

A COMPARATIVE REVIEW OF PSYCHOLOGICAL INTERVENTIONS FOR STRESS AND ANXIETY IN SURGICAL PATIENTS: A SYSTEMATIC REVIEW

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ABSTRACT

Background: Surgery is a potent psychological and physiological stressor. Prevalence estimates for clinically significant preoperative anxiety vary widely by setting and instrument, from as low as 11.8% in a Tanzanian tertiary hospital using the Amsterdam Preoperative Anxiety and Information Scale (Msoma et al., 2023) to 40-90% in several Euro-American cohorts, with pooled multi-country estimates commonly cited near 60-80%. Elevated anxiety is associated with heightened cortisol and inflammatory responses, elevated anaesthetic and analgesic requirements, higher odds of postoperative delirium, delayed wound healing, and prolonged recovery (Shebl et al., 2025; Villa et al., 2020). A wide range of psychological interventions - psychoeducation, relaxation and guided imagery, mindfulness-based practices, cognitive-behavioural therapy (CBT), and music therapy - have been trialled to reduce this burden, yet comparative evidence on their relative effectiveness remains fragmented, particularly outside high-income settings.

Objective: To systematically review and comparatively synthesise randomised and quasi-experimental evidence, together with existing systematic reviews and meta-analyses, on the effectiveness of psychological interventions in reducing stress and anxiety and improving postoperative recovery outcomes among adult surgical patients, and to situate this evidence within its underlying neuroendocrine and inflammatory mechanisms and its generalisability across high, middle- and low income surgical settings.

Methods: This review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines. PubMed/MEDLINE, Scopus, CINAHL, PsycINFO, and Cochrane CENTRAL were the primary databases for the eligibility-defined search, supplemented by hand-searching of the reference lists of two closely related systematic reviews from the same research group (Villa et al., 2020; Lanini et al., 2022) and of a 2025 meta-analysis of anxiety-outcome associations (Shebl et al., 2025). Randomised controlled trials, pilot RCTs, prospective observational/predictor studies, and systematic reviews/meta-analyses published in English that evaluated a non-pharmacological psychological intervention, or the association between preoperative anxiety and surgical outcomes, in adult elective (or, where explicitly subgrouped, paediatric) surgical patients were eligible. Two reviewers were to independently screen records, extract data using a standardised form, and appraise risk of bias using the Cochrane RoB 2 tool for trials, the Newcastle-Ottawa Scale for observational studies, and AMSTAR-2 for existing reviews. Findings were synthesised narratively and grouped by intervention category, with studies additionally tabulated in chronological order to trace the evolution of the evidence base from 1980 to 2026.

Results: Evidence drawn from primary trials and existing systematic reviews/meta-analyses across psychoeducation, relaxation/guided imagery, mindfulness-based interventions, CBT, and music therapy consistently favoured active psychological intervention over standard care for reducing preoperative state anxiety, with standardised mean differences generally in the

small-to-moderate range (approximately -0.3 to -0.9) and larger, more consistent effects for music-based and mindfulness-based interventions than for single-session verbal psychoeducation. Guided imagery and relaxation training additionally reduced serum cortisol and favourably shifted lymphocyte subsets and inflammatory markers (Felix et al., 2018; Lanini et al., 2022; Villa et al., 2020). A 2025 meta-analysis of 24 studies (n=3,388) demonstrated that anxiety itself is associated with clinically significant downstream consequences, including increased anaesthetic (SMD 0.67) and analgesic (SMD 0.89-1.02) consumption, higher odds of adult postoperative delirium (OR 1.89-2.03), and prolonged recovery time (Shebl et al., 2025), strengthening the clinical rationale for intervention. Prevalence and predictor data from Tanzania (Msoma et al., 2023) and India (Bagle et al., 2024) indicated that both the burden of anxiety and the relative effectiveness of intervention format (verbal versus multimedia; economic/insurance status) vary substantially by health-system context. Comparative head-to-head trials directly contrasting two or more psychological interventions within the same sample remained scarce, especially outside high-income settings.

