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Coping strategies to prevent or reduce stress and burnout among oncology physicians: a systematic review

Estratégias de enfrentamento para prevenir ou reduzir o estresse e o *burnout* entre médicos oncologistas: uma revisão sistemática

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ABSTRACT

The purpose of this systematic review (SR) was to identify interventions that are effective to prevent or reduce stress and burnout among oncologists. Search was conducted in eight electronic databases and grey literature databases, with no language or time restrictions. Included studies involved medical oncologists and contained interventions to prevent or deal with stress or burnout with outcomes assessment. In two selection phases process, 19 out of 3,020 studies were included. Risk of bias was low for nine studies, moderate for six studies and high for four ones. Certainty of evidence was considered low and very low for the analyzed outcomes. Interventions varied a lot and those which had a significant effect in stress and burnout reduction among oncologists were experience sharing between female doctors in virtual groups, integrative meetings outside the work environment, and team sessions supervised by counselors. Although interventions had variable effects on reducing or preventing burnout and stress, mores studies are needed due to outcomes low evidence.

Keywords: Oncologists; Burnout, Professional; Stress, Psychological; Systematic review; Evaluation of the efficacy-effectiveness of interventions.

RESUMO

O objetivo desta revisão sistemática (RS) foi identificar intervenções eficazes para prevenir ou reduzir o estresse e o burnout entre oncologistas. A busca foi realizada em oito bases de dados eletrônicas e bases de dados de literatura cinzenta, sem restrições de idioma ou tempo. Os estudos incluídos envolveram médicos oncologistas e continham intervenções para prevenir ou lidar com o estresse ou *burnout* com avaliação de resultados. Em duas fases de seleção, 19 dos 3.020 estudos foram incluídos. O risco de viés foi baixo para nove estudos, moderado para seis estudos e alto para quatro. A certeza da evidência foi considerada baixa e muito baixa para os desfechos analisados. As intervenções variaram muito e as que tiveram efeito significativo na redução do estresse e do *burnout* entre os oncologistas foram o compartilhamento de experiências entre médicas em grupos virtuais, reuniões integrativas fora do ambiente de trabalho e sessões de equipe supervisionadas por conselheiros. Embora as intervenções tenham efeitos variáveis na redução ou prevenção de *burnout* e estresse, mais estudos são necessários devido à baixa evidência dos resultados.

Descritores: Oncologistas; Burnout, Profissional; Estresse Psicológico; Revisão sistemática; Avaliação da eficácia-efetividade das intervenções.

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INTRODUCTION

Oncology may be viewed as an extraordinary rewarding specialty.[1] However, its practice poses many challenges, such as overload from continuous evolution of therapeutic possibilities, increasing bureaucratization and workload due to the increasing incidence of cancer in the population. In addition, oncologists face uncertainties about patients' responses to treatment and have intense involvement with critically ill and/or end-of-life patients, having to handle their own and others' emotions.[1-3] As a consequence, they are generally under stress and may have burnout.

Burnout is a work-related psychological syndrome characterized by emotional exhaustion, depersonalization and reduced personal accomplishment. It may occur in persons who work with other people when occupational pressures persist over time. Burnout syndrome was first described in the 1970s and has been extensively studied by Dr. Maslach et al. (1986),[4] who developed the Maslach burnout inventory (MBI), a diagnostic method still used in current studies.[4-6] Its personal and professional consequences include increased incidence of illnesses, car accidents, divorces, obesity, alcoholism, depression, drug use, higher rates of absenteeism, early retirements, difficulty in recruiting and maintaining professionals, decrease in the quality of services and patient satisfaction, increase in medical errors and increase in medical errors and in the number of sues and processes against the doctor.[4]

Data provided by oncologists' professional associations are alarming. Study conducted by the American Society of Clinical Oncology (ASCO) detected that 45% of oncologists had already experienced burnout symptoms.[7] And, a study in 41 European countries by the European Society of Medical Oncology (ESMO) found the percentage of 71% of burnout among oncologists aged up to 40 years.[2]

A prevalence of 58% was found among oncologist who worked in a Brazilian hospital.[8] The awareness of having burnout syndrome is difficult because many of its signs and symptoms are interpreted as personal failures. When professionals feel unable to manage their conflicts, they may delay looking for help and being diagnosed and treated for burnout.[9,10]

In 2016, a meta-analysis assessed the effectiveness of various interventions to prevent and reduce physicians' burnout.[9,11] Several approaches proved to be effective, but authors called attention to the need of further studies to establish the best strategies for different realities within the medical profession.[12] We have therefore conducted this systematic review (SR) to answer the following question: "What interventions are effective to prevent or reduce oncologists' signs and symptoms of stress and burnout when compared to oncologists without these interventions?".

METHODS

Protocol and registration

A systematic review protocol was elaborated based on the preferred reporting items for systematic reviews and meta-analyses protocols (PRISMA-P),[13] and registered at the prospective register of systematic reviews (PROSPERO),[14] available under registration number CRD42019141517. We followed the preferred reporting items for systematic reviews and meta-analyses checklist (PRISMA)[15] and synthesis without meta-analysis (SWiM) reporting items[16] for reporting this SR.

Eligibility criteria and search strategy

Based on the acronym PICOS, the participants were oncologist physicians, the interventions included those to prevent and reduce stress and burnout; the comparison (control) were with oncologists who had not undergone these interventions; outcomes included quality of life, and signs and symptoms of stress and burnout; and, the study types included randomized and quasi-randomized clinical trials.

Initially, with assistance of experienced librarians, a search strategy was developed to identify studies that contemplated interventions to deal with stress and burnout among oncologists. The strategy included keywords such as "burnout", "stress", "oncologists", "interventions" and its synonyms. The full search is detailed in Appendix 1.

The search was applied in the following databases: CINAHL, Cochrane Library, EMBASE, LILACS, PsycINFO, PubMed, Scopus and Web of Science. In addition, the grey literature was searched on Google Scholar, ProQuest Dissertation and Theses and Open Grey. The reference list of the articles found was carried out manually, and the main authors of the subject were contacted, asking for possibly non included articles to complement the search. Filters for languages and restrictions on the date of publication were not used.

According to pre-elaborated criteria, studies were included if they involved oncologists, either clinical oncologists, radio-oncologists, oncology surgeons, pediatric oncologists or onco-hematologists; and, contained specific data on interventions to prevent or deal with stress or burnout.

Studies were excluded if they: 1) involved only non-medical oncologist professionals or medical students; 2) did not involve interventions to prevent or handle with stress and burnout; 3) had duplicated data from another included study or insufficient data; 4) were conducted in animals; 5) were reviews, letters, books, case report, case series, opinion article, technique articles and guidelines; 6) did not have their complete text available online/published and if the texts were not accessible after three contact attempts in a 15-day period by electronic mail to corresponding authors.

Study selection

Articles found in the databases were organized in the EndNote X9 program. Two reviewers (A.S. and C.W.) selected the articles independently in two phases. In phase-1, the two reviewers read the titles and abstracts applying the eligibility criteria using an online software (Rayyan, Qatar Computing Research Institute). In phase-2, the same reviewers read the full-text, also applying the eligibility criteria. In case of disagreement, in both phases, doubts were resolved by consensus and, if incompatibility remained, a third reviewer (J.M.D.O.) was called.

Data collection process and data items

The first and second reviewers (A.C.S. and C.W.) collected the main information from the selected studies independently. After that, the collected information was cross-checked, and its accuracy confirmed in a consensus meeting. In case of disagreement, conflict was resolved with a final decision by the third reviewer (J.M.D.O).

Criteria for data extraction were determined prior to the review, using a table that included: author, year, participants, country, type of study, primary and secondary objectives, type of intervention, results and outcomes, participants' acceptability, satisfaction of the intervention and intervention effectiveness If data were not found in the article, three contact attempts were tried in a 15-day period by electronic mail to corresponding authors to obtain relevant unpublished information.

Risk of bias in included studies

The risk of bias (RoB) of included studies was evaluated using the Joanna Briggs Institute (JBI) critical appraisal checklist for quasi-experimental,[17] the JBI critical appraisal checklist for analytical cross-sectional studies[18] for descriptive studies, Cochrane risk of bias tool RoB 2.0 for randomized trials and Cochrane risk of bias tool RoB 2.0 for cluster-randomized trials.[19] Judgement was made by two independent reviewers (A.C.S. and C.W.) and decisions about scoring were agreed by both reviewers before critical appraisal assessments. The RoB was characterized by the reviewers as high when the study reached up to 49% of bias, moderate when the study reached 50% to 69%, and low when the study reached more than 70%. All RoB figures and plots were created using robvis.[20]

Summary measures

Stress levels and burnout symptoms were considered as the main outcome and the analysis was not restricted by any method for measuring or diagnosing them.

No restrictions were made on how these outcomes were measured or whether they were obtained by psychologists or by self-assessment. The extracted data were synthesized in a descriptive manner. Studies including any type of intervention and any number of doctors were accepted.

Synthesis of results

Heterogeneity within studies was evaluated either by the inconsistency index (I^2) statistical test or by their clinical, methodological and statistical characteristics.[21]

Meta-analysis was considered inappropriate due to the included studies heterogeneity in clinical and methodological characteristics. The synthesis of results was also descriptive.

Confidence in cumulative evidence

A summary of the overall confidence in cumulative evidence available by outcomes analyzed was presented using "grading of recommendations assessment, development and evaluation" (GRADE). Summary of Findings (SoF) table was produced using the GRADE online software.[22]

RESULTS

Study selection

In phase-1, 3,020 citations were identified from electronic databases. After removing duplicated records, a total of 2,067 titles and abstracts were evaluated with the eligibility criteria. Following phase-1, 197 articles entered phase-2. After full-text reading, 19 articles fulfilled the eligibility criteria and were included for qualitative analysis (see on Appendix 2 the exclusions and their reasons). Quantitative analysis was not possible considering heterogeneity. A detailed flowchart of this process is shown in Figure 1.

Study characteristics

The 19 included studies were conducted in thirteen countries. One in Australia,[23,24] Austria,[23] Belgium,[25] Canada,[26,27] Costa Rica,[28] Germany,[23,29] Israel,[30,31] Italy,[32-34] the Netherlands,[35] New Zealand,[23] Switzerland,[23] United Kingdom,[36,37] and five in the United States.[31,38-41]

All included studies evaluated samples with at least one group of medical oncology doctors (fellows, residents, or specialist physicians) and the total of 1,513 individuals were analyzed. They included oncology care providers as specialist physicians (oncology, onco-hematology, pediatric, palliative care),[23-26,28,29,31,33,38] oncology residents,[27,30,40] oncology and onco-hematology fellows,[24,24,28,29,31,34,36-39,41] nurses,[28,31-35] radiotherapy assistants,[24,35] psychologists, and social workers.[31]

A summary of the descriptive characteristics of the various studies can be found in Tables 1 and 2.

In regard to the study design, nine were quasi-randomized studies,[26-28,30,33,34,37,40,41] one was cross-sectional,[38] and nine were RCT (two cluster-randomized trials[35,39] and seven individually-randomized parallel-group trial).[23-25,29,31,32,36]

The interventions to prevent and/or reduce stress levels and burnout included mostly classrooms[27,31,32,35,36] (in four studies totalizing 15 hours each), workshops[23,24,28] (in three studies for approximately 14 hours) and group sessions[25,29,30,33,34,37,41] (in six studies totalizing 16 hours each).

