Current Anesthesiology Reports
https://doi.org/10.1007/s40140-024-00623-2

PREHABILITATION (B RIEDEL AND S JACK, SECTION EDITORS)

The Effect of Unimodal, Non-pharmacological, Preoperative Psychological Prehabilitation Interventions on Preoperative Anxiety and Stress: A Systematic Review

J. G. Verhoeven[1] · M. M. B. Horstink[1] · J. Jeekel[1] · M. Klimek[2]

Accepted: 21 February 2024

Abstract

Background Prehabilitation is a novel clinical strategy to optimize patients' health in the waiting period before surgery.
Objectives This article aims to gather the evidence for the effectiveness of unimodal, non-pharmacological psychological prehabilitation interventions on preoperative anxiety and stress before surgery.
Design This is a PRISMA-guided systematic review and narrative synthesis of randomized controlled trials.
Methods The online databases Medline, Embase, Web of Science Core Collection, Cochrane Central Register of Controlled Trials, PsycINFO and Google Scholar were searched on March 20th 2023. The search strategy led to 13,667 records screened and five records of randomized controlled trials included for full-text analysis. A risk-of-bias assessment was performed using the Revised Cochrane Risk of Bias 2 tool.
Results Significant reduction in preoperative anxiety was seen in three studies comprising 337 participants. Two studies did not find that unimodal psychological prehabilitation reduces preoperative anxiety. Only one study assessed preoperative stress and reported a significant reduction. Intervention types used included guided imagery, stress management training, virtual reality experience and computer cognitive behavioral therapy.
Conclusions There is contradictory evidence whether unimodal, non-pharmacological psychological prehabilitation can reduce preoperative anxiety. There is little evidence that non-pharmacological prehabilitation can reduce preoperative stress. Suggestions to improve the research in this field are discussed.

Keywords Unimodal · Psychological · Prehabilitation · Anxiety · Stress · Non-pharmacological · Surgery

Background

Prehabilitation is a rapidly expanding field of preventative medicine [1, 2]. Preoperative prehabilitation interventions aimed at improving different aspects of preoperative health [3, 4] are tested in randomized controlled trials throughout the world [5–7]. Proponents of prehabilitation repeatedly highlight the importance of the psychological aspect of improving preoperative health [8, 9]. Psychological factors such as anxiety, stress, and depression are increasingly recognized as important determinants of surgical outcomes [10]. Psychological prehabilitation is an umbrella term used to describe the preoperative process of optimizing a patient's mental or psychological health to better cope with surgical stress. A variety of non-pharmacological interventions can be considered psychological prehabilitation such as the use of guided imagery [11], relaxation techniques [12], or stress management training [13]. A distinction is often made in

✉ J. G. Verhoeven
j.g.verhoeven@erasmusmc.nl

M. M. B. Horstink
m.horstink@erasmusmc.nl

J. Jeekel
j.jeekel@erasmusmc.nl

M. Klimek
m.klimek@erasmusmc.nl

[1] Department of Neuroscience, Erasmus MC, Dr. Molewaterplein 40, 3015 GD Rotterdam, The Netherlands

[2] Department of Anesthesiology, Erasmus MC, Dr. Molewaterplein 40, 3015 GD Rotterdam, The Netherlands

Published online: 04 March 2024

prehabilitation literature between multimodal and unimodal interventions [14, 15]. A multimodal prehabilitation program typically includes at least two different interventions aimed at, for example, improving physical health, nutritional status, or psychological wellbeing. In contrast, a unimodal intervention typically only targets one subdomain of preoperative health.

Several systematic reviews have examined the effects of non-pharmacological prehabilitation interventions on patient reported psychological outcomes [16, 17]. Generally, these reviews describe positive effects with low certainty of evidence and high risks of bias. However, these reviews have mostly discussed postoperative psychological outcomes, which are inherently influenced by the surgical event too. A dedicated systematic review focusing on preoperative outcomes, omitting the complex effects of surgery on outcomes, can help shed light on the still unclear efficacy of psychological prehabilitation.

Preoperative anxiety is very common in surgical patients [18]. It is an independent risk factor for a myriad of deleterious postoperative effects including pain [19, 20], increased analgesia requirement [19], and decreased sleep quality [21]. It has even been associated with a higher mortality rate in patients undergoing high-risk surgery [18, 22]. The term stress is sometimes interchangeably used with anxiety in the context of preoperative psychological health [23, 24]. Stress, however, is a distinct more physiological than psychological entity that is not to be confused with anxiety [25].

This study was conducted to provide a comprehensive and detailed review of the evidence concerning unimodal, non-pharmacological psychological prehabilitation interventions, and their effects on preoperative anxiety and stress. Studies under review were randomized controlled trials testing unimodal psychological, i.e., non-pharmacologic interventions in adult surgical patients.

Design and Methods

This systematic review was performed following the PRISMA guidelines [26]. The study protocol was prospectively registered in the PROSPERO database (PROSPERO no.: CRD42023408042).