Conclusion: Structured psychological interventions produce measurable, clinically meaningful reductions in surgical stress and anxiety, and anxiety itself is now linked to objectively measurable adverse events such as delirium and prolonged recovery, elevating the clinical urgency of routine screening and intervention. Multicomponent and culturally adapted, low-literacy-appropriate delivery formats show the most promise for resource-constrained settings such as India and East Africa. Comparative, adequately powered trials evaluating multiple interventions within the same surgical population, across diverse economic and cultural contexts, are needed to guide the integration of psychological care into routine perioperative protocols

KEYWORDS: Preoperative Anxiety; Surgical Stress; Psychological Intervention; Psychoeducation; Relaxation Therapy; Mindfulness; Cognitive-Behavioural Therapy; Postoperative Delirium; Systematic Review; PRISMA.

Article History

Received: 19 Sep 2026 | Revised: 22 Sep 2026 | Accepted: 29 Sep 2026

INTRODUCTION

Surgery remains one of the most psychologically demanding experiences an individual can face, eliciting significant emotional and physiological responses well before the procedure itself begins (Gouin & Kiecolt-Glaser, 2011). The earliest systematic attention to this phenomenon dates to Johnston's (1980) descriptive account of fear in surgical patients, which established anxiety as a distinct, measurable perioperative construct rather than an incidental accompaniment to illness. Building on this foundation, Mitchell's (2003) review of 34 studies conducted between 1990 and 2002 (3,754 patients across in-patient and day-case procedures) documented that a considerable proportion of patients remained highly anxious despite the shift toward shorter hospital stays, and that formal psycho-educational care had not kept pace with this shift in surgical delivery models. Prevalence estimates continue to vary by surgical setting, instrument, and health-system context: more recent pooled estimates across roughly 14,000 surgical patients worldwide place overall prevalence near 60-80% (Shebl et al., 2025), while a 2023 Tanzanian cohort using the Amsterdam Preoperative Anxiety and Information Scale (APAIS) recorded a markedly lower prevalence of 11.8% (Msoma et al., 2023) - a discrepancy discussed further in Section 3.7. In the days preceding surgery, patients commonly report fear of hospitalisation, anaesthesia, postoperative pain, disability, and separation from family (Johnston, 1980; Mitchell, 2003). These stress responses typically begin several days before surgery, peak approximately two days before the procedure, and gradually diminish within the first postoperative week, although the trajectory varies with the complexity of the procedure.

The clinical significance of this distress extends well beyond subjective discomfort. Elevated preoperative anxiety has been consistently linked to increased heart rate and blood pressure, immune suppression, heightened inflammatory and cortisol responses, delayed wound healing, greater anaesthetic and analgesic requirements, and prolonged recovery (Carr et al., 2006; Desborough, 2000; Kehlet, 2000; Pritchard, 2009). This mechanistic picture has since been substantiated at the level of specific biomarkers: two related systematic reviews from the same Italian research group traced the pathophysiology of the surgical stress response through hypothalamic-pituitary-adrenal (HPA) axis activation, cortisol and catecholamine secretion, and cytokine-mediated inflammation (interleukin-1, interleukin-6, tumour necrosis factor- α , C-reactive protein, and lymphocyte subsets such as CD3+/CD4+), and showed that structured psychological interventions were consistently associated with more favourable values on these same biomarkers alongside improved pain and anxiety outcomes (Lanini et al., 2022; Villa et al., 2020). Quantifying the downstream clinical consequences of this pathway, a 2025 meta-analysis of 24 studies (3,388 patients) found that preoperative anxiety was significantly associated with increased anaesthetic (standardised mean difference [SMD] = 0.67) and analgesic (SMD = 0.89-1.02) requirements, prolonged time to reach a Modified Aldrete Score of 9 and delayed extubation, and, in adults specifically, close to double the odds of postoperative delirium (odds ratio = 2.03) (Shebl et al., 2025). Despite this well-documented burden, psychological preparation remains inconsistently integrated into routine surgical care, particularly in resource-constrained health systems where nursing and anaesthesia staff are already stretched across high patient volumes.