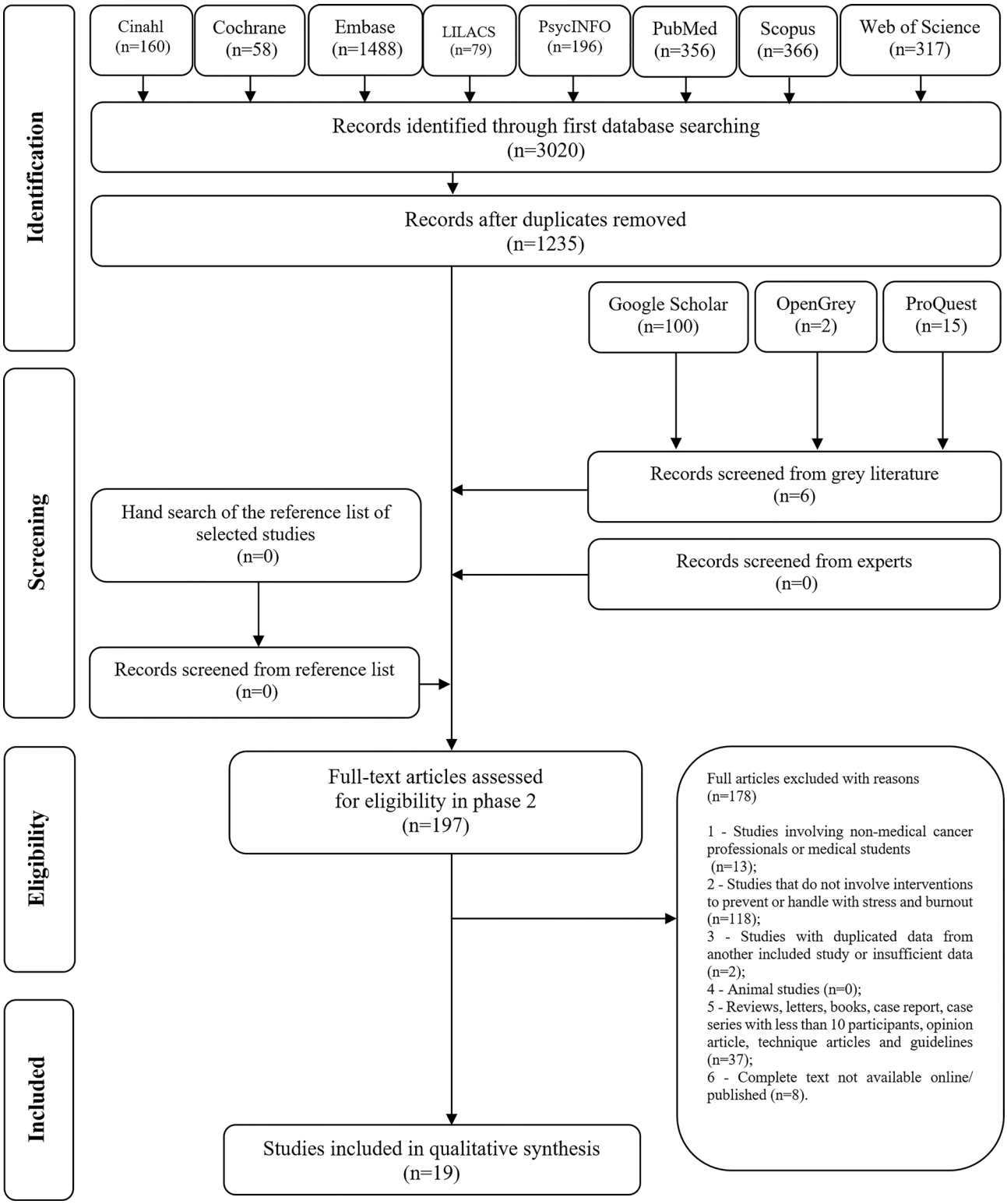

Figure 1. Flow diagram of literature search and selection criteria. (Adapted from PRISMA - Moher et al. (2010):[15] preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement).

Table 1. Summary of population characteristics of included articles (n=19).

Author, Year (Country)	Study design	Participants / Context / Setting	Groups (n/%)	Outcomes measured	Measures
Bar-Sela, Lulav-Grinwald and Mitnik, 2012[30] (Israel)	Before -after	15 Oncology residents[1] Division of Oncology, Rambam Health Care Campus, and Faculty of Medicine, Technion-Israel Institute of Technology	IG Junior: 1º part of residency (<3y) (8/53.3*); Senior: 2º part of residency (>3y) (7/46.7*)	Burnout measures (Emocional Exaustion and Despersonalization), Communication skills and self-awareness	MBI and expectations questionnaire that was completed at the beginning and at the end of the year
Barzelloni et al, 2014[32] (Italy)	RCT	34 Physicians and nurses Departments of Medical Oncology the Policlinico Tor Vergata University hospital and John of Procida Salerno	IG (12/35.3*) CG (22/64.7*)	Burnout and Health at T0 and quarterly (T1, T2, T3, T4).	General Health Questionnaire (GHQ) and MBI -
Bragard et al, 2010[25] (Belgium)	RCT	62 Cancer physicians specialists All Belgian specialists working in cancer care were invited	IG (29/46.8*) CG group (33/53.2*)	Burnout, communication skills, contextual variables	MBI; Standardized Breaking Bad News Simulated Interview for assessment of communication skills; Socioprofessional questionnaire and the Job Stress Survey (JSS)
Brown et al, 2014[23] (Australian/ New Zealand/ Swiss/ German/ Austrian)	RCT	62 Oncologists 21 from 10 Australian/ New Zealand (ANZ) centers and 41 from 10 Swiss/ German/ Austrian (SGA) centers	IG: 1-day workshop group (NR) cg (NR)	Communication behavior, stress and satisfaction	NR
Bui et al, 2021[33] (Italy)	Before -after	28 participants among medical doctors, nurses, socio-sanitary assistant, biologists, support, and administrative staff Oncology Department Oncology Units (Recovery Ward and Day Hospital)	Medical doctors (7/23.5%) Nurses (8/29.4%)	Burnout effective, lifestyle and work factors	MBI; B-C Working Fit and Socio demographic questionnaire
Butow et al, 2008[24] (Australia)	RCT	30 medical and radiation oncologists from six tertiary care hospitals in six Australian cities	IG (16/53.3*) CG (14/46.7*)	Doctor behaviors	MBI and Demographic, previous training and current practice assessed at baseline
Clemons et al, 2019[26] (Canada)	Before -after	13 Medical and surgical oncologists and a palliative care physician a group of oncologists from Canada	1 group (13/100*)	Physician, burnout happiness and compliance with the virtues	Abbreviated MBI and Oxford Happiness Questionnaire
Dahn et al, 2019[27] (Canada)	Before -after (pilot study)	9 participants – 8 residents and 1 staff Centre for Radiation Oncology residents. Dalhousie University, Halifax, NS	Resident group (8/88.9%*) Staff group (1/11.1%*)	Burnout, Resiliency, welness	

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Author, Year (Country)	Study design	Participants / Context / Setting	Groups (n/%)	Outcomes measured	Measures
Graff et al, 2018[38] (United States)	Cross Sectional	169 Female oncologist/ hematologist (H/O), pediatric, radiation oncology, surgical specialties, and palliative care from a Facebook closed group	1 group (169/100*)	Burnout, Career satisfaction	12-question online survey using a visual analog scale
Italia et al, 2007[34] (Italy)	Before -after	65 Doctors (50.77%*) and nurses of oncology unit in two hospital units of Catania	Group A –16 doctors and 16 nurses of an adult oncology unit (32/49.2*) Group B –17 doctors and 16 nurses of a pediatric oncology unit (33/50.8*)	Burnout	MBI
Kesselheim et al, 2020[39] (United States)	Cluster RCT	19 pediatric hematology-oncology fellowship programs during the 2016-2017 academic year – 100 fellows from All PHO fellowship training programs in the United States	59 intervention and 41 usual training fellows	Pediatric Hematology-Oncology Self-Assessment in Humanism (PHOSAH)	Pediatric Hematology-Oncology Self-Assessment in Humanism (PHOSAH), MBI, Patient-Provider Orientation Scale (PPOS), Empowerment at Work Scale, and a 5-point satisfaction scale
Landaverde et al, 2018[28] (Costa Rica)	Before -after	Medical oncologists (155 members including hematologists, medical oncologists, pharmacists, laboratory personnel, nurses and secretaries) from medical oncology team at Mexico Hospital, San Jose Costa Rica	NR	Burn out	MBI
Le Blanc et al, 2007[35] (the Netherlands)	Cluster RCT	664 care providers (physicians, nurses, and radiotherapy assistants) working in direct care for oncology patients.of 29 oncology wards from the Netherlands	IG (260/39.2%) CG (404; 60.8%)	Burnout and Association of burnout and the level of social support, job control, and participation in decision making	MBI and other questionnaires about work situation and well-being
Mache et al, 2017[29] (Germany)	RCT	80 German-speaking employed junior physicians working in clinic departments of oncology and hematology medicine hospital departments in Germany	IG (39/48.75*) CG (CG) (41/51.25*)	Perceived stress Work-related health Psychosocial skills self-perceived training outcome and training design	Perceived Stress Questionnaire (PSQ), Copenhagen Psychosocial Questionnaire, MBI-emotional exhaustion (EE), and Emotion Regulation Skills Questionnaire–27
Medisauskaite and Kamau, 2019[36] (United Kingdom)	RCT	91 doctors - 54.9% (50) work in hospitals and 72.5% (66) work >41 h a week (6% oncologists) randomly selected NHS trusts, 9 royal colleges of medicine, and the British Medical Association (BMA)	Trial group 4 – Modules 1-4 / IG (39/*) Trial group 5 – Doctors not assigned to any module / CG (52/*)	Burnout, anxiety, insomnia, grief, alcohol/ drug use, binge eating, physical symptoms, and psychiatric morbidity	MBI, General Anxiety Disorder-7, the 12 items General Health Questionnaire, Texas Revised Inventory of Grief, Patient Health Questionnaire, Alcohol Use Disorder Identification Scale (AUDIT), Commonly Abused Drugs Charts, Insomnia Severity Index, 5 items from the Binge Eating Scale from the Eating Disorder Diagnostic Scale and the Physical Symptom Inventory

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Author, Year (Country)	Study design	Participants / Context / Setting	Groups (n/%)	Outcomes measured	Measures
Moody et al, 2013[31] (United States and Israel)	RCT	47 (21% of oncologist physician and 53% of oncologist nurses) From the Children's Hospital of Montefiore in New York City and the Schneider Children's Hospital in Petach Tivka,Israel	IG (23/48.94*) CG (24/ 51.06*)	Burnout, Depression and perceived stress	MBI, Beck Depression Inventory and Perceived Stress Scale-14
Pathak, Eapen and Zell, 2019[40] (United States)	Before-after	NR number Oncology trainees from Hematology and Oncology Division of an academic Comprehensive Cancer Care center	The Henrietta Lacks Firm The Jane Wright Firm The Padmini Iyer Firm The Rita Mehta Firm NR numbers	Burnout	MBI
Sekeres et al, 2003[41] (United States)	Non-randomized clinical trial	28 first-year hematology-oncology fellows (14 each academic year of 2000-2001 and 2001-2002) From Dana-Farber Cancer Institute/ Brigham and Women's Hospital (DFCI/BWH) and Massachusetts General Hospital (MGH)	Fellows that started at Dana-Farber Cancer Institute/Brigham and Women's Hospital (DFCI/ BWH) – CG and IG (14/50*) (7 each academic year of 2000-2001 and 2001-2002) Fellows that started at Massachusetts General Hospital (MGH) CG and IG(14/50*) (7 each academic year of 2000-2001 and 2001-2002)	Fellows' Fellows' perceptions on: how they related to patients and colleagues "attitudes" questionnaire - attitudes during the course of the first fellowship year	32-item attitudes questionnaire6, scored 1 to 5, at three time points during their first year (within the first week of the start of fellowship; during the sixth month of fellowship, just before the switch-over; and during the final month of the first year of fellowship)
Tjasink and Soosaipillai, 2018[37] (England)	Before- after	16 doctors[7] (4 participants were from medical oncology, 4 from palliative care, 3 from clinical oncology and 3 from haematology) within a large teaching hospital in Central London	Single group	Burnout	MBI

Abreviattions: CI=confidence interval; d=days; CG=Control Group; IG=Intervention Group; h=hour; min=minutes; mo=month; MBI=Maslach Burnout Inventory; EE=Emotional exhaustion; RPA=Reduced personal accomplishment; Dp=Depersonalization; NR=Not reported; RCT=randomized-controlled trial; SD=Standard Deviation; U=Unclear; w=weeks; y=years; (*) data calculated by the authors.

[1] Of the 17 residents that were participating, 2 decided not to continue after 2 meetings and therefore were excluded.

[2] 13 physicians completed the baseline scores, 11 completed Maslach/Oxford scores at the end of the study, and 8 the 1-month post-study assessment

[3] Dropouts: at T2 the number of participants had dropped from 664 (experimental group: 260; control group: 404) to 376 (experimental group: 231; control group: 145), and at T3 it had dropped to 304 (experimental group: 208; control group: 96).

[4] The study involved 227 doctors however the analysis considered in the present SR were Group 4 and control (91 doctors).

[5] Additional information by emailing official authors.

[6] The questionnaire derived from the Physician's Belief Scale; the American Academy on Physician and Patient evaluation; common objectives of Balint-like groups across the United States; barriers to physician recognition of psychosocial aspects of health care reports; and from surveys of previous hematology-oncology fellows to explore attitudes toward patients, colleagues, and psychosocial issues

[7] In total 18 candidates were recruited but four were excluded from our analysis as: two candidates withdrew prior to the first session, and two candidates did not complete the post-intervention MBI-HSS survey.

Table 2. Summary of descriptive characteristics of included articles (n=19).

