, psychotic disorders or severe personality disorder
Yun 2017 (e6)	20.4% (164/206) female	Average age in years (SD): 50.5 (10.2) IG; 51.0 (7.6) CG	Previous mental illness (e.g. schizophrenia, bipolar disorder or eating disorder)
Zernicke 2014 (e7)	72.6% (45/62) female	Average age in years (SD): 58 (8.2) IG; 58 (13.0) CG	Previous mental illness (e.g. schizophrenia, bipolar disorder, substance abuse or suicidality; inclusion of patients with depression, anxiety disorder, or adjustment disorder)
Zhang 2017 (e8)	Female	Average age in years (SD): 48.7 (8.5) IG; 46.0 (5.1) CG	Severe mental disorders

CG, Control group; IG, intervention group; SD, standard deviation

eTABLE 2

Supplementary overview of studies with quantitative analysis 2

Studies	Cancer type	Description of cancer	Comorbidities at baseline	Profession of intervention staff
Cerezo 2014 (40)	Breast cancer	Breast cancer stages 1–3, 77% receiving chemotherapy	Not specified	Psychotherapists
Hamidian 2018 (32)	Breast cancer	Patients receiving chemotherapy for breast cancer	Not specified	Psychiatric nurses with years of professional experience
Hong 2016 (16)	Gastric cancer	Newly diagnosed	Symptoms of anxiety (STAI): IG: 50.50 (7.69); CG: 45.30 (13.21)	Specially trained study staff
Loprinzi 2011 (e1)	Breast cancer	Breast cancer diagnosed more than 3 years previously (in 18 of 20 patients)	Symptoms of anxiety (SAS): IG: 49.4 (18.2); CG: 42.8 (14.0)	Specially trained study staff
May 2016 (e2)	Breast cancer	Diagnosed with breast cancer in the past year; status post curative surgery	Mental health (BSI-18): IG: 27.00 (13.13); CG: 26.33 (12.75)	Psychologists with experience in CBT and mindfulness
Mousavi 2015 (e3)	Cancer of the GIT	Patients receiving chemotherapy	Not specified	Not specified
Norouzi 2017 (e4)	Breast cancer	Stage 2 breast cancer, undergoing treatment	Not specified	Psychologists with experience in CBT and mindfulness
O'Brien 2017 (30)	Bowel cancer	Colorectal cancer treated surgically or with adjuvant chemotherapy	Mental health (assessment area of SF12v2): IG: 52; CG: 49	Specially trained study staff
Ramos 2018 (39)	Breast cancer	Stage 1–3 breast cancer; no recurrence or metastases; 20% undergoing chemotherapy, 10% radiation therapy, 60% hormone therapy; average time since diagnosis 18 months	Not specified	Psychologists
van der Spek 2017 (17)	Cancer in the past 5 years	Diagnosed with cancer in the past 5 years; not undergoing treatment for 16 and 19 months, respectively (median)	Depression (HADS): IG: 5.1 (3.5); CG1: 4.5 (3.3); CG2: 4.4 (3.3); Symptoms of anxiety (HADS): IG: 7.2 (3.9); CG1: 7.9 (3.8); CG2: 7.4 (2.8)	Psychotherapists
Ye 2016 (e5)	Breast cancer	Patients with breast cancer stages 0–2, not more than 4 weeks after completion of treatment	Depression (HADS): IG: 9.54 (2.64); CG: 9.12 (2.29); Symptoms of anxiety (HADS): 7.42 (3.09); CG: 7.67 (3.51)	Experts, mentors, nurses
Ye 2017 (34)	Metastatic breast cancer	Metastatic breast cancer, no CNS metastases, >60% with life expectancy less than 24 months	Depression (HADS): IG: 10.32 (2.96); CG: 9.96 (3.01); Symptoms of anxiety (HADS): IG: 8.09 (2.78); CG: 7.94 (2.85)	Psychologists, dieticians, nurses, social workers, long-term cancer survivors (among others)
Yun 2017 (e6)	Breast, gastric, large bowel, or lung cancer	Completed cancer treatment in the past 18–24 months (>80% stage 2 or less)	Depression (HADS): IG: 6.4 (3.5); CG: 6.1 (3.1); Symptoms of anxiety (HADS): IG: 5.7 (3.4); CG: 5.9 (3.1)	Long-term cancer survivors after training by psychotherapists
Zernicke 2014 (e7)	Cancer	Completed cancer treatment in the past 3 years (>60% stage 2 or less)	Mental health (POMS) (POMS): IG: 39.57 (3.67); CG: 40.72 (3.55)	Psychologists with experience in mindfulness
Zhang 2017 (e8)	Breast cancer	Patients with breast cancer stages 1–3; 2–6 months after surgery	Symptoms of anxiety (STAI): IG: 45.79 (5.49); CG: 44.23 (4.80)	Psychologists with experience in mindfulness