A broad repertoire of non-pharmacological psychological interventions has been developed to address this gap. These include structured psychoeducation and preoperative counselling; relaxation techniques such as progressive muscle relaxation and guided imagery; mindfulness-based practices; cognitive-behavioural therapy (CBT); and music-based interventions. Individually, each of these approaches has accumulated a credible evidence base. Cochrane-level synthesis of psychological preparation for adults undergoing general anaesthesia found modest but inconsistent benefits on pain, negative affect, and length of stay across 34 trials (Powell et al., 2016), while more recent, intervention-specific meta-analyses report more clearly favourable and, in some cases, sizeable effects: mindfulness-based interventions have shown standardised mean differences of roughly -0.36 for preoperative anxiety and up to -0.89 for postoperative pain at 28 days, and music interventions have shown weighted mean differences exceeding six points on standard anxiety inventories in some surgical populations. A narrower systematic review restricted to relaxation, CBT, mindfulness, narrative medicine, hypnosis and coping-skills training in abdominal and urologic surgery similarly found consistent, if individually modest, benefit across 8 of 9 included trials, without establishing the comparative superiority of any single modality (Villa et al., 2020).

What remains comparatively underdeveloped is head-to-head, comparative evidence: which of these interventions - or which combination - performs best for a given surgical population, and whether findings generated predominantly in high-income, Euro-American and East Asian settings generalise to health systems shaped by different literacy levels, family structures, economic arrangements, and health-seeking behaviour. The available cross-national contrast is instructive: a Tanzanian tertiary-hospital cohort found a comparatively low overall anxiety prevalence of 11.8%, with admission/insurance category - rather than age, sex, education, or surgical unit - the only significant predictor of anxiety (public-sector patients had 7.4 times the odds of insured, executive-category patients; Msoma et al., 2023), while an Indian randomised comparative trial found that multimedia counselling outperformed verbal counselling specifically because of lower health literacy in the study population (Bagle et al., 2024). Only a handful of studies have directly compared intervention modalities within the same sample (e.g., verbal versus multimedia counselling; Bagle et al., 2024; Mehta et

al., 2018), and even fewer have compared psychologically distinct intervention types such as relaxation training versus structured counselling versus mindfulness within the same surgical cohort.

This review was undertaken to consolidate and comparatively synthesise the existing evidence on psychological interventions for surgical stress and anxiety, with particular attention to (a) the relative magnitude of effect across intervention categories, (b) the neuroendocrine and inflammatory mechanisms that plausibly link psychological state to surgical outcome, (c) downstream postoperative outcomes such as pain, delirium, anaesthetic/analgesic consumption, emotional adjustment, and satisfaction, and (d) contextual and cultural factors - including health literacy, economic status, and delivery mode - that may moderate effectiveness and prevalence alike. The review's objectives were to: (1) systematically identify controlled trials and existing systematic reviews/meta-analyses evaluating psychological interventions for, or the clinical consequences of, preoperative stress and anxiety in adult elective surgical patients; (2) compare the relative effectiveness of psychoeducation, relaxation/guided imagery, mindfulness-based interventions, CBT, and music therapy; (3) synthesise evidence on postoperative recovery outcomes, including delirium and anaesthetic consumption, associated with anxiety and with its treatment; (4) examine the generalisability of prevalence and effectiveness findings across high-, middle- and low-income surgical settings; and (5) identify gaps in the evidence base, particularly regarding comparative trials in Indian and other low- and middle-income surgical settings, to inform the design of future comparative intervention research.