The inclusion and exclusion criteria were based around the PICOS framework:

1. *Population*: Adults undergo moderate to major invasive surgery (examples of excluded minor surgery types were dental, ophthalmological, minor otorhinolaryngological, suturing procedures, oocyte retrieval, and abortions. Caesarian sections were excluded due their unique emotional connotation).
2. *Intervention*: Unimodal non-pharmacological intervention was performed at least 24 h pre-surgery and at most 30 days before surgery. Unimodal was defined as focusing on one pillar of prehabilitation, and thus, trials where the psychological intervention was part of a multimodal program also containing other physical or nutritional interventions were excluded.
3. *Control:* Standard care, without prehabilitation.
4. *Outcome:* Preoperative anxiety and/or preoperative subjective stress.
5. *Study type:* Randomized controlled trials.

Furthermore, articles had to be published and available in full-text, in English. Trials investigating multimodal prehabilitation interventions and those that had a distinct physical nature or component such as exercise therapy, acupuncture, or yoga were excluded. Records of editorials, commentaries, and conference proceedings were excluded.

In collaboration with a biomedical information expert, a comprehensive systematic literature search was conducted in electronic databases MEDLINE, Embase, Psychinfo, OVID, and Google Scholar from inception of the platform until the 20th of March 2023. The complete search strategy can be found in the supplementary materials. Additionally, reference lists were manually screened for any relevant articles not included in the initial search.

Two authors (JV and MH) independently examined the records to determine eligibility for full-text analysis. Any conflicts were discussed, and if consensus could not be reached, a third, senior author (MK) was consulted. The full-text analysis was performed in the same manner. Data from the included studies were extracted manually by both reviewing authors (JV and MH) using a preformatted Microsoft Excel spreadsheet and subsequently combined. Due to large heterogeneity in both intervention types and outcome measures, a narrative synthesis approach was used to report the results of these studies.

The TIDieR format was used to structurally extract intervention details [27]. To assess the risk of bias in the included studies, the revised Cochrane risk-of-bias tool for randomized trials was used [28].

Results

Study Selection

The search yielded 13,677 records after duplicate removal. After title and abstract screening, 94 articles were included for full-text screening. Full-text articles were not found for four records. After full text screening, five studies were included for data extraction [29–33]. Interrater agreement for the title and abstract screening (98%) and full-text

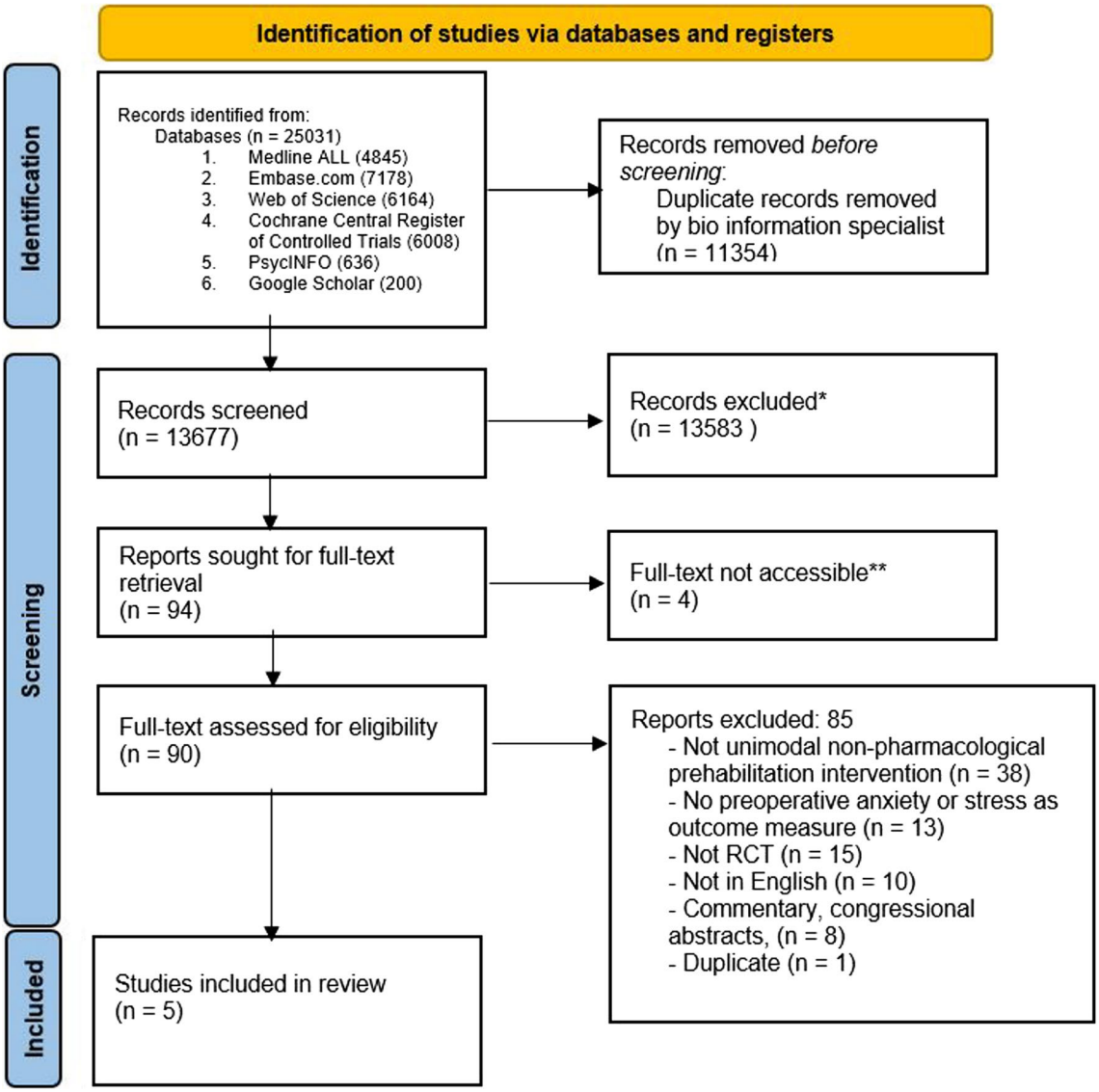
inclusion (90%) were rated as high. The PRISMA flow chart, with reasons for exclusion, is presented as Fig. 1. The included studies' characteristics are summarized in Table 1.