Author, Year (Country)	Intervention	Final Diagnosis / After intervention Results before and after intervention	Conclusions	Limitations
Bar-Sela, Lulav-Grinwald and Mitnik, 2012[30] (Israel)	Balint-type case discussion groups 1.5 h monthly (9 sessions/y)	Before intervention/Baseline MBI parameter score: - EE: Junior: 3.66 / Senior: 3.14 - RPA: Junior: 1.33 / Senior: 1.34- Dp Junior: 2.6 / Senior: 0.98 After Follow-up 1y MBI parameter score: - EE: Junior: 3.67 / Senior: 3.48 -RPA: Junior: 1.96 / Senior: 1.48 - Dp: Junior: 2.13 / Senior: 1.4	No significant difference was found in regard to Burnout. However, Balint group may improve tresidents' communication abilities and contribute to their self-accomplishment as doctors.	- Small sample size; - Limited number of group sessions
Barzelloni et al, 2014[32] (Italy)	1 day of classroom training and discussion meetings on a monthly basis for a year T0 (previous) T4 after a year	MBI - Emociona Exaustion: statistically significant reduction ($p \leq 0.04$) T0 versus T4 in the EG. - No statistical differences in the other MBI test two dimensions GHQ IG T0 vs. T4, $p \leq 0.00$), IG vs CG at the end of surgery (T4 $p \leq 0.01$).	There was clinical significant implications	NR
Bragard et al, 2010[25] (Belgium)	19h BT (two 8h day sessions and one 3h evening session - 2h plenary session focusing on theoretical information in the form of two lectures and 17h of small-group role-playing sessions) CW (six sessions of 3h spread over a 3-month period)	Before intervention/Baseline MBI mean (SD): - EE: BT: 21 (7) vs BT with CW: 18 (8) - RPA: BT: 39 (5) vs BT with CW: 39 (6) - Dp: BT: 7 (4) vs BT with CW: 6 (5) After intervention – after 6 monts MBI mean (SD): - EE: BT: 22 (8) vs BT with CW: 18(10) - RPA: BT: 39 (3) vs BT with CW: 39 (4) - Dp: BT: 8 (5) vs BT with CW: 7 (6)	No difference found in Burnout scores. The authors consider that the amount of clinical workload and the overuse of some facilitative communication skills were associated with cancer physicians' burnout.	- Use of role play with direct feedback focusing mainly on the acquisition of communication skills oriented towards patient; voluntary participation (and thus highly motivated physicians); Small sample size
Brown et al, 2014[23] (Australian/ New Zealand/ Swiss/German/ Austrian)	1 day 7h interactive face-to-face workshop (2h of written and oral materials, 30 min of video modeling ideal behavior, 4h of role-play practice, and 30 min of individualized feedback on audio-taped consultations with actual patients)	Only AFTER 1 month of intervention CG versus IG ANZ: - IG: significant increase in collaborative communication after training ; - CG: decline in use of collaborative behaviors during the study period. No effect of training on other doctor communication behaviors. Trained doctors did not demonstrate increased confidence in their information provision or reduced stress and burnout	The intervention was not sufficient to reduce stress and burnout	NR

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Author, Year (Country)	Intervention	Final Diagnosis / After intervention Results before and after intervention	Conclusions	Limitations
Bui et al, 2021[33] (Italy)	8-months intervention involved fortnight meetings by facilitators, incorporated elements of reflection, shared experiences and managing emotions; 3-hour meetings occurring once every two weeks with an expert team in building, communication strategies and emotional management; Topics addressed were organized into 4 modules: 1 Specific training focused on personal work experience and relationship between colleagues in each department 2 Individual counselling 3 Emotion management (residential course) 4 Self-Help Groups activation	MBI percentage of participants with each levels (2 weeks before the intervention): - EE: Low: 29.4% High: 17.6% - RPA: NR - DP: NR MBI percentage of participants with each levels(6mo) After the intervention: - EE: Low: 52.9%: High: 5.9% - RPA: no difference from T0 - DP: no difference from T0	The intervention was not able to change Burnout,, but there was dramatic reduction in high degree of EE (Emocional Exaustion), mainly in Day Hospital	- Limited sample size - No control group
Butow et al, 2008[24] (Australia)	CST: 1.5-day intensive face-to-face workshop incorporating presentation of principles, a DVD modelling ideal behavior and role-play practice, followed by four 1.5h video-conferences at monthly intervals incorporating role-play of doctor-generated scenarios	Baseline MBI's median: - EE IG: 18.0 versus CG: 16.0 - RPA IG: 40.0 versus CG: 40.0 - Dp IG: 8.0 versus CG: 2.5 MBI's median: - EE IG: 18.0 versus CG: 13.5 - RPA IG: 39.0 versus CG: 38.5 - Dp IG: 6.0 versus CG: 3.0	The intervention did not succeed in reducing levels of stress and burnout	Small sample size of doctors and of institutions making it i impossible to stratify; -skill levels were high at Baseline; over-representation of female doctors in the sample;

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Author, Year (Country)	Intervention	Final Diagnosis / After intervention Results before and after intervention	Conclusions	Limitations
Clemons et al, 2019[26] (Canada)	Modified Franklin's 13 virtues (the next virtue was added to the previously listed virtues and scores were requested daily) - Each day during the 13-week program, oncologists were emailed a list of virtues to focus on and scored how they felt they were complying with them (5-point Likert scale was used instead of a simple yes/no to increase potential variability in responses)	Baseline MBI score: - EE: 7 - RPA: 16 - Dp: 4 Happiness Questionnaire: 4.2 17w (13w of follow-up and 1mo following study completion After interventio MBI score: - EE: 13w: 7 +1mo: 4.5 - RPA: 13w: 16 +1mo: 15.5 - Dp: 13w: 3 +1mo: 2 Happiness Questionnaire: 13w: 4.7 +1mo: 4.7	There was no improvement of happiness nor burnout reduction. Scores which significantly changed in self-rated virtue over time were order temperance, and resolution	- Small sample size; Includedprofessionals involved in different aspects of cancer care; - Used a 200-year-old program and the "translation" of Franklin's original text, could lead to improvements in happiness and reduced burnout in physicians caring for cancer patients
Dahn et al, 2019[27] (Canada)	2-hour resident seminar with discussions, mentorship and teaching communication and stress management skills focused on fostering resiliency and wellness in oncology residents by a local Radiation Oncologist, covered topics such as mindfulness, healthy habits and reframing stress with an interactive focus on experiential learning and group discussion;	Resident group: - Burnout rate: NR - Average Connor-Davidson Resiliency score: NR Overall rating of the initial resident seminar: 8.3/10 - usefulness: 7.0-8.9/10 Overall rating of the resident and staff session: 8.4/10 - individual activities rated from 8.3-8.8/10 Follow up 3 mo After Resident group: - Burnout rate: 50% - Average Connor-Davidson Resiliency score: 68	The intervention was highly valued by residents and faculty, suggesting the importance of resilience education in the Radiation Oncology residency curriculum	NR
Graff et al, 2018[38] (United States)	Online virtual Facebook (FB) community for female physicians practicing in hematology/oncology, founded in 2015, dynamic evolved to include advice on complex deidentified cases, real-time updates from H/O conferences, designated discussions on the art of oncology and career-life balance, virtual journal clubs, easy transfers of care for relocating patients, and improved access to clinical trials	No previous assessment and no follow-up Respondents also felt the community as compared with FB in general reduced their sense of professional burnout (FB mean: 5.5; SD, 2.63; 95% CI, 5.0 to 6.0; community mean, 7.8; SD, 1.86; 95% CI, 7.5 to 8.1)	Social media can be an effective venue to educate physicians, augment patient care via advice, foster networking, reduce burnout, and improve career satisfaction among female physicians in the field of H/O.	- Self-reported measures; a selection bias may have been introduced, with members of Hematology/Oncology Women Physician Group (HOWPG) with better experiences completing; Control arm (regular FB use); Use of a visual analog scale rather than an independently validated tool for assessment of burnout and/or career satisfaction

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Author, Year (Country)	Intervention	Final Diagnosis / After intervention Results before and after intervention	Conclusions	Limitations
Italia et al, 2007[34] (Italy)	13 weekly meetings organized by psychologist and psychologist–art therapist: 5 used psychodrama techniques to promote communicative exchanges; 4 'play-therapy' and stimulate a sense of comfort by non-verbal communication based on play; 3 to Ericksonian relaxation techniques; and 1 to observed and discussed a video with techniques to support children during painful procedures)	Baseline MBI mean±SD: - EE: Group A: NR Group B: 15.85±6.37 - RPA: Group A: NR Group B: 60.35±11.07 - Dp: Group A: NR Group B: 3.80±4.20 After 4mo MBI mean±SD: - EE: Group A: NR Group B: 11.70±3.63 - RPA: Group A: NR Group B: 67.40±9.10 - Dp: Group A: NR Group B: 2.25±2.63	Techniques using AT such as psychodrama and relaxation were effective for the operators who were most at risk of burnout	- Intervention was composed of different techniques
Kesselheim et al, 2020[39] (United States)	A novel, 4-module, case-based curriculum entitled "Humanism and Professionalism for Pediatric Hematology-Oncology Fellows", which aims to foster pediatric hematology-oncology fellows' reflection on the feelings, challenges, and conflicts arising in the care of children and families affected by cancer or blood disorders	Baseilne PHOSAH - intervention: 8.2 (3.3); usual training: 7.4 (4.2) MBI mean (SD): - EE: intervention:2.3 (1.0); usual training: 2.4 (1.2) - RPA: intervention 4.8 (0.7); usual training: 4.7 (0.8) - Dp: intervention 1.1 (0.9) - usual training: -1.2 (0.9) PPOS - intervention: 4.4(0.3) - usual training: 4.4 (0.4) Empowerment at Work Scale - intervention: 4.9 (0.6) - usual training: 4.5 (0.8) Follow up 1y After PHOSAH: - intervention: 9.0 (3.9); - usual training: 8.0 (4.0) MBI mean (SD): - EE: intervention: 2.2 (1.0); usual training: 2.2 (1.2) - RPA: intervention 4.9 (0.7); usual training = 4.8 (0.8) - Dp: intervention = 1.1 (0.8); usual training = : 1.2 (0.9) PPOS: - intervention: 4.3 (0.4); - usual training: 4.4 (0.4) Empowerment at Work Scale: - intervention: 5.0 (0.7); - usual training: 4.7 (0.6)	Exposure to the curriculum did not alter fellows' self-assessed humanism and professionalism skills. However, fellows expressed significantly higher levels of satisfaction in their humanism training, indicating the curriculum potential for positive impact on their perceived learning environment	The study: did not explicitly collect information about feasibility; and, is vulnerable to selection bias, as program directors who chose to have their programs participate may already prioritize humanism training in their fellowships; - Data on the routine strategies for teaching humanism that were utilized by usual training sites were collected retrospectively and could be vulnerable to recall bias

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Author, Year (Country)	Intervention	Final Diagnosis / After intervention Results before and after intervention	Conclusions	Limitations
Landaverde et al, 2018[28] (Costa Rica)	Anti-stress program to medical oncologists consisting of oncologists' 1d-meeting outside outside the workplace every 3mo, in which there are integrative activities, teamwork, and workshops of stress management	Follow up 2y Reduction of burnout risk from intermediate in 60% of the oncologists to 10%,.None of the oncologists had developed burnout syndrome	The intervention was effective	NR
Le Blanc et al, 2007[35] (the Netherlands)	Team-based burnout intervention called "Take Care!" program with a training plan of 6mo sessions of 3h each, which were supervised by both team counselors	MBI mean±SD: - EE: IG: 1.54±0.89 vs CG: 1.46±0.80 - RPA: NR - Dp: IG: 0.96±0.70 vs CG: 0.86±0.58 Follow pu 6 m0 After MBI mean±SD: - EE: IG: 1.53 0.92 vs CG: 1.65±1.00 - RPA: NR - Dp: IG: 0.98±0.65 vs CG: 0.93±0.62	The relatively brief, team-based intervention program, not only influenced the stress component of burnout (EE) but also was a motivational component (Dp).	- High attrition rate over time; - No objective (i.e., non–self-report) outcome measures were included; Interaction of the EG (training) and CG
Mache et al, 2017[29] (Germany)	Intervention based on Lazarus transactional model of stress, including 2 strategies of coping with stressors: problem- and emotion-oriented coping ; psychosocial competency training focus on current working situations and problems of junior oncologists, coping strategies, resilience, and self-efficacy training as well as developing a support system among colleagues (12w sessions of 1.5h. All training sessions involved theoretical input, watching videos, oral group discussions, experiential exercises, and home assignments) combined with cognitive behavioral and solution-focused counselling	Baseine Perceived stress (mean±SD): - IG: 3.25±0.69 - CG: 3.20±0.66 MBI-EE (mean±SD): - IG: 4.09±0.59 - CG: 4.19±0.60 Follow up 36 w after Perceived stress (mean±SD): - IG: 2.83±0.72 - CG: 3.29±0.64 MBI-EE (mean±SD): - IG: 3.71±0.68 - CG: 4.18±0.61 Preceived stress IG at T1 ($F = 29.21$, $P < .001$), T2 ($F = 24.7$, $P < .001$), and T3 ($F = 8.76$, $P < .01$) Decrease emotional exhaustion (MBI-EE) and some emotion regulation skills ($P < .01$) (d=0.3-0.7)	A significant effect indicated that lower scores for perceived stress after intervenção and there was decrease in emotional exhaustion and and some emotion regulation skills with small to medium effect sizes	- Small sample size; - Short follow-up ; self-report measures; - Potential positive bias within the study group (participating physicians were motivated to learn and practice new skills and coping techniques); - Potential outcome bias (simply spending time in a group of people facing similar working conditions may have played an important role in the outcomes)