Definition of Pre-operative Anxiety

Pre-operative anxiety is a vague, anticipatory emotional state whose source is often diffuse and only partly known to the patient, arising from sympathetic, parasympathetic, and endocrine activation in the period leading up to a planned surgical procedure (Sonani & Dudhamal, 2023). Johnston (1980) was the first to formalise this as a distinct, measurable perioperative construct rather than an incidental accompaniment to illness, and this definitional groundwork underlies most subsequent instrument development, including the Indian scales discussed below.

For the purposes of this review, pre-operative anxiety is defined, consistent with Sonani and Dudhamal (2023) and the American Psychological Association's general definition of anxiety, as a subjective feeling of tension, apprehension, and worried thought, accompanied by physical changes such as raised blood pressure and heart rate, that is triggered by the anticipation of a surgical procedure and its associated uncertainties (anaesthesia, pain, complications, recovery, and dependency on others). Abhishek et al. (2022), reporting from a rural Indian tertiary-care hospital, operationalised this construct through eight discrete worry domains – anaesthesia, the surgical procedure itself, complications, postoperative pain, finance, postoperative hunger, cancellation of surgery, and dependency on family – in their indigenously developed Pravara Preoperative Anxiety Assessment Scale (PPAAS), reflecting a definition grounded specifically in the concerns reported by Indian surgical patients rather than one imported wholesale from Euro-American instruments.

Theoretical Literature: State and Trait Anxiety

Spielberger's distinction between trait anxiety (a stable personality disposition toward anxiety-proneness) and state anxiety (a transient psychological and physiological reaction to a specific threatening situation) remains the dominant theoretical frame for pre-operative anxiety research (Sonani & Dudhamal, 2023). Pre-operative anxiety is conventionally treated as a state phenomenon – it fluctuates with proximity to surgery, typically rising from the day of admission and peaking on entry to the operating room – although trait anxiety has been shown to moderate the intensity of this state response. This state-

trait distinction underlies the State-Trait Anxiety Inventory (STAI) and Amsterdam Preoperative Anxiety and Information Scale (APAIS) findings reported later in this review (Bagle et al., 2024).

Incidence and Prevalence: International and Indian Evidence

Global pooled prevalence estimates cluster around 48–60% (Sonani & Dudhamal, 2023; Shebl et al., 2025), though individual studies range far more widely – from 11.8% in a Tanzanian cohort (Msoma et al., 2023) to 70–80% in parts of Western Europe (Sonani & Dudhamal, 2023). Within India specifically, three sources are of direct relevance to the present review:

- Abhishek et al. (2022), in a rural tertiary-care cohort of 1,021 patients, found that 30% of patients scored ≥ 15 on the PPAAS (indicating clinically significant anxiety), with general surgery patients contributing the largest share (42.3%) and recording the highest departmental average anxiety score (10.1), against a low of 7.07 in ophthalmology.
- Bagle, Yerramshetty, and Garud (2024), in a randomised comparative trial, found that multimedia counselling reduced APAIS anxiety scores more effectively than verbal counselling alone, attributing part of this advantage to comparatively lower health literacy in their Indian study population.
- Mehta, Thomas, and Joseph (2018) and Sharma and Reddy (2021) provide earlier Indian evidence on counselling and guided-imagery interventions respectively, situating the present review within a small but growing Indian evidence base rather than one that is exclusively imported from Euro-American or East Asian literature.

This Indian evidence converges on two points that distinguish it from the higher-income literature reviewed elsewhere in this manuscript: first, health literacy and delivery format (verbal vs. multimedia) emerge as significant moderators of both measured anxiety and intervention effectiveness; second, financial and dependency-related worry (cost, family dependency, hospitalisation) is heavily represented in Indian patients' anxiety profiles (Abhishek et al., 2022) in a way not always captured by STAI-based Euro-American instruments.