The combined studies present data on 445 patients undergoing a preoperative unimodal psychological prehabilitation intervention and their effects on preoperative anxiety and subjective stress. Number of analyzed patients between studies ranged from 38 [30] to 130 [32].

All studies were single-center RCT's except for one that reported a multicenter RCT where patients were recruited from two hospitals [33]. A variety of surgical populations were investigated including patients undergoing craniotomies and spinal procedures [29], gynecological surgery [30], breast cancer surgery [31], colorectal resections [32], and laryngectomies [33]. The mean age of all included patients was 51.9 years. Dropout rates were 0% for two studies [32, 33] but higher in the other three studies 13.6% [30], 15.3% [29], and 17.7% [31].

Interventions

Reporting of intervention details was extracted using the TIDieR format [27]. The full results can be seen in Supplementary Table 1. Two studies used guided imagery as psychological intervention [30, 32]. One study employed a virtual reality experience [29], one used a digital cognitive behavioral therapy module on a computer [33], and one described using stress management training complemented



*An additional 147 duplicates were manually removed by the researchers. *Efforts were made to retrieve the full-text via the medical library, ResearchGate, or through emailing an author if an email address was available. A reminder was sent after at least two weeks if there was no reply to the initial request

Fig. 1 PRISMA flow chart

Table 1 Study characteristics and results

Author	Year	Country	No. of patients	Age (years)	Female (%)	Surgery type	Intervention	Preoperative anxiety*	Effect of intervention on preoperative anxiety	*P*-value	Preoperative stress*	Effect of intervention on preoperative stress	*P*-value
Bekelis et al.	2017	USA	127	55	42%	Craniotomy or spinal surgery	Virtual reality experience	APAIS	− 29.9 (24.5 to 35.2)^	< 0.01	VAS-stress	− 41.7 (− 33.1 to − 50.2)^	*P* < 0.01
Billquist et al.	2018	USA	38	61	100%	Gynecological surgery	Guided imagery	STAI	Not reported	Unknown, reported as not significant	–	–	–
Garssen et al.	2013	The Netherlands	70	53	100%	Breast cancer surgery	Stress management training	STAI	− 0.6	Unknown, reported as not significant	–	–	–
Tusek et al.	1997	USA	130	40	Not reported	Colorectal resection	Guided imagery	VAS-anxiety	− 30 range (− 95 to 50) ~	< 0.001	–	–	–
Yang et al.	2022	China	80	51	17.50%	(Partial) laryngectomy	Computer cognitive behavioral therapy	STAI	− 6.57	< 0.001	–	–	–

**APAIS* Amsterdam Preoperative Anxiety and Information Scale, *STAI* State-Trait Anxiety Inventory, *VAS* visual analogue scale

*Low scores are favorable for each scale used

^95% CI presented

~Median change with range presented

with CDs with relaxation techniques [31]. Four studies started the intervention within one week before surgery (range 3–7 days) [29]. The location where the interventions occurred was at home [30, 32], the outpatient clinic [29], a combination of the two [31], or not clearly described [33]. One study did not specify the time between surgery and intervention. Two studies tested interventions that were designed to be only performed preoperatively [29, 30]; others continued post-operatively. The mean total time spent by the participant during the respective study receiving the preoperative intervention was 72 min (range 5–120). No study provided information regarding possible tailoring of intervention to the individual participant or modifications made during the trial. Adherence to the intervention in the single-moment virtual reality experience trial was not reported [29]. Self-reported adherence to the preoperative intervention was 72% [30] and 86% [31] for participants listening to guided imagery tapes. In-person preoperative stress management training sessions were all attended in the trial reported by Garssen et al. [31]. Yang et al. reported no strategies for assessing adherence but included a flow diagram stating that 100% of participants received the computer cognitive behavioral therapy intervention according to allocation [33].