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Author, Year (Country)	Intervention	Final Diagnosis / After intervention Results before and after intervention	Conclusions	Limitations
Medisauskaite and Kamau, 2019[36] (United Kingdom)	Intervention of 4 modules: - Module 1 taught doctors about stress - Module 2 taught doctors about burnout - Module 3 taught doctors about coping with patient death - Module 4 taught doctors about methods of managing distress.	Baseline Mean (SD) MBI: - EE: EG: 3.26±1.41 CG: 3.2±1.4 - RPA: EG: 4.42±0.83 CG: 4.41±0.82 - Dp: EG: 1.98±1.49 CG: 1.68±1.29 Anxiety: EG: 0.96±0.81 CG: 0.88±0.74 Psychiatric morbidity: EG: 2.14±0.57 CG: 2.17±0.61 Grief: EG: 1.6±0.6 CG: 1.74±0.66 Insomnia: EG: 1±0.84 CG: 1.18±0.84 Physical symptoms: EG: 1.75±0.51 CG: 1.84±0.56 Alcohol use habits: EG: 7.33±2.26 CG: 6.71±1.92 Binge-eating features: EG: 1.38±1.75 CG: 1.1±1.69 Drug use: EG: 0.71±0.87 CG: 0.78±0.78 Follow up 7 d mean±SD MBI: - EE: EG: 2.98±1.44 CG: 3.04±1.42 - RPA: EG: 4.38±0.91 CG: 4.27±0.85 - Dp: EG: 1.68±1.41 CG: 1.72±1.35 Anxiety:EG: 0.73±0.72 CG: 0.81±0.74 Psychiatric morbidity: EG: 2.16±0.57 CG: 2.21±0.64 Grief: EG: 1.51±0.57 CG: 1.64±0.62 Insomnia: EG: 1.02±0.96 CG: 1.11±0.87 Physical symptoms: EG: 1.69±0.61 CG: 1.85±0.65 Alcohol use habits: EG: 7.39±2.38 CG: 6.99±1.95 Binge-eating features: EG: 1.54±1.86 CG: 1.1±1.74 Drug use: EG: 0.53±0.69 CG:0.69±0.81	From baseline to time-2 there were significant reductions in burnout (EE), burnout (Dp) and anxiety among doctors who completed all modules about the psychology of distress.	- Short follow-up
Moody et al, 2013[31] (United States and Israel)	Mindfulness-based course (MBC) participants received 8 weeks of didactic and experiential mindfulness education via a structured, skills-training course delivered in a group setting at their hospital. The course included 1 initial 6-hour session; 6 weekly 1-hour follow-up sessions; and a final 3-hour wrap-up session (15 hours total class time).	Baseline MBI mean±SD: - EE: IG: 27.2 CG: 26.2 - RPA: IG: 16.0 CG: 15.4 - Dp: IG: 19.6 CG: 18.2 Follow up 8w After MBI mean±SD: - EE: IG: 26.9 CG: 24.2 - RPA: IG: 15.0 CG: 13.9 - Dp: IG: 19.3 CG: 18.7	Nearly 100% of participants met criteria for high levels of burnout in the categories of RPA and (Dp). in both the CG and EG at baseline and at the end of the study. In the category of EE, greater than 95% of participants in both groups, at both time points, showed moderate or high levels of burnout	- Small sample size; - Overrepresentation of women in the sample; - Lack of any intervention in the CG; lack of blinding

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Author, Year (Country)	Intervention	Final Diagnosis / After intervention Results before and after intervention	Conclusions	Limitations
Pathak, Eapen and Zell, 2019[40] (United States)	Adapted Firm System called the FitFirms, which focused on social connectivity and altruistic service as means to combat burnout in oncology trainees The faculty and fellows interacted on an at-minimum quarterly basis in casual social events and/or community service-oriented events A didactic discussion series was created to explore concepts of resiliency, work-life balance, and the role of art in medicine—mentored by faculty across the spectrum of oncologic disciplines	Before Nine pre-intervention surveys were collected with 78% of trainees describing themselves as on the burnout spectrum of feeling either ineffective, overextended, disengaged, or burned out (22% engaged) Follow up 15 mo 10 post-intervention surveys were collected in which 60% of trainees described themselves on the burnout spectrum (40% engaged)	The FitFirms are a novel system using social capital to reduce the problem of burnout in oncology trainees by engaging in social connectivity and altruistic service through faculty-mentored, historically-named divisional cohorts	NR
Sekeres et al, 2003[41] (United States)	Balint-like physician awareness group every 2 weeks for 1.5 to 2 hours for 6 months -	Base line Mean (range) - Full questionnaire summary score: 3.6 (3.5-3.7) - Stress in the work environment: 3.3 (3.2-3.5) - Comfort dealing with emotional patient/clinical situations: 3.5 (3.3-3.7) - Fellow's views of him/herself as a physician: 3.8 (3.7-3.9) - Discomfort with psychosocial issues: 3.7 (3.5-3.9 Follow up 1y after Mean (range) - Full questionnaire summary score: 3.7 (3.6-3.8) - Stress in the work environment: 3.4 (3.2-3.6) - Comfort dealing with emotional patient/clinical situations: 3.7 (3.6-3.9) - Fellow's views of him/herself as a physician: 4.1 (3.9-4.2) - Discomfort with psychosocial issues: 3.7 (3.5-3.9)	In conclusion, hematology-oncology fellows' attitudes change over the course of the first fellowship year. Positive attitudes and development as caring physicians can be enhanced through the institution of a physician awareness group. The impact and effectiveness of the EG can be measured, and successful groups should improve the ability of physicians to communicate with their patients, and thus patient satisfaction	- Small sample size; Important effects of the intervention or of the first oncology fellowship year may have been missed; Two-group comparison analyses were used instead of paired comparisons; Fellows in this program may not have been representative of Hematology-Oncology fellows across the United States; Attitudes questionnaire we used has not been validated previously, and individual topic domains varied in their reliability

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Author, Year (Country)	Intervention	Final Diagnosis / After intervention Results before and after intervention	Conclusions	Limitations
Tjasink and Soosaipillai, 2018[37] (England)	**Art Therapy:** mixture of different techniques such as mindfulness, relaxation, visualization, psychodrama and skills based supervision alongside art therapy; Six weeks of structured art therapy sessions lasting 90–120 minutes each, structured and divided into three broad themes: Self-awareness and self-care; Collegial connection and the organization; Reflecting on death, bereavement and finding meaning	Baseline MBI mean±SD: - EE: 30.79±8.31 - RPA: 35.38±6.51 - Dp: 7.93±5.05 Follow up 1 mo AfterMBI mean±SD: - EE: 23.5±7.61 - RPA: 38.31±5.31 - Dp: 6.79±4.68 improvements in EE (p=<0.001) and RPA (p=0.011)	MBI-HS pre- and post-intervention demonstrated statistically significant improvements in EE	- Small sample; more effective techniques learned through the first experience may have been used in the second and third groups; group was self-selecting; the authors feel that a reluctance for some to join the course; Data was not collected from those who chose not to respond to the opportunity

CI=confidence interval; d=days; CG=Control Group; EG=Experimental Group; h=hour; min=minutes; mo=month; MBI=Maslach Burnout Inventory; EE=Emotional exhaustion; RPA=Reduced personal accomplishment; Dp=Depersonalization; NR=Not reported; RCT=randomized-controlled trial; SD=Standard Deviation; U=Unclear; w=weeks; y=years; (*) data calculated by the authors.

[1] Of the 17 residents that were participating, 2 decided not to continue after 2 meetings and therefore were excluded.

[2] 13 physicians completed the baseline scores, 11 completed Maslach/Oxford scores at the end of the study, and 8 the 1-month post-study assessment

[3] Dropouts: at T2 the number of participants had dropped from 664 (experimental group: 260; control group: 404) to 376 (experimental group: 231; control group: 145), and at T3 it had dropped to 304 (experimental group: 208; control group: 96).

[4] The study involved 227 doctors however the analysis considered in the present SR were Group 4 and control (91 doctors).

[5] Additional information by emailing official authors.

[6] The questionnaire derived from the Physician's Belief Scale; the American Academy on Physician and Patient evaluation; common objectives of Balint-like groups across the United States; barriers to physician recognition of psychosocial aspects of health care reports; and from surveys of previous hematology-oncology fellows to explore attitudes toward patients, colleagues, and psychosocial issues

[7] In total 18 candidates were recruited but four were excluded from our analysis as: two candidates withdrew prior to the first session, and two candidates did not complete the post-intervention MBI-HSS survey.

Two studies used art therapy,[34,37] one study used a virtue list,[26] one used an online virtual community of women oncologists on Facebook, in which,[38] and another used a novel case-based curriculum.[39]

The Maslach burnout inventory (MBI) was used to measure changes before and after the intervention in fifteen studies.[24,33,37,39,40] Other questionnaires were used in some studies to analyze the interventions' effect on stress and burnout levels,[23,29,31,32,35,36,38] but only three of them also used MBI.[29,32,36] In two studies non-validated questionnaires were used to examine the participants' behavior and satisfaction after the intervention.[38,41]

Results of individual studies

The follow-up periods ranged from 7 days[36] to 2 years,[28] with eight studies with follow-ups longer than 1 year[24,28-30,33,39,40] and ten shorter than 6 months.[23,25-27,31,34-37,41] One cross-sectional study did not have follow-up, and evaluated participants' outcomes only after the intervention.[38]

Art-therapy was evaluated in two studies, both with before and after design.[34,37] Italia et al. (2008)[34] organized weekly meetings that included psychodrama, games, relaxation techniques and videos. Tjasink and Soosaipillai (2018)[37] applied relaxation techniques, visualization, mindfulness meditation, psychodrama and skill-based supervision with art therapy. Through these techniques, authors addressed three broad themes: self-awareness and self-care; collegial connection and the organization; reflecting on death, bereavement and finding meaning alongside art therapy.[37]

A cross-sectional study published by Graff et al. (2018)[38] impact of a closed community on Facebook in reducing professional burnout in women oncologists. In this group, they had the opportunity to discuss complex clinical cases, promote updates to clinical practice and magazine clubs, relocate transferred patients and disseminate research protocols. In addition, they were able to share ideas on the balance between life and work, and on the art of oncology.

Kesselheim et al. (2020)[39] developed a curriculum with the objective to promote reflections on the feelings, challenges, and conflicts that arise in the care of children and families affected by cancer or blood disorders by pediatric hematology-oncology fellows.

Other approaches that worked to reduce physician stress and burnout were based on small groups, and their curriculum included the following strategies: a training program supervised by counselors,[27,33,35] coping with problems based on the Lazarus,[29] and educational approach on stress, burnout and methods to combat them.[36] Landaverde et al. (2018)[28] developed an anti-stress program that consisted of taking oncologists for a day out of the workplace for integration activities, teamwork and workshops to deal with stress, and Pathak et al. (2019)[40] used an adapted system to combat burnout in oncology trainees by focusing on social connectivity and altruistic service with a later didactic discussion.

Three studies included in this systematic review attempted to combat the burnout of the oncologist by promoting communication skills between doctors and patients.[23-25] These studies, however, have failed to demonstrate effectiveness.

Two studies evaluated Balint groups' impact on reducing burnout in residents and oncology fellows.[30,41] Intervention promoted the improvement of communication skills and contributed to the doctors' sense of self-realization, but it was not effective in preventing or reducing burnout.

In a randomized clinical trial conducted by Moody et al. (2013),[31] despite mindfulness caused positive changes in the participants, both at work and at home, it did not reduce their burnout.