Factors Associated with Pre-operative Anxiety (India-Specific)

Drawing on Abhishek et al. (2022), four factors recur in the Indian literature:

- Gender – females reported anxiety at 1.7 times the rate of males, consistent with international findings but attributed by the Indian authors partly to the relatively higher rate of illiteracy among female patients in their rural sample.
- Literacy – illiterate patients showed higher anxiety than literate patients, a finding that directly supports the multimedia-format advantage later reported by Bagle et al. (2024).
- Financial burden – 56.3% of patients expressed anxiety about the cost of surgery, consistent with prior low-and middle-income-country findings.
- Surgical department – general surgery and orthopaedic patients recorded the highest anxiety scores and ophthalmology the lowest, suggesting perceived surgical severity or invasiveness as a driver.

Measurement in the Indian Context

Two points are foregrounded here for the methods and discussion sections that follow. First, the PPAAS (Abhishek et al., 2022) represents a deliberate move toward a culturally grounded Indian instrument, paralleling the argument in Sonani and Dudhamal (2023) that there remains a lack of standard indigenous pre-operative anxiety assessment scales; this is cited here to justify why an Indian-specific or India-adapted instrument, rather than the STAI or APAIS alone, may be warranted in the present author's own Tamil Nadu cardiac and orthopaedic cohort. Second, Bagle et al. (2024) is the strongest same-country precedent for using the APAIS as a comparative outcome measure between intervention formats, and is drawn on again in Section 3.7 when discussing cross-context generalisability alongside Msoma et al. (2023).

METHODS

Protocol and Reporting

This review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) statement (Page et al., 2021). Prospective registration of the full review protocol on PROSPERO is recommended prior to formal execution of the search and is noted here as a planned step rather than a completed one; the present manuscript should be read as a structured evidence synthesis built from an initial representative literature search, to be finalised against a complete, date-stamped multi-database search before journal submission.

Eligibility Criteria (PICOS)

- Population: Adult patients (≥ 18 years) scheduled for elective surgical procedures under general, regional, or local anaesthesia, in any surgical specialty (with particular attention to cardiac, orthopaedic, abdominal, and urologic surgery); paediatric-subgroup data from pooled meta-analyses were retained only where explicitly disaggregated.
- Intervention: Any structured, non-pharmacological psychological intervention - psychoeducation/counselling, relaxation training, guided imagery, mindfulness-based practice, CBT, music therapy, or multicomponent combinations - delivered in the preoperative period.
- Comparator: Standard/usual perioperative care, an attention-control condition, or an alternative psychological intervention (for comparative/head-to-head designs); for predictor/prevalence studies, the comparator was the non-anxious or lower-anxiety patient subgroup.
- Outcomes: Primary - preoperative state anxiety and/or perceived stress, measured using validated instruments (e.g., State-Trait Anxiety Inventory [STAI], Amsterdam Preoperative Anxiety and Information Scale [APAIS], Perceived Stress Scale [PSS], Hamilton Anxiety Scale). Secondary - postoperative pain, cortisol/physiological and inflammatory stress markers, anaesthetic and analgesic consumption, postoperative delirium, recovery/recovery-time indices, emotional adjustment, patient satisfaction, and length of stay.
- Study design: Randomised controlled trials (RCTs), pilot/quasi-experimental trials, prospective observational/predictor studies, and existing systematic reviews or meta-analyses. Case reports, editorials, and conference abstracts without extractable data were excluded.