Preoperative Anxiety

All studies reported the effects of unimodal, psychological prehabilitation interventions on anxiety [29–33]. Three studies, examining computer cognitive behavioral therapy, virtual reality experience, and guided imagery, reported a significant decrease in preoperative anxiety compared to control groups [29, 32, 33]. One study examining stress management training reported a non-significant decrease [31], and another guided imagery trial reported no difference between intervention and control group in preoperative anxiety. Three studies used a version of the State-Trait Anxiety Inventory questionnaire [30, 31, 33], one used the Amsterdam Preoperative Anxiety and Information scale [29], and one used a visual analogue scale for anxiety [32]. Time of measurement of preoperative anxiety was defined as "day of surgery" [29–31], shortly before surgery [32], and one hour before surgery [33].

Preoperative Subjective Stress

Only one study, Bekelis et al., investigated subjective stress as an outcome after using a virtual reality experience [29]. They reported a significant decrease in subjective stress measured on a VAS-stress score on the day of surgery compared to the control group. This finding was concordant with their finding that preoperative anxiety was reduced using a virtual reality experience.

Risk of Bias Assessment

The overall risk of bias for all included studies was high. Study participants were aware of intervention assignment, i.e., unblinded, in each trial. In all but one study [31], the overall high risk of bias score was solely due to high risk of bias rating in the outcome measurement domain. Outcome assessors were considered not blinded as preoperative anxiety and stress were patient reported outcome measures. When omitting the outcome measurement domain, four of the articles were at moderate risk of bias overall [29, 30, 32, 33] and one remained at high risk of bias [31]. The block randomization strategy used by Garssen et al. where participants were alternately assigned to intervention and control group from one week to the next was considered a high risk of bias [31]. Two of the authors reporting on the positive effects of a virtual reality experience had previously cofounded a virtual reality company that was uninvolved with the trial [29]. The full results of the risk of bias assessment can be found in Figs. 2 and 3.

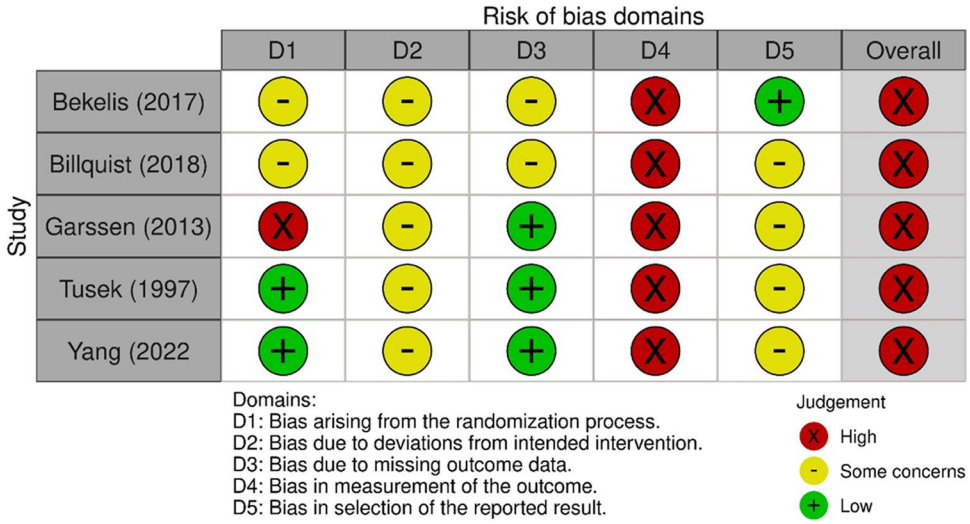
Other Reported Perioperative Outcomes

Two studies investigated the effect of computer cognitive behavioral therapy and stress management training on preoperative depression scores but found no difference between intervention and control group [31, 33]. There was no effect on the length of stay of patients in the two studies on computer cognitive behavioral therapy and guided imagery that reported it as an outcome [32, 33]. One study that reported on complication rate (ileus, nausea, pruritus, and vomiting) found no difference between patients undergoing the prehabilitation intervention, guided imagery, and the usual care group [32]. That same study did report a significant difference in the postoperative analgesia consumption recorded as milligrams of morphine favoring the intervention group. In this study, the intervention continued intra- and postoperatively [32]. No study investigated mortality rate.