Interventions which had a significant effect in the reduction of stress and burnout were experience sharing between women doctors in virtual groups,[38] art therapy,[34,37] team monthly meetings outside the work environment,[28] training sessions supervised by counselors,[35] sessions with strategies for coping with stressors focused on both the problem and the solution,[29] and teaching doctors about stressors, burnout, how to deal with death and with stress.[36]

Interventions that did not reduce were simulated communication skills training,[23-25] Balint groups,[30,41] Franklin's new virtue model,[26] mindfulness,[31] adapted systems,[40] and the created humanism and professionalism curriculum.[39]

Risk of bias within and across studies

Nine of the 19 studies included fulfilled all the applicable questions regarding the methodological quality criteria, being classified with low-risk of bias: three RCT,[35,36,39] the cross-sectional study,[38] and five quasi-randomized studies.[26,30,34,37,40] Six articles had a moderate RoB[24,25,29,31,33,41] and four were classified as a high RoB[23,27,28,32] score according to the specific checklist.

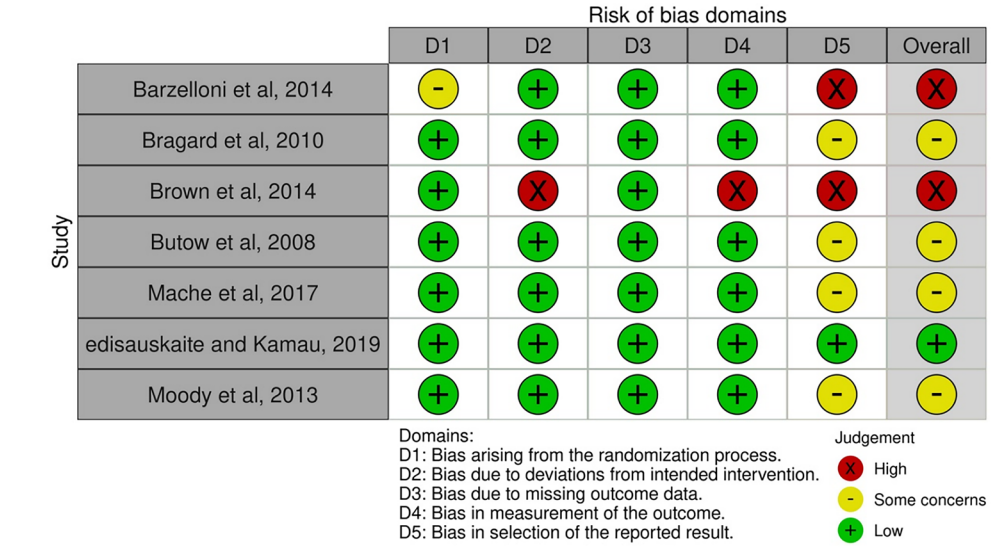
The main topics that introduced potential bias into the studies were the selection of the reported results and the existence of other interventions on the compared groups. Figures 2A-2D and Appendix 3 present the RoB graphs and detailed information regarding the RoB assessment, respectively.

Synthesis of results

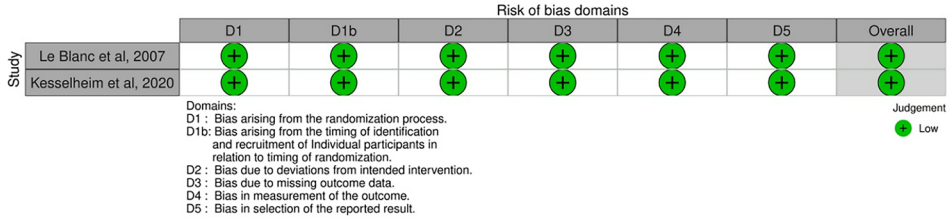
All studies were based on interventions focused on the participants individually, or in group, and any intervention made a structural change within the work environment.[28] There has been no study that made a structural change within the work environment.

Confidence in cumulative evidence

Certainty in cumulative evidence was considered low and very low for randomized and observational studies, respectively. Further explanations regarding evidence appraisal are presented in Table 3.



(A)



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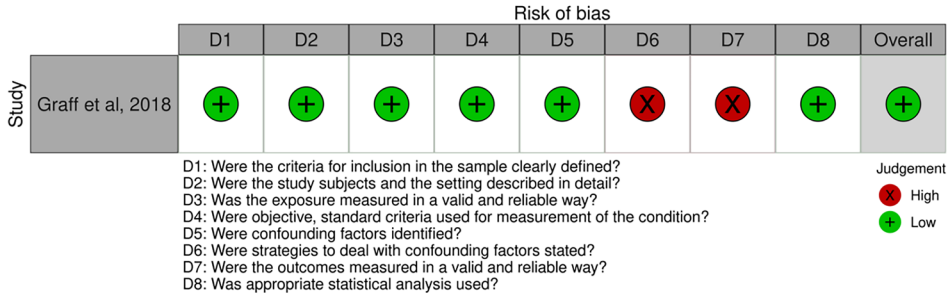

(D)

Figure 2. RoB summary author's judgments for each included study, assessed by the Cochrane risk of bias tool RoB 2.0 for randomized trials[19] (A), the Cochrane risk of bias tool RoB 2.0 for cluster-randomized trials[19] (B), the JBI Critical Appraisal Checklist for Quasi-experimental for non-randomized experimental studies[17] (C), and the JBI Critical Appraisal Checklist for Analytical Cross Sectional Studies[18] for descriptive studies (D). Author's judgements were graphically represented by "Traffic-light" plot (generated using the online tool *robvis* (Risk-Of-Bias VISualization) (National Institute for Health Research).[20]

Table 3. The Grading of Recommendation Assessment, Development and Evaluation (GRADE) summary of findings table.

Certainty assessment							Certainty
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	
Impact on Burnout symptoms (follow up: range 7 days to 1 years)							
6	randomised trials	serious [a]	serious [b]	not serious	not serious	none	⊕⊕◯◯ LOW
Impact on Burnout symptoms (follow up: range 1 months to 2 years)							
9	observational studies	very serious [c]	very serious [b]	not serious	not serious	none	⊕◯◯◯ VERY LOW
Impact on Burnout symptoms							
1	observational studies	not serious	not serious	not serious	serious [d]	none	⊕◯◯◯ VERY LOW
Prevention on Burnout							
1	randomised trials	very serious [e]	not serious	not serious	not serious	none	⊕⊕◯◯ LOW
Stress level (follow up: range 1 months to 9 months)							
3	randomised trials	very serious [f]	very serious [b]	serious [g]	not serious	none	⊕◯◯◯ VERY LOW

CI: Confidence interval
Explanations:
a. Some included studies presented problems on domains 1 (randomization process), 4 (measurement of the outcome) and 5 (selection of the reported results). Overall risk of bias was considered Moderate.
b. Studies have methodological differences - Measurement method to burnout detection, coping strategy and / or follow-up period.
c. Included studies showed concerns in domain related to control group and it comparision treatment/care.
d. Intervention group with small size.
e. The study present concerns in the randomization process.
f. The studies showed some concerns in the domain related to selection of the reported results.
g. Stress is one of the predictor factors to burnout, however isolated is not conclusive.

DISCUSSION

The objective of this systematic review was to identify interventions which are effective to prevent or reduce the signs and symptoms of stress and burnout on oncology physicians compared to oncology physicians who did not participate in the interventions.

Our findings showed that eight studies had interventions which were effective.

Two of these studies[34,37] were their interventions based on art therapy. This type of intervention has been used in oncology and palliative care environments with the aim of helping to overcome grief, boost morale and reduce the burnout of the multidisciplinary team.[42] As both studies used several techniques,[34,37] despite the good results, there are doubts about which strategy or strategies in the interventions were the real agents of change.

Another intervention which reduced burnout was a virtual community of practices to sharing experiences among women oncologists' doctors.[38] This was an innovative work, without any previous reference in literature. However, the study was cross-sectional and evaluated the community members (female physician practicing hematology and oncology) through a voluntary anonymous 12-question online survey using a visual analog scale, that is not the gold standard way of measuring burnout before and after any intervention. Thus, the results found in this study may be led to a more subjective effect of stress than burnout itself.

Other interventions that reduced stress and burnout were based on small groups and were conducted at a time protected (paid) by the employer. It's important because both doctors and employers share the responsibility to promote the doctor's well-being.[12]

On the other hand, eleven studies had interventions which had no effect on stress and burnout.

Three of them used interventions to promote communication skills between doctors and patients.[23-25] Ineffective communication, in addition to negatively influencing the patient's well-being, interferes with the multidisciplinary team, which can cause increased stress and burnout, as well as less satisfaction with work.[43] These studies, however, have failed to demonstrate effectiveness.[23-25] Data are in line with literature. A systematic review published in the Cochrane Library and updated for the third time in 2018 shows that training communication skills are not effective in reducing the burnout of professionals working with cancer.[43]

Two of them had Balint groups[30,41] and showed no effect on stress and burnout. Balint groups were created in the 1950s by the psychoanalyst Michael Balint[44] and aims at improving physician-patient relationship, by reflecting on the patterns of action of the patient and reaction of the physician (transference and counter-transference). Results must be interpreted with caution, due to the small number of participants in the studies and to the limited number of sessions. However, they are in agreement with the findings of other studies.[30,41]

A systematic review published in 2017[45] with the aim of reviewing and evaluating evidence on psychosocial interventions to reduce occupational stress and burnout among physicians in general showed that none of the studies that used Balint groups reported significant effects.

Studies containing attempts to promote reflections on the feelings[39] and focusing on social connectivity and altruistic service[40] also failed in reducing burnout among oncologists.

Furthermore, one randomized clinical trial with the effects of mindfulness could not identify its effect on stress and burnout.[31] However, it caused positive changes in the participants, both at work and at home. Mindfulness has appeared in recent studies as a potential treatment for work-related burnout.[46,47] Defined as an awareness obtained when paying close attention to the moment, on purpose and without judgement, it originates from Buddhist values and can be learned.[46] Most programs currently offered are based on a program developed in the 1970s called mindfulness-based stress reduction (MBSR).[46] Some studies explore the relationship between mindfulness and burnout in healthcare professionals and suggest benefits, but with no significant impact on reducing burnout.[47]

Some of the interventions of the studies included in our systematic review, such as mindfulness and Balint groups, require a period of participations, learning or practice,[48] and perhaps the studies that evaluated these interventions did not have time enough to demonstrate effectiveness.

In regard to the interventions' predominant focus on individuals, similar findings have been found in other reviews.[12]

West et al. (2016)[12] evaluated the effectiveness of interventions in doctors with burnout in a systematic review and meta-analysis involving 15 randomized studies and 37 observational studies. Only three of these were institutional structural studies.

Petrie et al. (2019),[48] in a meta-analysis of interventions that could reduce the symptoms of mental disorders and suicidal ideation among doctors was not able to include any controlled study at the organizational level. This was considered quite worrying for the authors, since an institutional study has the advantage of identifying risk factors present in the work environment, the potential to be more acceptable to the participants and to have greater preventive power.[48]

Despite some important findings in the studies included in this systematic review,[23-41] many limitations are present. Among them the small sample size, the limited number of sessions, the voluntary recruitment, the interaction between control and intervention groups and only one institution included in the study.

In addition, most studies had evidenced the low quality and the follow-up periods were quite different. Also, the studies had methodological differences, both in terms of design and in the population, in which not only oncologists were included. In some studies, measures were also differently obtained, through distinctive self-assessment questionnaires.[23-26,28]

Even with failures, all studies that have evaluated possible ways to reduce stress and burnout among oncologist physician are still valid, since the prevalence of burnout varies from 23% to 48% around the world.[36] Any way of trying to mitigate such public health problem must be recognized and encouraged.

Individual approaches are useful, but in order to improve physicians' conditions to get involved and really care for people, the healthcare organization must work to control or eliminate known causes of wear and tear and enhance their defense and support systems.[49] Medical societies, hospitals, governments have a great responsibility to improve working conditions, but they commonly have difficulties in allocating resources to bring about effective changes.[1]

It cannot be said with certainty that the interventions which did not presented impact on burnout in the included studies do not actually work. Likewise, data are also insufficient to show exactly the most effective interventions. Therefore, additional studies with interventions to prevent or decrease stress and burnout are still needed, including not only individual but also organizational and work environment changes.

CONCLUSION

In this systematic review, interventions which have effect in the reduction of stress and burnout were virtual oncologists' women community of practices to share experiences, art therapy, team monthly meetings outside the work environment, training sessions supervised by counselors, the teaching of stress coping strategies, and about stressors, burnout, and ways to identify and handle them. Interventions that did not reduce were communication skills training included Balint groups, Franklin's new virtue model, mindfulness, adapted systems, and the created humanism and professionalism curriculum for pediatric hematology-oncology.