Information Sources and Search Strategy

The primary databases identified for the full search were PubMed/MEDLINE, Scopus, CINAHL, PsycINFO, Cochrane CENTRAL, and Web of Science, supplemented by manual reference-list screening of retrieved systematic reviews, including two closely related reviews from the same Italian anaesthesiology research group covering abdominal/urologic surgery (Villa et al., 2020) and the neurochemical/metabolic mechanisms of psychological intervention (Lanini et al., 2022), and a 2025 meta-analysis of the clinical consequences of preoperative anxiety (Shebl et al., 2025). Search terms combined controlled vocabulary and free-text keywords across three concept blocks: (1) surgery-related terms ("surgical patients", "preoperative", "perioperative", "elective surgery"); (2) psychological-outcome terms ("anxiety", "stress", "State-Trait Anxiety Inventory", "delirium"); and (3) intervention terms ("psychoeducation", "relaxation", "guided imagery", "mindfulness", "cognitive behavioural therapy", "music therapy", "psychological intervention"), combined using Boolean operators. An initial representative search was conducted covering literature from 1980 to 2026, restricted to English-language, peer-reviewed publications.

Study Selection

Titles and abstracts were to be independently screened by two reviewers against the eligibility criteria, with full-text review of potentially eligible records and disagreements resolved by a third reviewer. The full PRISMA flow diagram (records identified, duplicates removed, records screened, full texts assessed, and studies included) should be completed once the exhaustive multi-database search described in Section 2.3 has been executed; a template structure is provided in Figure 1 for completion.

Data Extraction

A standardised extraction form was used to capture author(s) and year, country, study design and sample size, surgical specialty, intervention and comparator details, outcome measures and time points, and key quantitative findings, including - where reported - biomarker outcomes (cortisol, cytokines, lymphocyte subsets) and downstream clinical outcomes (delirium, anaesthetic/analgesic consumption, recovery time). Extracted data for a representative, chronologically ordered set of included studies are presented in Table 1.

Risk of Bias Assessment

Risk of bias in individual randomised trials was to be appraised using the Cochrane Risk of Bias 2 (RoB 2) tool across five domains: randomisation process, deviations from intended interventions, missing outcome data, outcome measurement, and selective reporting. Prospective observational/predictor studies (e.g., Msoma et al., 2023) were to be appraised using the Newcastle-Ottawa Scale (NOS), consistent with the approach adopted in the Shebl et al. (2025) meta-analysis, in which 17 of 24 included observational studies were rated low risk of bias ($\text{NOS} \geq 7$) and the remaining seven were rated intermediate risk. Existing systematic reviews and meta-analyses included in the synthesis were appraised narratively using AMSTAR-2 criteria where full methodological detail was available.

Data Synthesis

Given the anticipated heterogeneity in intervention protocols, comparators, outcome measures, and study designs (interventional versus observational/predictor), a narrative synthesis was undertaken, with studies grouped by intervention category (psychoeducation, relaxation/guided imagery, mindfulness-based interventions, CBT, music therapy, multicomponent/digital approaches, and underlying neuroendocrine/inflammatory mechanisms) and, within each category,

ordered chronologically to trace the development of the evidence base. Where meta-analytic effect sizes were reported in the primary literature, standardised mean differences (SMD), weighted mean differences (WMD), or odds ratios (OR) with 95% confidence intervals were extracted and reported alongside the narrative synthesis rather than re-pooled, consistent with an umbrella-review approach to the existing quantitative evidence.

RESULTS

Study Selection

An initial representative search identified a substantial and rapidly growing literature base on psychological interventions for surgical stress and anxiety, spanning single-centre RCTs, pilot trials, prospective observational/predictor studies, and both narrative and quantitative (meta-analytic) systematic reviews. Table 1 summarises a representative, chronologically ordered set of studies and reviews retrieved and judged eligible for narrative synthesis, spanning the period 1980-2026 and now including foundational descriptive work (Johnston, 1980; Mitchell, 2003), mechanistic/biomarker-focused reviews (Lanini et al., 2022; Villa et al., 2020), a low- and middle-income-country prevalence study (Msoma et al., 2023), and a large multi-outcome meta-analysis of the clinical consequences of anxiety (Shebl et al., 2025). As noted in Section 2.4, the complete PRISMA flow diagram with exact counts of records identified, screened, excluded, and included should be finalised once the full multi-database search is executed and documented; the structure below (Figure 1) indicates the reporting format to be completed.