Discussion

This systematic review indicates there is some but not unequivocal evidence that unimodal, psychological prehabilitation interventions reduce preoperative anxiety. Out of the five reports included in this review, the three largest studies show positive effects of a psychological prehabilitation intervention on preoperative anxiety. However, there is insufficient evidence to suggest psychological prehabilitation reduces preoperative stress. Studies investigating a virtual reality experience [29] and computer-based cognitive behavioral therapy [33] have been shown to reduce preoperative anxiety with moderate risk of bias. However,

Fig. 2 Risk of bias assessment



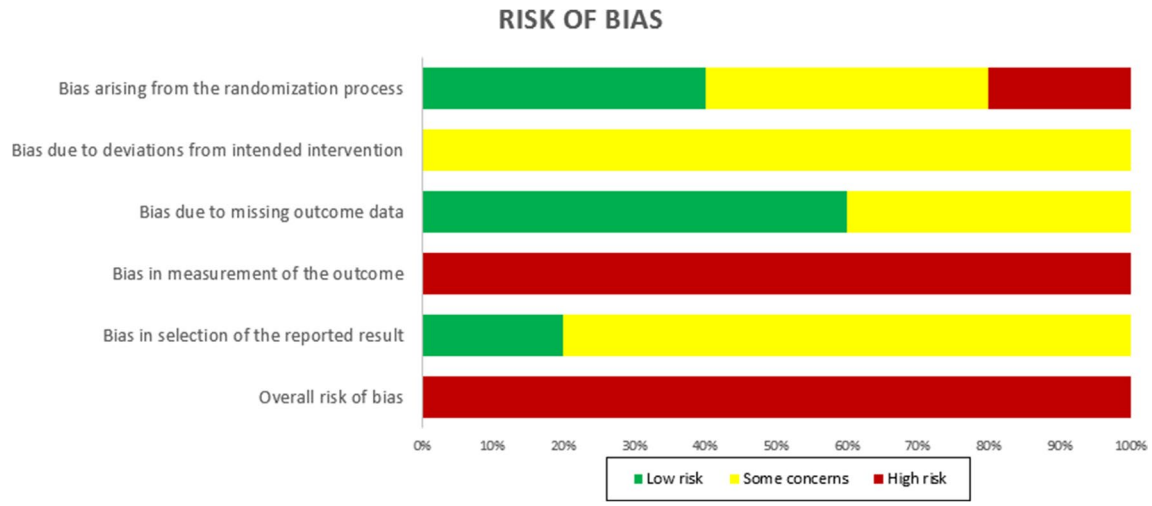


Fig. 3 Summary of risk of bias

guided imagery as a psychological prehabilitation intervention shows contradictory effectiveness [30, 32]. Reduction in preoperative stress was investigated by only one study, which showed that a virtual reality experience could reduce subjective stress [29]. In all but one study [31], the overall high risk of bias score was solely due to high risk of bias rating in the outcome measurement domain. The reporting of intervention details as assessed by the TIDieR was incomplete.

Studies investigating non-pharmacological psychological prehabilitation have examined a wide range of outcomes including anxiety, depression, quality-of-life, dosage of anesthetics used, pain-catastrophizing, and experienced pain [12, 13, 34]. Of these outcomes, anxiety is the most frequently studied patient reported outcome measure. The effectiveness of non-pharmacological psychological interventions at decreasing perioperative anxiety varies between different interventions. This is supported by the results of this review where three studies showed a significant positive effect and two studies showing either no effect of a non-significant one. Furthermore, although systematic reviews and meta-analyses generally tend to suggest a positive effect of psychological prehabilitation on postoperative anxiety [16, 17] a recent international multicenter RCT found no difference in postoperative anxiety between intervention and control groups in a multimodal prehabilitation program [5]. In this study, the psychological intervention constituted anxiety reducing techniques taught by a trained psychologist in one-on-one sessions. Patients that had high anxiety scores at baseline were referred to a medical psychologist. The employed intervention shows similarities to ones explored in this systematic review, yet did not show a positive result. It should be noted that in this trial postoperative anxiety was measured four weeks after surgery as a secondary outcome whereas reports included in this review measured

postoperative anxiety within a few days after surgery if not sooner. The time elapsed between intervention and measurement of anxiety might play a part.

Whether postoperative anxiety is a proper outcome measure of the effectiveness of a psychological intervention is debatable. A significant reduction in postoperative anxiety has been observed in observational cohorts and the control groups of RCTs. This decrease in anxiety post-surgery is also seen in the placebo-arms of randomized controlled trials investigating pharmacological interventions for peri-surgical anxiety reduction using benzodiazepines [35, 36]. Interestingly, these studies have shown that although benzodiazepines were successful in decreasing preoperative anxiety, there were no differences in postoperative anxiety between intervention and placebo groups. Conversely, patient reported quality of recovery was found to be lower in the patients who had been administered benzodiazepines compared to placebo. This unexpected finding was attributed by the authors as a result of side-effects of the benzodiazepines [37]. These results suggest that although positive preoperative outcomes are relevant because they measure the effect of a preoperative intervention, the absence of a positive postoperative outcome means the intervention cannot be considered clinically effective. As discussed above, postoperative anxiety may not be the appropriate postoperative outcome of choice in this context due to natural postoperative reduction and measurement of postoperative clinical recovery could be a better option. Further research, focusing on preoperative anxiety and postoperative quality of recovery after psychological prehabilitation could elucidate whether the non-pharmacological interventions could supplement or even outperform the pharmacological interventions.