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APPENDIX

Appendix 1. Database search strategy

Database	Search (on July 22nd, 2021)
CINAHL	("Burnout" OR "Burn out" OR "burned out" OR ((stress* OR distress*) AND (work* OR "job"))) AND (Oncologist* OR "medical oncology" OR "oncology physician" OR "oncology physicians") AND ("psychological adaptation" OR "psychological adaptations" OR "Coping" OR "Behavior" OR resilienc* OR "happiness" OR "well being" OR "wellness" OR therapeutic* OR treatment* OR therap* OR "quality of life" OR "Life satisfaction" OR intervention*)
COCHRANE	("Burnout" OR "Burn out" OR "burned out" OR ((stress* OR distress*) AND (work* OR "job"))) AND (Oncologist* OR "medical oncology" OR "oncology physician" OR "oncology physicians") AND ("psychological adaptation" OR "psychological adaptations" OR "Coping" OR "Behavior" OR resilienc* OR "happiness" OR "well being" OR "wellness" OR therapeutic* OR treatment* OR therap* OR "quality of life" OR "Life satisfaction" OR intervention*)
EMBASE	EMBASE ("Burnout" OR "Burn out" OR "burned out" OR ((stress* OR distress*) AND (work* OR "job"))) AND (Oncologist* OR "medical oncology" OR "oncology physician" OR "oncology physicians") AND ("psychological adaptation" OR "psychological adaptations" OR "Coping" OR "Behavior" OR resilienc* OR "happiness" OR "well being" OR "wellness" OR therapeutic* OR treatment* OR therap* OR "quality of life" OR "Life satisfaction" OR intervention*)
LILACS	(tw:("Burnout" OR "Burn out" OR "burned out" OR ((stress* OR distress* OR estres*) AND (work* OR "job" OR trabalho OR trabajo)))) AND (tw:(oncologist* OR "medical oncology" OR "oncology physician" OR "oncology physicians" OR oncolog* OR cancerolog* OR radioterapeuta*)) AND (tw:("psychological adaptation" OR "Psychological Adaptations" OR "psychological adaptations" OR "Coping" OR "Behavior" OR resilienc* OR "happiness" OR "well being" OR "wellness" OR therapeutic* OR treatment* OR therap* OR "quality of life" OR "Life satisfaction" OR intervention* OR "adaptação" OR "comportamento adaptativo" OR "felicidade" OR "alegria" OR "equilibrio" OR "bem-estar" OR "terapia" OR "Terapeutica" OR tratamento* OR "qualidade de vida" OR prevenc* OR intervenc* OR "adaptacion" OR "felicita" OR "bienestar" OR tratamiento* OR "calidad de vida")) AND (instance:"regional") AND (db:("LILACS") AND type:("article"))
PSYCINFO	("Burnout" OR "Burn out" OR "burned out" OR ((stress* OR distress*) AND (work* OR "job"))) AND (Oncologist* OR "medical oncology" OR "oncology physician" OR "oncology physicians") AND ("psychological adaptation" OR "psychological adaptations" OR "Coping" OR "Behavior" OR resilienc* OR "happiness" OR "well being" OR "wellness" OR therapeutic* OR treatment* OR therap* OR "quality of life" OR "Life satisfaction" OR intervention*)
PUBMED	("Burnout, Professional"[Mesh] OR "Burnout, Psychological"[Mesh] OR "Burn out" OR "Burnout"[Title/Abstract] OR "burned out" OR (("Stress, Physiological"[Mesh:NoExp] OR Stress* OR distress*) AND (work* OR "job"))) AND ("Oncologists"[Mesh] OR "Oncologists"[Title/Abstract] OR "Oncologist"[Title/Abstract] OR "Oncologists"[Title/Abstract] OR "medical oncology"[Title/Abstract] OR "oncology physician"[Title/Abstract] OR "oncology physicians"[Title/Abstract])AND ("adaptation, psychological"[MeSH Terms] OR "psychological adaptation" OR "psychological adaptations" OR "Coping" OR "Behavior" OR "resilience" OR "Resiliences" OR "happiness"[MeSH Terms] OR "happiness" OR "well being" OR "wellness" OR "therapeutics"[MeSH Terms] OR "therapeutics" OR "therapeutic" OR "treatment" OR "treatments" OR "therapy" OR "therapies" OR "quality of life"[MeSH Terms] OR "quality of life" OR "Life satisfaction" OR "intervention" OR "interventions")
SCOPUS	TITLE-ABS-KEY(("Burnout" OR "Burn out" OR "burned out" OR ((stress* OR distress*) AND (work* OR "job"))) AND (Oncologist* OR "medical oncology" OR "oncology physician" OR "oncology physicians") AND ("psychological adaptation" OR "Psychological Adaptations" OR "Coping" OR "Behavior" OR resilienc* OR "happiness" OR "well being" OR "wellness" OR therapeutic* OR treatment* OR therap* OR "quality of life" OR "Life satisfaction" OR intervention*)) AND (LIMIT-TO (DOCTYPE,"ar"))
WEB OF SCIENCE	("Burnout" OR "Burn out" OR "burned out" OR ((stress* OR distress*) AND (work* OR "job"))) AND (Oncologist* OR "medical oncology" OR "oncology physician" OR "oncology physicians") AND ("psychological adaptation" OR "psychological adaptations" OR "Coping" OR "Behavior" OR resilienc* OR "happiness" OR "well being" OR "wellness" OR therapeutic* OR treatment* OR therap* OR "quality of life" OR "Life satisfaction" OR intervention*)
GOOGLE SCHOLAR	("Burnout" OR "Burn out" OR "burned out") AND (Oncologist) AND ("psychological adaptation" OR "Coping" OR "Behavior" OR resilienc* OR "happiness" OR "well being" OR "wellness" OR "quality of life" OR "Life satisfaction")

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Database	Search (on July 22nd, 2021)
OPENGREY	("Burnout" OR "Burn out" OR "burned out" OR ((stress* OR distress*) AND (work* OR "job"))) AND (Oncologist* OR "medical oncology" OR "oncology physician" OR "oncology physicians") AND ("psychological adaptation" OR "psychological adaptations" OR "Coping" OR "Behavior" OR resilienc* OR "happiness" OR "well being" OR "wellness" OR therapeutic* OR treatment* OR therap* OR "quality of life" OR "Life satisfaction" OR intervention*)
PROQUEST	noft(("Burnout" OR "Burn out" OR "burned out" OR ((stress* OR distress*) AND (work* OR "job"))) AND (Oncologist* OR "medical oncology" OR "oncology physician" OR "oncology physicians") AND ("psychological adaptation" OR "psychological adaptations" OR "Coping" OR "Behavior" OR resilienc* OR "happiness" OR "well being" OR "wellness" OR therapeutic* OR treatment* OR therap* OR "quality of life" OR "Life satisfaction" OR intervention*))

Appendix 2. Articles excluded and the reasons for exclusion (n=178)

Reference	Author	Reasons for Exclusion*
1.	Allegra et al, 2005	2
2.	Alorabi et al, 2015	2
3.	Ansmann et al, 2013	2
4.	Armstrong et al, 2004	5
5.	Asai et al, 2007	2
6.	Back et al, 2017	5
7.	Balbay, 2011	2
8.	Balch, 2010	2
9.	Balch, 2007	5
10.	Balch, 2009	5
11.	Balch et al, 2011	2
12.	Banerjee et al, 2017	2
13.	Barberio et al, 2015	2
14.	Beas et al, 2016	5
15.	Berman et al, 2007	2
16.	Bittner et al, 2011	1
17.	Blanchard et al, 2009	5
18.	Blanchard et al, 2010	2
19.	Borate, 2017	5
20.	Bragard et al, 2012	2
21.	Bragard et al, 2010	2
22.	Bressi et al, 2008	2
23.	Burki, 2018	5
24.	Camps et al, 2009	2
25.	Cano, 2016	2
26.	Caruso et al, 2012	2
27.	Carvalho et al, 2014	2
28.	Catt et al, 2005	2
29.	Chatwal et al, 2018	6
30.	Ciammella et al, 2011	2
31.	Cotton, 2018	5
32.	Creagan, 1993	5
33.	Crowe, 2016	5

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Reference	Author	Reasons for Exclusion*
34.	Cubero et al, 2013	2
35.	Cumbe et al, 2017	2
36.	Dahn et al, 2019	2
37.	Daruvala et al, 2019	2
38.	De Rezende et al, 2011	5
39.	Dix et al, 2012	5
40.	Dougherty et al, 2009	2
41.	Dubois et al, 2020	6
42.	Eelen et al, 2014	2
43.	Essaadi et al, 2013	2
44.	Fang et al, 2010	2
45.	Fiore et al, 2016	6
46.	Fitzgerald et al, 2012	2
47.	Flores et al, 2014	2
48.	Ftanou, 2017	5
49.	Fujimori et al, 2015	1
50.	Fusco et al, 2019	2
51.	Giansante et al, 2012	2
52.	Girgis et al, 2009	2
53.	Glasberg et al, 2007	2
54.	Granek et al, 2016 (A)	2
55.	Granek et al, 2017	2
56.	Granek et al, 2016 (B)	2
57.	Granek et al, 2015	2
58.	Granek et al, 2017	2
59.	Granek et al, 2016 (C)	2
60.	Granek et al, 2013	2
61.	Grant, 2018	6
62.	Grootenhuis et al, 1996	2
63.	Gross et al, 2014	2
64.	Grunfeld et al, 2000	2
65.	Guadagna et al, 2012	6
66.	Guest et al, 2011 (A)	2
67.	Guest et al, 2011 (B)	2
68.	Guveli et al, 2015	2
69.	Haley et al, 2004	2
70.	Hamilton, 2019	2
71.	Hegedus, 2012	1
72.	Henrik et al, 2021	2
73.	Hipp et al, 2015	2
74.	Hlubocky et al,	2
75.	Hlubocky et al, 2017	5
76.	Hlubocky et al,	2
77.	Holliday et al, 2017	2

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Reference	Author	Reasons for Exclusion*
78.	Hudson et al, 2018	2
79.	Hunter, 2019	6
80.	Huynh et al, 2019	2
81.	Isc-En et al, 2011	2
82.	Jackson et al, 2008	2
83.	Jasperse et al, 2012	2
84.	Jasperse et al, 2014	2
85.	Joaquim et al, 2018	2
86.	Jørgensen et al, 2009	2
87.	Joubert et al, 2013	1
88.	Jutagir et al, 2017	1
89.	Karnyski et al, 2017	5
90.	Kash et al, 2000	2
91.	Kattlove et al, 1992	5
92.	Kavalieratos et al, 2017	1
93.	Kaymak et al, 2010	2
94.	Kearney et al, 2009	5
95.	Kiguchi et al, 2018	5
96.	Kinderman and Gross, 2014	3
97.	Kleiner and Wallace, 2017	2
98.	Knight et al, 2014	2
99.	Koh et al, 2015	1
100.	Koo et al, 2013	2
101.	Koocher, 1980	5
102.	Korones, 2010	5
103.	Kracen, 2011	2
104.	Kuerer et al, 2007	2
105.	Laurent et al, 2015	2
106.	Leones et al, 2020	6
107.	Liakopoulou et al, 2008	2
108.	Lievrouw et al, 2016	2
109.	López-Castillo et al, 1999	2
110.	Lyckholm, 2001	5
111.	Lyckholm, 2007	5
112.	Mahendran et al, 2014	1
113.	Mampuya et al, 2016	2
114.	Mampuya et al, 2017	2
115.	Manochakian, 2014	5
116.	Martins et al, 2016	2
117.	McFarland et al, 2017	2
118.	McLean et al, 2011	2
119.	Mehlis et al, 2018	2
120.	Mougalian et al, 2013	2
121.	Mount, 1986	5

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Reference	Author	Reasons for Exclusion*
122.	Mukherjee et al, 2014	2
123.	Murali et al, 2019	5
124.	Muriel et al, 2009	1
125.	Na, 2019	5
126.	Nabhan, 2009	5
127.	Nissim et al, 2019	2
128.	Nowakowski et al, 2016	2
129.	O'Byrne et al, 1997	2
130.	Paiva et al, 2018	2
131.	Paula Vega et al, 2017	2
132.	Penson et al, 2000	5
133.	Penson et al, 2005	5
134.	Poulsen et al, 2018	2
135.	Poulsen et al, 2011	2
136.	Poulsen et al, 2012	2
137.	Pye et al, 2013	2
138.	Ramey et al, 2017	2
139.	Ramirez et al, 1995	2
140.	Raphael et al, 2019	2
141.	Rath et al, 2014	2
142.	Rath et al, 2015	2
143.	Ratti et al, 2019	2
144.	Rohan et al, 2009	2
145.	Romeo et al, 2016 (A)	2
146.	Romeo et al, 2016 (B)	2
147.	Rosenstein, 2019	2
148.	Roth et al, 2011	2
149.	Royce et al, 2019	5
150.	Russo et al, 2014	2
151.	Sargsyan et al, 2017	2
152.	Sarra and Feuz, 2019	2
153.	Schirmers, 2016	5
154.	Schraub et al, 2004	2
155.	Shanafelt et al, 2006	5
156.	Shanafelt, 2005	5
157.	Shanafelt et al, 2014	2
158.	Shanafelt et al, 2014 (A)	2
159.	Shanafelt et al, 2005	2
160.	Shanafelt et al, 2014 (B)	2
161.	Shanafelt et al, 2014 (C)	2
162.	Shayne et al, 2012	1
163.	Shereck et al, 2014	3
164.	Sheth et al, 2019	2
165.	Shimp, 2014	5

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166.	Shinan-Altman et al, 2018	1
167.	Sundquist, 2009	6
168.	Swetz et al, 2009	1
169.	Tamura et al, 2020	2
170.	Thompson et al, 2018	5
171.	Torres et al, 2013	2
172.	Tucunduva et al, 2006	2
173.	Turner et al,	2
174.	Vachon et al, 2016	1
175.	Vasylyeva et al, 2011	2
176.	Vetter et al, 2018	2
177.	Vici et al, 2021	2
178.	Wan, 2008	5

*Legend: 1) involved only non-medical cancer professionals or medical students; 2) did not involve interventions to prevent or handle with stress and burnout; 3) had duplicated data from another included study or insufficient data; 4) were conducted in animals; 5) were reviews, letters, books, case report, case series with less than 10 participants, opinion article, technique articles and guidelines; 6) did not have their complete text available online/published and if the texts were not accessible after three contact attempts in a 15-day period by electronic mail to corresponding authors.