BSI-18, Brief Symptom Inventory 18; CBT, cognitive behavioral therapy; CG, control group; GIT, gastrointestinal tract; HADS, Hospital Anxiety and Depression Scale; IG, intervention group; POMS, Profile of Mood States; SAS, Smith Anxiety Scale; SF12v2, 12-item medical outcomes study short form health survey version 2.0; STAI, State–Trait Anxiety Inventory

eTABLE 3

Overview of the studies with qualitative analysis

Studies	Participants	Intervention
1. Study 2. Outcome instrument	1. Treatment period 2. Exclusion of mental disorders 3. Number of patients (randomized) 4. Number of patients (last FU)	1. Delivery format 2. Theoretical foundation 3. Intervention duration 4. Control group
1. Carlson 2016 (e9) 2. PTGI	1. CP 2. Partly 3. IG1 113/ IG2 104/ CG 54 4. IG1 51/ IG2 55/ CG 35	1. F2F; group 2. Mindfulness and SEG 3. IG1 8×@ 90 min 1×/week; IG2 12×@ 90 min, 1×/week 4. AC
1. Caruso 2015 (e10) 2. PTGI	1. CPF 2. Partly 3. IG 27/ CG 23 4. IG 18/ CG 19	1. F2F; individual 2. Theory of attachment, existential analysis (among others) 3. 12×@ 45–50 min, 1×/2 weeks 4. TAU
1. Hawkes 2014 (e11) 2. PTGI	1. AP 2. All 3. IG 205/ CG 205 4. IG 159/ CG 163	1. F2F; group 2. CBT, mindfulness 3. 11×, 1×/2 weeks 4. TAU
1. Kovács 2012 (e12) 2. PTGI	1. AP 2. All 3. IG 86/ CG 87 4. IG 34/ CG 51	1. F2F; group 2. Positive psychology 3. 14×@ 300 min, 1×/week, 5-day retreat 4. TAU
1. Lee 2010 (e13) 2. PTGI	1. CPF 2. All 3. IG 86/ CG 86 4. IG 66/ CG 55	1. F2F; group 2. CBT and psychosocial interventions (among others) 3. 5×@ 180 min, 1×/week 4. TAU
1. Victorson 2017 (e14) 2. PTGI	1. CP 2. All 3. IG 24/ CG 19 4. IG 17/ CG 14	1. F2F; group 2. Mindfulness 3. 8×@ 150 min, 1×/week 4. TAU
1. Yun 2013 (e15) 2. PTGI	1. CP 2. All 3. IG 34/ CG 36 4. IG 34/ CG 36	1. F2F; group 2. Transtheoretical model 3. 8× 4. Waiting list

AC, Attention control; ACP, acute and chronic patients; AP, acute patients; CBT, cognitive behavioral therapy; CG, control group; CP, chronic patients; CPF, chronic patients with advanced disease; individual, individual setting; F2F, face to face; FU, follow-up; group, group setting; IG, intervention group; PTGI, Posttraumatic Growth Inventory; SEG, supportive-expressive group therapy; TAU, treatment as usual