The authors agree with previous reviewers that have noted the low quality of studies and evidence in this field of research [16, 17, 38, 39]. Lepore and Coyne [40] raised the issue of reviewers having to compromise standards to come to an adequate number of studies to review when investigating psychological interventions. A decade after this initial observation, the authors of a frequently cited systematic review on psychological prehabilitation noted that they could not exclude poor-quality studies due to the limited amount of relevant literature [16]. This review too deviated from study protocol to come to a reasonable number of studies. Initially, the inclusion criteria for this review required studies to have a sample size calculation based on pilot trials, meta-analyses or comparable trials to be eligible. However, only one study was eligible using that strict criterion [33], and thus, the decision was made not to enforce this requirement. In all but one study [31] the overall high risk of bias score was due to high risk of bias rating in the outcome measurement domain. Furthermore, reporting of adherence rates or strategies to evaluate adherence to study intervention was lacking in three of the five studies in this review. We reiterate the call for methodologically robust studies and suggest a correct and clearly reported sample size calculation and reporting of adherence rates as feasible and necessary first steps.

The correct and comprehensive reporting of intervention details improves replicability of trials, aids implementation of effective interventions, and reduces waste of resources [41]. The level of detail and clarity of reporting of intervention characteristics in the included studies in this review varied. Information was sometimes hard to find and spread throughout the "Background" and "Design and Methods" sections. None of the included articles used a guideline for reporting such as the different iterations of the CONSORT-statement [42, 43] or the TIDieR checklist [27]. The use of such checklists and guidelines could help researchers in prehabilitation increase the quality of reporting and aid decision making of clinicians hoping to implement effective interventions.

Limitations of this systematic review were the low number of studies eligible for inclusion and heterogeneity in intervention, study population and outcome measurements used. As aforementioned, an inclusion criterion to increase the methodological quality of included studies by requiring a proper sample-size calculation was dropped to come to a meaningful number of reports for inclusion. Furthermore, each study investigated a different surgical population with a different kind of treatment making direct comparisons difficult. Two studies both examined guided imagery as a prehabilitation intervention [30, 32], but the mean age of participants differed twenty years. Moreover, the two studies that did not find a significant effect on preoperative anxiety did not fully report the outcome data [30, 31]. The authors refrained from performing meta-analyses as this was deemed inappropriate because of the heterogeneous study populations and varying interventions. A strength of this study was the comprehensive literature search conducted with the aid of a biomedical information specialist. The high number of records illustrate the authors' intention to rather screen too much, than too little.

The search for unimodal non-pharmacological interventions that could serve as prehabilitation modalities continues. One promising intervention is the use of music interventions, or music medicine. The use of recorded music perioperatively has been shown to decrease anxiety, pain, and stress [44, 45]. A recent trial has found that music interventions used perioperatively in craniotomy patients reduced delirium observation scale score [46]. Music interventions are cheap, sustainable, and readily available but have yet been tested in the prehabilitation setting and its efficacy for that purpose remains unknown.

Conclusion

There is conflicting evidence that unimodal, non-pharmacological psychological prehabilitation interventions can reduce preoperative anxiety. Despite repeated calls by reviewers, the methodological and reporting quality of trials

investigating psychological interventions remains low and risks of bias remains high. Trialists deciding to investigate psychological interventions could meaningfully increase the level of evidence by performing sound sample size calculations. Furthermore, reporting intervention characteristics according to the CONSORT-statement or TIDieR guidelines would increase replicability of trials.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s40140-024-00623-2.

Acknowledgements The authors wish to thank Elise Krabbendam from the Erasmus MC Medical Library for developing and updating the search strategies.

Author Contribution JV: conceptualization, investigation, and writing—original draft, review, and editing. MH: investigation, visualization, and writing—original draft. JJ: conceptualization, supervision, and writing—review. MK: conceptualization, supervision, and writing—review.

Declarations

Ethics Approval Due to the nature of this manuscript being a systematic review, no ethical approval was sought.

Competing Interests The authors declare no competing interests.