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Appendix 3. Risk of bias assessed by Cochrane risk of bias tool and Joanna Briggs Institute (JBI) critical appraisal tools. Risk of bias was categorized as High when the study reaches up to 49% score "yes", Moderate when the study reached 50% to 69% score "yes", and Low when the study reached more than 70% score "yes".

Cochrane Risk of Bias tool for Randomized Trials (RoB 2.0)

Study	Bias	Signalling question	Coments	Authors' judgement
Barzelloni et al, 2014	Bias arising from the randomization process	1.1. Was the allocation sequence random?		**PY**
		1.2. Was the allocation sequence concealed until participants were recruited and assigned to interventions?	Study: Abstract - Few information	**NI**
		1.3. Were there baseline imbalances that suggest a problem with the randomization process?		**N**
		Domain-level judgement	**Some concerns**	
	Bias due to deviations from intended interventions (effect of assignment to intervention)	2.1. Were participants aware of their assigned intervention during the trial?	Intervention: 1 day of classroom training Control: No intervention	**Y**
		2.2. Were carers and trial personnel aware of participants' assigned intervention during the trial?		**Y**
		2.3. **If Y/PY/NI to 2.1 or 2.2:** Were there deviations from the intended intervention that arose because of the trial context?		**N**
		2.4. **If Y/PY to 2.3**: Were these deviations likely to have affected the outcome?		**NA**
		2.5. **If Y/PY/NI to 2.4**: Were these deviations from intended intervention balanced between groups?		**NA**
		2.6. Was an appropriate analysis used to estimate the effect of assignment to intervention?		**PY**
		2.7. **If N/PN/NI to 2.6**: Was there potential for a substantial impact (on the result) of the failure to analyse participants in the group to which they were randomized?		**NA**
		Domain-level judgement	**Low risk**	
	Bias due to missing outcome data	3.1. Were data for this outcome available for all, or nearly all, participants randomized?		**NI**
		3.2. **If N/PN/NI to 3.1**: Is there evidence that the result was not biased by missing outcome data?		**N**
		3.3. **If N/PN to 3.2**: Could missingness in the outcome depend on its true value?		**PN**
		3.4. **If Y/PY/NI to 3.3**: Is it likely that missingness in the outcome depended on its true value?		**PN**
		Domain-level judgement	**Low risk**	

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Study	Bias	Signalling question	Coments	Authors' judgement
Barzelloni et al, 2014	Bias in measurement of the outcome	4.1. Was the method of measuring the outcome inappropriate?		N
		4.2. Could measurement or ascertainment of the outcome have differed between intervention groups?		N
		4.3. If N/PN/NI to 4.1 and 4.2: Were outcome assessors aware of the intervention received by study participants?		NA
		4.4. If Y/PY/NI to 4.3: Could assessment of the outcome have been influenced by knowledge of intervention received?		NA
		4.5. If Y/PY/NI to 4.4: Is it likely that assessment of the outcome was influenced by knowledge of intervention received?		NA
		Domain-level judgement	Low risk	
	Bias in selection of the reported result	5.1. Were the data that produced this result analysed in accordance with a pre-specified analysis plan that was finalized before unblinded outcome data were available for analysis?	Study: Abstract - Few information	NI
		5.2. Is the numerical result being assessed likely to have been selected, on the basis of the results, from multiple eligible outcome measurements (e.g. scales, definitions, time points) within the outcome domain?	- Study: Abstract - Few information - Evaluations were performed at T0 and quarterly (T1, T2, T3, T4) butonlyresults comparing T0 and T4 were showed.	PY
		5.3. Is the numerical result being assessed likely to have been selected, on the basis of the results, from multiple eligible analyses of the data?		PY
		Domain-level judgement	High risk	
	Overall bias		High risk	
Bragard et al, 2010	Bias arising from the randomization process	1.1. Was the allocation sequence random?		PY
		1.2. Was the allocation sequence concealed until participants were recruited and assigned to interventions?		Y
		1.3. Were there baseline imbalances that suggest a problem with the randomization process?		N
		Domain-level judgement	Low risk	
	Bias due to deviations from intended interventions (effect of assignment to intervention)	2.1. Were participants aware of their assigned intervention during the trial?	Intervention: consolidation workshops Control: No intervention	Y
		2.2. Were carers and trial personnel aware of participants' assigned intervention during the trial?		Y
		2.3. **If Y/PY/NI to 2.1 or 2.2**: Were there deviations from the intended intervention that arose because of the trial context?		N
		2.4. **If Y/PY to 2.3**: Were these deviations likely to have affected the outcome?		NA
		2.5. **If Y/PY/NI to 2.4**: Were these deviations from intended intervention balanced between groups?		NA
		2.6. Was an appropriate analysis used to estimate the effect of assignment to intervention?		Y
		2.7. **If N/PN/NI to 2.6**: Was there potential for a substantial impact (on the result) of the failure to analyse participants in the group to which they were randomized?		NA
		Domain-level judgement	Low risk	

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Study	Bias	Signalling question	Coments	Authors' judgement
Bragard et al, 2010	Bias due to missing outcome data	3.1. Were data for this outcome available for all, or nearly all, participants randomized?		PY
		3.2. **If N/PN/NI to 3.1**: Is there evidence that the result was not biased by missing outcome data?		NA
		3.3. **If N/PN to 3.2**: Could missingness in the outcome depend on its true value?		NA
		3.4. **If Y/PY/NI to 3.3**: Is it likely that missingness in the outcome depended on its true value?		NA
		Domain-level judgement	Low risk	
	Bias in measurement of the outcome	4.1. Was the method of measuring the outcome inappropriate?		N
		4.2. Could measurement or ascertainment of the outcome have differed between intervention groups?		N
		4.3. If N/PN/NI to 4.1 and 4.2: Were outcome assessors aware of the intervention received by study participants?		NI
		4.4. If Y/PY/NI to 4.3: Could assessment of the outcome have been influenced by knowledge of intervention received?		N
		4.5. If Y/PY/NI to 4.4: Is it likely that assessment of the outcome was influenced by knowledge of intervention received?		N
		Domain-level judgement	Low risk	
	Bias in selection of the reported result	5.1. Were the data that produced this result analysed in accordance with a pre-specified analysis plan that was finalized before unblinded outcome data were available for analysis?		NI
		5.2. Is the numerical result being assessed likely to have been selected, on the basis of the results, from multiple eligible outcome measurements (e.g. scales, definitions, time points) within the outcome domain?		N
		5.3. Is the numerical result being assessed likely to have been selected, on the basis of the results, from multiple eligible analyses of the data?		N
		Domain-level judgement	Some concerns	
	Overall bias		Some concerns	
Brown et al, 2014	Bias arising from the randomization process	1.1. Was the allocation sequence random?	Study: Abstract – Few information	PY
		1.2. Was the allocation sequence concealed until participants were recruited and assigned to interventions?		NI
		1.3. Were there baseline imbalances that suggest a problem with the randomization process?		PN
		Domain-level judgement	Low risk	
	Bias due to deviations from intended interventions (effect of assignment to intervention)	2.1. Were participants aware of their assigned intervention during the trial?	Intervention: face-to-face workshop Control: No intervention	Y
		2.2. Were carers and trial personnel aware of participants' assigned intervention during the trial?		Y
		2.3. **If Y/PY/NI to 2.1 or 2.2**: Were there deviations from the intended intervention that arose because of the trial context?		N
		2.4. **If Y/PY to 2.3**: Were these deviations likely to have affected the outcome?		NA
		2.5. **If Y/PY/NI to 2.4**: Were these deviations from intended intervention balanced between groups?		NA
		2.6. Was an appropriate analysis used to estimate the effect of assignment to intervention?		NI
		2.7. **If N/PN/NI to 2.6**: Was there potential for a substantial impact (on the result) of the failure to analyse participants in the group to which they were randomized?		PY
		Domain-level judgement	High risk	

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Study	Bias	Signalling question	Coments	Authors' judgement
Brown et al, 2014	Bias due to missing outcome data	3.1. Were data for this outcome available for all, or nearly all, participants randomized?		NI
		3.2. **If N/PN/NI to 3.1**: Is there evidence that the result was not biased by missing outcome data?		N
		3.3. **If N/PN to 3.2**: Could missingness in the outcome depend on its true value?		PN
		3.4. **If Y/PY/NI to 3.3**: Is it likely that missingness in the outcome depended on its true value?		PN
		Domain-level judgement	Low risk	
	Bias in measurement of the outcome	4.1. Was the method of measuring the outcome inappropriate?		Y
		4.2. Could measurement or ascertainment of the outcome have differed between intervention groups?		Y
		4.3. **If N/PN/NI to 4.1 and 4.2**: Were outcome assessors aware of the intervention received by study participants?		NA
		4.4. **If Y/PY/NI to 4.3**: Could assessment of the outcome have been influenced by knowledge of intervention received?		NA
		4.5. **If Y/PY/NI to 4.4**: Is it likely that assessment of the outcome was influenced by knowledge of intervention received?		NA
		Domain-level judgement	High risk	
	Bias in selection of the reported result	5.1. Were the data that produced this result analysed in accordance with a pre-specified analysis plan that was finalized before unblinded outcome data were available for analysis?		NI
		5.2. Is the numerical result being assessed likely to have been selected, on the basis of the results, from multiple eligible outcome measurements (e.g. scales, definitions, time points) within the outcome domain?		Y
		5.3. Is the numerical result being assessed likely to have been selected, on the basis of the results, from multiple eligible analyses of the data?		Y
		Domain-level judgement	High risk	
	Overall bias		High risk	
Butow et al, 2008	Bias arising from the randomization process	1.1. Was the allocation sequence random?		Y
		1.2. Was the allocation sequence concealed until participants were recruited and assigned to interventions?		PY
		1.3. Were there baseline imbalances that suggest a problem with the randomization process?		N
		Domain-level judgement	Low risk	
	Bias due to deviations from intended interventions (effect of assignment to intervention)	2.1. Were participants aware of their assigned intervention during the trial?	Intervention: Communication skills training Control: No intervention	Y
		2.2. Were carers and trial personnel aware of participants' assigned intervention during the trial?		Y
		2.3. **If Y/PY/NI to 2.1 or 2.2**: Were there deviations from the intended intervention that arose because of the trial context?		N
		2.4. **If Y/PY to 2.3**: Were these deviations likely to have affected the outcome?		NA
		2.5. **If Y/PY/NI to 2.4**: Were these deviations from intended intervention balanced between groups?		NA
		2.6. Was an appropriate analysis used to estimate the effect of assignment to intervention?		Y
		2.7. **If N/PN/NI to 2.6**: Was there potential for a substantial impact (on the result) of the failure to analyse participants in the group to which they were randomized?		NA
		Domain-level judgement	Low risk	