eTABLE 4

Supplementary overview of studies with qualitative analysis 1

Studies	Gender	Age	Exclusion of mental disorders
Carlson 2016 (e9)	Female	Average age in years (SD): 54.7 (9.7) IG1; 53.6 (10.1) IG2; 56.3 (10.9) CG	Previous mental illness (e. g., schizophrenia, bipolar disorder, substance abuse or suicidality); inclusion of patients with depression, anxiety disorder, or adjustment disorder
Caruso 2015 (e10)	76% (38/50) female	Average age in years (SD): 60 (11.8)	Currently in psychotherapeutic treatment
Hawkes 2014 (e11)	46.1% (189/410) female	Average age in years (SD): 64.9 (10.8) IG; 67.8 (9.2) CG	Mental illnesses that interfere with study participation
Kovács 2012 (e12)	Female	Average age in years (SD): 53.17 (7.66) IG; 52.09 (9.15) CG	All mental illnesses
Lee 2010 (e13)	33.7% (56/166) female	Average age in years (SD): 58.9 (10.5) IG; 60.5 (10.8) CG	All mental illnesses
Victorson 2017 (e14)	Male	Average age in years (SD): 69.4 (7.1) IG; 71.2 (6.5) CG	No exclusion
Yun 2013 (e15)	78.6% (55/70) female	IG < 55 years 14 (41.2%), ≥ 55 years 20 (58.8%); CG < 55 years 14 (38.9%), ≥ 55 years 22 (61.1%)	Previous mental illness (e. g., schizophrenia, bipolar disorder, depression, anxiety or eating disorder)

CG, Control group; IG, intervention group; SD, standard deviation

eTABLE 5

Supplementary overview of studies with qualitative analysis 2

Studies	Cancer type	Description of cancer	Comorbidities at baseline	Profession of intervention staff
Carlson 2016 (e9)	Breast cancer	Completion of all treatments except hormone therapy; diagnosis 25.8 months previously	Mental health (POMS): IG: 39.57 (3.67); CG: 40.72 (3.55)	Not specified
Caruso 2015 (e10)	Advanced disease	Advanced cancer	Depression (PHQ-9): IG: 13.33 (5.34); CG: not specified Symptoms of anxiety (GAD-7): IG: 8.83 (5.68); CG: not specified	Specially trained study staff
Hawkes 2014 (e11)	Colorectal cancer	Completed colorectal cancer treatment	Mental health (BSI-18): IG: 48.8 (9.0); CG: 47.8 (8.2)	Nurses, psychologists, or health-care scientists with at least 5 years' professional experience
Kovács 2012 (e12)	Breast cancer	Breast cancer, currently undergoing treatment	Depression (BDI short version): IG: 12.34 (3.56); CG: 12.37 (3.88); Symptoms of anxiety (STAI-T): IG: 44.50 (9.04); CG: 43.23 (10.53)	Oncologists, psychologists, psychiatrists, dieticians, yoga teachers (among others)
Lee 2010 (e13)	Colorectal cancer	Diagnosed about 2 years previously; 60% in advanced stage; life expectancy at least 3 months	Depression (CECS): IG: 17.64 (4.78); CG: 16.85 (4.54); Symptoms of anxiety (CECS): IG: 18.95 (4.26); CG: 17.62 (3.94)	Not specified
Victorson 2017 (e14)	Prostate cancer	Prostate cancer under active surveillance	Not measured	Psychologists with experience in mindfulness
Yun 2013 (e15)	Disease more than 5 years ago	Treatment completed 5 years previously	Depression (HADS): IG: 3.0, CG: 2.9; Symptoms of anxiety (HADS): IG: 2.6, CG: 2.5; Post-traumatic stress symptoms (IES-R): IG: 44.2, CG: 43.7; Mental health (subscale of SF-36): IG: 81.4, CG: 83.9	Not specified

BDI, Beck Depression Inventory; BSI-18, Brief Symptom Inventory 18; CECS, Courtauld Emotional Control Scale; CG, control group; GAD-7, Generalized Anxiety Disorder 7; HADS, The Hospital Anxiety and Depression Scale; IES-R, Impact of Event Scale-Revised; IG, intervention group; PHQ-9, Patient Health Questionnaire 9 items; POMS, Profile of Mood States; SF-36, 36-Item Short Form Survey; STAI-T, State Trait Anxiety Inventory