References

1. Punnoose A, Claydon-Mueller LS, Weiss O, Zhang J, Rushton A, Khanduja V. Prehabilitation for patients undergoing orthopedic surgery: a systematic review and meta-analysis. JAMA Netw Open. 2023;6(4):e238050. https://doi.org/10.1001/jamanetworkopen.2023.8050.
2. Davis JF, et al. From theory to practice: an international approach to establishing prehabilitation programmes. Curr Anesthesiol Rep. 2022;12(1):129–37. https://doi.org/10.1007/s40140-022-00516-2.
3. Carli F, Minnella EM. Preoperative functional assessment and optimization in surgical patient: changing the paradigm. Minerva Anestesiol. 2017;83(2):214–8.
4. Molenaar C, Papen-Botterhuis N, Herrle F, Slooter G. Prehabilitation, making patients fit for surgery – a new frontier in perioperative care. Innov Surg Sci. 2019;4:132–8. https://doi.org/10.1515/iss-2019-0017.
5. Molenaar CJL et alEffect of multimodal prehabilitation on reducing postoperative complications and enhancing functional capacity following colorectal cancer surgery: the PREHAB randomized clinical trial. JAMA Surg. 2023. https://doi.org/10.1001/jamasurg.2023.0198.
6. Ferreira V, et al. "Multimodal prehabilitation for lung cancer surgery: a randomized controlled trial," (in eng). Ann Thorac Surg. 2021;112(5):1600–8. https://doi.org/10.1016/j.athoracsur.2020.11.022.
7. Milios JE, Ackland TR, Green DJ. Pelvic floor muscle training in radical prostatectomy: a randomized controlled trial of the impacts on pelvic floor muscle function and urinary incontinence. BMC Urol. 2019;19(1):116.
8. Gillis C, Ljungqvist O, Carli F. Prehabilitation, enhanced recovery after surgery, or both? A narrative review. Br J Anaesth. 2022;128(3):434–48.
9. Scheede-Bergdahl C, Minnella EM, Carli F. Multi-modal prehabilitation: addressing the why, when, what, how, who and where next? Anaesthesia. 2019;74(Suppl 1):20–6.
10. Levett DZH, Grimmett C. "Psychological factors, prehabilitation and surgical outcomes: evidence and future directions," (in eng). Anaesthesia. 2019;74(Suppl 1):36–42. https://doi.org/10.1111/anae.14507.
11 Haase O, Schwenk W, Hermann C, Müller JM. Guided imagery and relaxation in conventional colorectal resections: a randomized, controlled, partially blinded trial. Dis Colon Rectum. 2005;48(10):1955–63. https://doi.org/10.1007/s10350-005-0114-9.pdf.
12. Barabady A, Baghdassarians A, Memary E, Yazdani A, Barabady A, Sayadi S. Effect of Benson's relaxation technique on propofol consumption and preoperative anxiety of patients undergoing cataract surgery. Anesth Pain Med. 2020;10(3):e100703. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7472786/pdf/aapm-10-3-100703.pdf.
13. Cohen L, et al. "Presurgical stress management improves postoperative immune function in men with prostate cancer undergoing radical prostatectomy," (in eng). Psychosom Med. 2011;73(3):218–25. https://doi.org/10.1097/PSY.0b013e31820a1c26.
14. Mareschal J, Hemmer A, Douissard J, Dupertuis YM, Collet TH, Koessler T, Toso C, Ris F, Genton L. Surgical prehabilitation in patients with gastrointestinal cancers: impact of unimodal and multimodal programs on postoperative outcomes and prospects for new therapeutic strategies-a systematic review. Cancers (Basel). 2023;15(6):1881. https://doi.org/10.3390/cancers15061881
15. Bruns ERJ, et al. Improving outcomes in oncological colorectal surgery by prehabilitation. Am J Phys Med Rehabil. 2019;98(3):231–8.
16 Tsimopoulou I, et al. Psychological prehabilitation before cancer surgery: a systematic review. Ann Surg Oncol. 2015;22(13):4117–23. https://doi.org/10.1245/s10434-015-4550-z.pdf.
17. Powell R, et al. Psychological preparation and postoperative outcomes for adults undergoing surgery under general anaesthesia. Cochrane Database Syst Rev. 2016;2016(5):CD008646.
18. Kassahun WT, Mehdorn M, Wagner TC, Babel J, Danker H, Gockel I. The effect of preoperative patient-reported anxiety on morbidity and mortality outcomes in patients undergoing major general surgery. Sci Rep. 2022;12(1):6312. https://doi.org/10.1038/s41598-022-10302-z.
19. Ip HY, Abrishami A, Peng PW, Wong J, Chung F. Predictors of postoperative pain and analgesic consumption: a qualitative systematic review. Anesthesiology. 2009;111(3):657–77.
20 Sobol-Kwapinska M, Bąbel P, Plotek W, Stelcer B. Psychological correlates of acute postsurgical pain: a systematic review and meta-analysis. Eur J Pain. 2016;20(10):1573–86. https://doi.org/10.1002/ejp.886?download=true.