Figure 1 (PRISMA 2020 flow diagram - template). Identification: records identified through database searching (n = [to be completed]) and other sources (n = [to be completed]); duplicates removed (n = [to be completed]). Screening: records screened (n = [to be completed]); records excluded (n = [to be completed]). Eligibility: full-text articles assessed for eligibility (n = [to be completed]); full-text articles excluded, with reasons (n = [to be completed]). Included: studies included in qualitative synthesis (n = [to be completed]); studies included in quantitative synthesis, if pooled (n = [to be completed]).

Characteristics of Included Studies

The included body of evidence now spans a wider range of countries (UK, USA, Denmark, Thailand, Taiwan, New Zealand, Iran, China, Brazil, Italy, Iceland, Greece, France, Tanzania, and India, alongside pooled multi-country meta-analyses), surgical specialties (bariatric, cardiac, orthopaedic, gynaecological, ophthalmic, spinal, sinus, urologic, and general abdominal surgery), and study designs (single-centre RCTs, pilot RCTs, prospective observational/predictor studies, and systematic reviews/meta-analyses). Sample sizes for individual RCTs ranged from small pilot trials (n = 24-40) to larger pooled meta-analytic samples exceeding 3,000 participants (Shebl et al., 2025). Table 1 presents a representative, year-ordered selection of these studies, from Johnston's (1980) foundational descriptive account to the 2026 Solomon four-group trial.

Table 1: Representative Studies and Reviews on Psychological Interventions for Surgical Stress and Anxiety, Arranged Chronologically (1980-2026)

Year	Author (Year)	Country	Design / N	Surgery Type	Intervention vs. Comparator	Key Finding (Anxiety/Stress/Outcome)
1980	Johnston (1980)	UK	Narrative review	Mixed elective surgery	Descriptive study of preoperative fear	Established anxiety as a measurable perioperative phenomenon; foundational to later instrument development (e.g., STAI).
2000	Kehlet (2000)	Denmark	Narrative review	Mixed elective surgery	Manipulation of the metabolic stress response vs standard care	Articulated the pathophysiological rationale (neuroendocrine/metabolic stress response) later used to justify non-pharmacological perioperative interventions.
2003	Mitchell (2003)	UK	Literature review, 34 studies, n=3,754	Modern day-case / intermediate elective surgery	Anxiolytic pre-medication and distraction (music, television, relaxation) vs usual care	Prevalence of pre-operative anxiety was substantial across in-patient and day-case settings; distraction techniques showed inconsistent, patient-choice-dependent benefit; anaesthetist visits and premedication reduced anxiety more reliably than distraction alone.
2004	Rosenberger et al. (2004), cited in Lanini et al. (2022)	USA	RCT	Knee arthroscopic surgery	Active vs avoidant coping strategies	Active coping was associated with greater cortisol reduction and lower pain (West Haven-Yale Multidimensional Pain Inventory) at 1 and 24 weeks post-surgery.
2004	Roykulcharoen et al. (2004)	Thailand	RCT, n=102	Abdominal surgery	Systematic relaxation vs usual care	Relaxation group had significantly less postoperative pain sensation/distress (VAS reduction 56% vs 5%, p<.001) and lower anxiety.
2005	Lin & Wang (2005)	Taiwan	RCT, n=62	Abdominal surgery	Preoperative coping-skills nursing intervention vs usual care	Coping group showed significantly lower preoperative anxiety and lower first-day pain intensity than controls.
2006	Kwekkeboom & Gretarsdottir (2006)	USA	Systematic review	Mixed adult surgery	Relaxation interventions vs usual care	Relaxation training reliably reduced self-reported anxiety across trials; effects on postoperative pain were more variable.
2009	Thornton et al. (2009), cited in Lanini et al. (2022)	USA	RCT, n=45	Breast cancer surgery	Relaxation techniques + coping strategies vs usual care	Reduced depressive symptoms, pain and fatigue, with parallel improvement in inflammatory markers (CD3+, CD4+, CD8+, neutrophil count).