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Study	Bias	Signalling question	Coments	Authors' judgement
Butow et al, 2008	Bias due to missing outcome data	3.1. Were data for this outcome available for all, or nearly all, participants randomized?		Y
		3.2. **If N/PN/NI to 3.1**: Is there evidence that the result was not biased by missing outcome data?		NA
		3.3. **If N/PN to 3.2**: Could missingness in the outcome depend on its true value?		NA
		3.4. **If Y/PY/NI to 3.3**: Is it likely that missingness in the outcome depended on its true value?		NA
		Domain-level judgement	Low risk	
	Bias in measurement of the outcome	4.1. Was the method of measuring the outcome inappropriate?		N
		4.2. Could measurement or ascertainment of the outcome have differed between intervention groups?		N
		4.3. **If N/PN/NI to 4.1 and 4.2**: Were outcome assessors aware of the intervention received by study participants?		Y
		4.4. **If Y/PY/NI to 4.3**: Could assessment of the outcome have been influenced by knowledge of intervention received?		N
		4.5. **If Y/PY/NI to 4.4**: Is it likely that assessment of the outcome was influenced by knowledge of intervention received?		NA
		Domain-level judgement	Low risk	
	Bias in selection of the reported result	5.1. Were the data that produced this result analysed in accordance with a pre-specified analysis plan that was finalized before unblinded outcome data were available for analysis?		NI
		5.2. Is the numerical result being assessed likely to have been selected, on the basis of the results, from multiple eligible outcome measurements (e.g. scales, definitions, time points) within the outcome domain?		N
		5.3. Is the numerical result being assessed likely to have been selected, on the basis of the results, from multiple eligible analyses of the data?		N
		Domain-level judgement	Some concerns	
	Overall bias		Some concerns	
Mache et al, 2017	Bias arising from the randomization process	1.1. Was the allocation sequence random?		Y
		1.2. Was the allocation sequence concealed until participants were recruited and assigned to interventions?		Y
		1.3. Were there baseline imbalances that suggest a problem with the randomization process?		N
		Domain-level judgement	Low risk	
	Bias due to deviations from intended interventions (effect of assignment to intervention)	2.1. Were participants aware of their assigned intervention during the trial?	Intervention: problem- and emotion-oriented coping Control: No intervention	Y
		2.2. Were carers and trial personnel aware of participants' assigned intervention during the trial?		N
		2.3. **If Y/PY/NI to 2.1 or 2.2**: Were there deviations from the intended intervention that arose because of the trial context?		N
		2.4. **If Y/PY to 2.3**: Were these deviations likely to have affected the outcome?		NA
		2.5. **If Y/PY/NI to 2.4**: Were these deviations from intended intervention balanced between groups?		NA
		2.6. Was an appropriate analysis used to estimate the effect of assignment to intervention?		Y
		2.7. **If N/PN/NI to 2.6**: Was there potential for a substantial impact (on the result) of the failure to analyse participants in the group to which they were randomized?		NA
		Domain-level judgement	Low risk	

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Study	Bias	Signalling question	Coments	Authors' judgement
Mache et al, 2017	Bias due to missing outcome data	3.1. Were data for this outcome available for all, or nearly all, participants randomized?		Y
		3.2. **If N/PN/NI to 3.1**: Is there evidence that the result was not biased by missing outcome data?		NA
		3.3. **If N/PN to 3.2**: Could missingness in the outcome depend on its true value?		NA
		3.4. **If Y/PY/NI to 3.3**: Is it likely that missingness in the outcome depended on its true value?		NA
		Domain-level judgement	Low risk	
	Bias in measurement of the outcome	4.1. Was the method of measuring the outcome inappropriate?		N
		4.2. Could measurement or ascertainment of the outcome have differed between intervention groups?		N
		4.3. **If N/PN/NI to 4.1 and 4.2**: Were outcome assessors aware of the intervention received by study participants?		Y
		4.4. **If Y/PY/NI to 4.3**: Could assessment of the outcome have been influenced by knowledge of intervention received?		N
		4.5. **If Y/PY/NI to 4.4**: Is it likely that assessment of the outcome was influenced by knowledge of intervention received?		N
		Domain-level judgement	Low risk	
	Bias in selection of the reported result	5.1. Were the data that produced this result analysed in accordance with a pre-specified analysis plan that was finalized before unblinded outcome data were available for analysis?		NI
		5.2. Is the numerical result being assessed likely to have been selected, on the basis of the results, from multiple eligible outcome measurements (e.g. scales, definitions, time points) within the outcome domain?		PN
		5.3. Is the numerical result being assessed likely to have been selected, on the basis of the results, from multiple eligible analyses of the data?		PN
		Domain-level judgement	Some concerns	
	Overall bias		Some concerns	
Medisauskaite and Kamau, 2019	Bias arising from the randomization process	1.1. Was the allocation sequence random?		Y
		1.2. Was the allocation sequence concealed until participants were recruited and assigned to interventions?		Y
		1.3. Were there baseline imbalances that suggest a problem with the randomization process?		N
		Domain-level judgement	Low risk	
	Bias due to deviations from intended interventions (effect of assignment to intervention)	2.1. Were participants aware of their assigned intervention during the trial?	Intervention: learning modules that presented doctors with information about stress Control: No intervention	Y
		2.2. Were carers and trial personnel aware of participants' assigned intervention during the trial?		N
		2.3. **If Y/PY/NI to 2.1 or 2.2**: Were there deviations from the intended intervention that arose because of the trial context?		N
		2.4. **If Y/PY to 2.3**: Were these deviations likely to have affected the outcome?		NA
		2.5. **If Y/PY/NI to 2.4**: Were these deviations from intended intervention balanced between groups?		NA
		2.6. Was an appropriate analysis used to estimate the effect of assignment to intervention?		Y
		2.7. **If N/PN/NI to 2.6**: Was there potential for a substantial impact (on the result) of the failure to analyse participants in the group to which they were randomized?		NA
		Domain-level judgement	Low risk	

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Study	Bias	Signalling question	Coments	Authors' judgement
Medisauskaite and Kamau, 2019	Bias due to missing outcome data	3.1. Were data for this outcome available for all, or nearly all, participants randomized?		Y
		3.2. **If N/PN/NI to 3.1**: Is there evidence that the result was not biased by missing outcome data?		NA
		3.3. **If N/PN to 3.2**: Could missingness in the outcome depend on its true value?		NA
		3.4. **If Y/PY/NI to 3.3**: Is it likely that missingness in the outcome depended on its true value?		NA
		Domain-level judgement	Low risk	
	Bias in measurement of the outcome	4.1. Was the method of measuring the outcome inappropriate?		N
		4.2. Could measurement or ascertainment of the outcome have differed between intervention groups?		N
		4.3. **If N/PN/NI to 4.1 and 4.2**: Were outcome assessors aware of the intervention received by study participants?		N
		4.4. **If Y/PY/NI to 4.3**: Could assessment of the outcome have been influenced by knowledge of intervention received?		NA
		4.5. **If Y/PY/NI to 4.4**: Is it likely that assessment of the outcome was influenced by knowledge of intervention received?		NA
		Domain-level judgement	Low risk	
	Bias in selection of the reported result	5.1. Were the data that produced this result analysed in accordance with a pre-specified analysis plan that was finalized before unblinded outcome data were available for analysis?		Y
		5.2. Is the numerical result being assessed likely to have been selected, on the basis of the results, from multiple eligible outcome measurements (e.g. scales, definitions, time points) within the outcome domain?		N
		5.3. Is the numerical result being assessed likely to have been selected, on the basis of the results, from multiple eligible analyses of the data?		N
		Domain-level judgement	Low risk	
	Overall bias		Low risk	
Moody et al, 2013	Bias arising from the randomization process	1.1. Was the allocation sequence random?		Y
		1.2. Was the allocation sequence concealed until participants were recruited and assigned to interventions?		PY
		1.3. Were there baseline imbalances that suggest a problem with the randomization process?		N
		Domain-level judgement	Low risk	
	Bias due to deviations from intended interventions (effect of assignment to intervention)	2.1. Were participants aware of their assigned intervention during the trial?	Intervention: Mindfulness-based course Control: No intervention	Y
		2.2. Were carers and trial personnel aware of participants' assigned intervention during the trial?		Y
		2.3. **If Y/PY/NI to 2.1 or 2.2**: Were there deviations from the intended intervention that arose because of the trial context?		N
		2.4. **If Y/PY to 2.3**: Were these deviations likely to have affected the outcome?		NA
		2.5. **If Y/PY/NI to 2.4**: Were these deviations from intended intervention balanced between groups?		NA
		2.6. Was an appropriate analysis used to estimate the effect of assignment to intervention?		Y
		2.7. **If N/PN/NI to 2.6**: Was there potential for a substantial impact (on the result) of the failure to analyse participants in the group to which they were randomized?		NA
		Domain-level judgement	Low risk	

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Study	Bias	Signalling question	Coments	Authors' judgement
Moody et al, 2013	Bias due to missing outcome data	3.1. Were data for this outcome available for all, or nearly all, participants randomized?		Y
		3.2. **If N/PN/NI to 3.1**: Is there evidence that the result was not biased by missing outcome data?		NA
		3.3. **If N/PN to 3.2**: Could missingness in the outcome depend on its true value?		NA
		3.4. **If Y/PY/NI to 3.3**: Is it likely that missingness in the outcome depended on its true value?		NA
		Domain-level judgement	Low risk	
	Bias in measurement of the outcome	4.1. Was the method of measuring the outcome inappropriate?		N
		4.2. Could measurement or ascertainment of the outcome have differed between intervention groups?		N
		4.3. **If N/PN/NI to 4.1 and 4.2**: Were outcome assessors aware of the intervention received by study participants?		N
		4.4. **If Y/PY/NI to 4.3**: Could assessment of the outcome have been influenced by knowledge of intervention received?		N
		4.5. **If Y/PY/NI to 4.4**: Is it likely that assessment of the outcome was influenced by knowledge of intervention received?		N
		Domain-level judgement	Low risk	
	Bias in selection of the reported result	5.1. Were the data that produced this result analysed in accordance with a pre-specified analysis plan that was finalized before unblinded outcome data were available for analysis?		NI
		5.2. Is the numerical result being assessed likely to have been selected, on the basis of the results, from multiple eligible outcome measurements (e.g. scales, definitions, time points) within the outcome domain?		PN
		5.3. Is the numerical result being assessed likely to have been selected, on the basis of the results, from multiple eligible analyses of the data?		PN
		Domain-level judgement	Some concerns	
	Overall bias		Some concerns	

Legend – Y=Yes, PY=Probably yes, PN= Probably no, N=No, NA=Not applicable, NI=No information.

JBI Critical Appraisal Checklist for Quasi-Experimental Studies (non-randomized experimental studies).

Question	1. Is it clear in the study what is the cause' and what is the effect' (i.e. there is no confusion about which variable comes first)?	2. Were the participants included in any comparisons similar?	3. Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?	4. Was there a control group?	5. Were there multiple measurements of the outcome both pre and post the intervention/exposure?	6. Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analyzed?	7. Were the outcomes of participants included in any comparisons measured in the same way?	8. Were outcomes measured in a reliable way?	9. Was appropriate statistical analysis used?	%yes/risk
Bar-Sela, LulavGrinwald and Mitnik, 2012	Y	Y	N	NA	Y	Y	Y	Y	Y	77.78
Bui et al, 2021	Y	N	N	NA	Y	Y	Y	Y	Y	66.67
Clemons et al, 2019	Y	Y	N	NA	Y	Y	Y	Y	Y	77.78
Dahn et al, 2019	Y	N	N	NA	Y	Y	Y	U	U	44.44
Italia et al, 2007	Y	Y	N	NA	Y	Y	Y	Y	Y	77.78
Landaverde et al, 2018	Y	U	N	NA	Y	U	Y	Y	U	44.44
Pathak, Eapen and Zell, 2019	Y	Y	N	NA	Y	Y	Y	Y	Y	77.78
Sekeres et al, 2003	Y	Y	N	N	Y	Y	Y	N	Y	66.67
Tjasink and Soosaipillai, 2018	Y	Y	N	NA	Y	Y	Y	Y	Y	77.78

Legend - Y=Yes, N=No, U=Unclear, NA=Not applicable.

JBI Critical Appraisal Checklist for Analytical Cross Sectional Studies

Question	1. Were the criteria for inclusion in the sample clearly defined?	2. Were the study subjects and the setting described in detail?	3. Was the exposure measured in a valid and reliable way?	4. Were objective, standard criteria used for measurement of the condition?	5. Were confounding factors identified?	6. Were strategies to deal with confounding factors stated?	7. Were the outcomes measured in a valid and reliable way?	8. Was appropriate statistical analysis used?	%yes/risk
Graff et al, 2018	Y	Y	Y	Y	Y	N	N	Y	75

Legend - Y=Yes, N=No, U=Unclear, NA=Not applicable.