21. Gu X, Zhang Y, Wei W, Zhu J. Effects of preoperative anxiety on postoperative outcomes and sleep quality in patients undergoing laparoscopic gynecological surgery. J Clin Med. 2023;12(5). https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10003609/pdf/jcm-12-01835.pdf.
22. Williams JB, et al. Preoperative anxiety as a predictor of mortality and major morbidity in patients aged >70 years undergoing cardiac surgery. Am J Cardiol. 2013;111(1):137–42.
23. Chen YK, Soens MA, Kovacheva VP. Less stress, better success: a scoping review on the effects of anxiety on anesthetic and analgesic consumption. J Anesth. 2022;36(4):532–53.
24. Carli F, et al. Surgical prehabilitation in patients with cancer: state-of-the-science and recommendations for future research from a panel of subject matter experts. Phys Med Rehabil Clin N Am. 2017;28(1):49–64.
25. Cusack B, Buggy DJ. Anaesthesia, analgesia, and the surgical stress response. BJA Educ. 2020;20(9):321–8.
26. Page MJ, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021;372: n71. https://doi.org/10.1136/bmj.n71.
27 Hoffmann TC, et al. Better reporting of interventions: template for intervention description and replication (TIDieR) checklist and guide. Bmj. 2014;348:g1687.
28. Sterne JAC, et al. RoB 2: a revised tool for assessing risk of bias in randomised trials. BMJ. 2019;366: l4898. https://doi.org/10.1136/bmj.l4898.
29. Bekelis K, Calnan D, Simmons N, MacKenzie TA, Kakoulides G. Effect of an Immersive preoperative virtual reality experience on patient reported outcomes: a randomized controlled trial. Ann Surg. 2017;265(6):1068–73.
30 Billquist EJ, Michelfelder A, Brincat C, Brubaker L, Fitzgerald CM, Mueller ER. Pre-operative guided imagery in female pelvic medicine and reconstructive surgery: a randomized trial. Int Urogynecol J. 2018;29(8):1117–22. https://doi.org/10.1007/s00192-017-3443-z.pdf.
31. Garssen B, et al. Stress management training for breast cancer surgery patients. Psychooncology. 2013;22(3):572–80.
32. Tusek DL, Church JM, Strong SA, Grass JA, Fazio VW. Guided imagery: a significant advance in the care of patients undergoing elective colorectal surgery. Dis Colon Rectum. 1997;40(2):172–8.
33. Yang Y, et al. The effectiveness of computer-assisted cognitive behavioral therapy (cCBT) for psychological outcomes in patients with laryngectomy: randomized controlled trial. J Affect Disord. 2022;300:59–65.
34. Lotzke H, et al. A person-centered prehabilitation program based on cognitive-behavioral physical therapy for patients scheduled for lumbar fusion surgery: a randomized controlled trial. Phys Ther. 2019;99(8):1069–88.
35. Mijderwijk H, van Beek S, Klimek M, Duivenvoorden HJ, Grune F, Stolker RJ. "Lorazepam does not improve the quality of recovery in day-case surgery patients: a randomised placebo-controlled clinical trial," (in eng). Eur J Anaesthesiol. 2013;30(12):743–51. https://doi.org/10.1097/EJA.0b013e328361d395.
36 van Beek S, Kroon J, Rijs K, Mijderwijk H-J, Klimek M, Stolker RJ. The effect of midazolam as premedication on the quality of postoperative recovery after laparotomy: a randomized clinical trial. Can J Anaesth. 2020;67(1):32–41. https://doi.org/10.1007/s12630-019-01494-6.
37. Maurice-Szamburski A, et al. Effect of sedative premedication on patient experience after general anesthesia: a randomized clinical trial. JAMA. 2015;313(9):916–25. https://doi.org/10.1001/jama.2015.1108.
38. Grimmett C, Heneka N, Chambers S. Psychological interventions prior to cancer surgery: a review of reviews. Curr Anesthesiol Rep. 2022;12(1):78–87. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8801554/pdf/40140_2021_Article_505.pdf.
39. Scriney A, Russell A, Loughney L, Gallagher P, Boran L. The impact of prehabilitation interventions on affective and functional outcomes for young to midlife adult cancer patients: a systematic revieW," (in eng). Psychooncology. 2022. https://doi.org/10.1002/pon.6029.
40. Lepore SJ, Coyne JC. Psychological interventions for distress in cancer patients: a review of reviews. Ann Behav Med. 2006;32(2):85–92.
41. Glasziou P, et al. Reducing waste from incomplete or unusable reports of biomedical research. Lancet. 2014;383(9913):267–76.
42. Begg C, et al. Improving the quality of reporting of randomized controlled trials. The CONSORT statement. JAMA. 1996;276(8):637–9.
43. Boutron I, Altman DG, Moher D, Schulz KF, Ravaud P, C. N. Group. CONSORT statement for randomized trials of nonpharmacologic treatments: a 2017 update and a CONSORT extension for nonpharmacologic trial abstracts. Ann Intern Med. 2017;167(1):40–7.
44. Kühlmann AYR, de Rooij A, Kroese LF, van Dijk M, Hunink MGM, Jeekel J. Meta-analysis evaluating music interventions for anxiety and pain in surgery. Br J Surg. 2018;105(7):773–83.
45. Hole J, Hirsch M, Ball E, Meads C. Music as an aid for postoperative recovery in adults: a systematic review and meta-analysis. Lancet. 2015;386(10004):1659–71.
46. Pablo RK, et al. Music to prevent deliriUm during neuroSurgerY (MUSYC): a single-centre, prospective randomised controlled trial. BMJ Open. 2023;13(6): e069957. https://doi.org/10.1136/bmjopen-2022-069957.