2010	Good et al. (2010)	USA	RCT, n=517	Abdominal surgery	Relaxation and music vs usual care	Perioperative relaxation significantly reduced pain on postoperative days 1-2 (VAS reduction 24-25%).
2012	Broadbent et al. (2012)	New Zealand	RCT, n=60	Laparoscopic cholecystectomy	Relaxation therapy vs usual care	Greater reduction in anxiety/perceived stress from pre-intervention to 7-day follow-up (PSS reduction 2.5 vs 0.5, $p<.05$); higher wound hydroxyproline deposition.
2013	Rejeh et al. (2013)	Iran	RCT, n=124	Abdominal surgery (older adults)	Relaxation therapy vs usual care	Lower pain (VAS 1.9 vs 3.6), anxiety (2.5 vs 3.7) and analgesic requirement than controls ($p<.001-.04$).
2016	Zhao et al. (2016), cited in Lanini et al. (2022)	China	RCT	Lung resection	Relaxation techniques vs usual care	Lower VAS pain (2.7 vs 4.2) and favourable shifts in CD3+/CD4+ lymphocyte subsets and cortisol vs control.
2016	Javadi Zaher, Vafaei & Ebrahimi Abianeh (2016)	Iran	Descriptive-comparative, n=220 nurses	Critical care vs internal-surgical units (nursing staff)	Cross-sectional DASS-42 comparison by workplace (context, not a patient intervention study)	Depression and stress were significantly higher among critical-care than surgical-ward nurses ($p=.002, .001$); anxiety did not differ by unit - illustrates the wider psychosocial climate of surgical care environments in which patient-directed interventions are delivered.
2015-16	Hansen (2015/16)	Iceland	RCT, n=105	Abdominal and urological day surgery	Mobile-delivered complementary therapies vs usual care	No statistically significant reduction in postoperative anxiety or pain, illustrating inconsistent effect for lower-intensity, technology-delivered interventions.
2016	Powell et al. (2016, Cochrane)	Multiple (pooled)	Cochrane systematic review, 34 RCTs	General anaesthesia, mixed surgery	Psychological preparation (information, relaxation, cognitive, hypnosis) vs usual care	Modest, inconsistent benefits on pain, negative affect and length of stay; certainty of evidence rated low-to-moderate.
2017	Hosseini et al. (2017, protocol)	Iran	4-arm RCT (protocol)	Coronary artery bypass graft (CABG)	Religious CBT vs CBT vs sertraline vs usual care	Protocol comparing structured psychotherapy and pharmacotherapy for post-CABG anxiety/depression.
2018	Mehta et al. (2018)	India	Comparative study	Mixed elective surgery	Preoperative psychological counselling vs usual care	Preoperative counselling associated with improved post-surgical outcomes relative to usual care.
2018	Felix et al. (2018)	Brazil	Triple-blind RCT, n=24-26	Video-laparoscopic bariatric surgery	Guided imagery relaxation vs standard care	Significant reduction in STAI state-anxiety ($p=.005$) and serum cortisol (9.9 to 7.9 micrograms/dL, $p<.001$) vs control.

2020	Mirmahmoodi et al. (2020), cited in Lanini et al. (2022)	Iran	RCT	Breast cancer surgery	Mindfulness vs usual care	Anxiety score fell from 31.2 to 23.5 in the mindfulness group vs a rise from 25.4 to 35.0 in controls ($p < .05$ between groups); parallel cortisol/CRP changes.
2020	Villa et al. (2020)	Italy (multi-country pooled)	Systematic review, 9 studies, $n=1,126$	Major elective abdominal / urologic surgery	Relaxation, CBT, mindfulness, narrative medicine, hypnosis, coping-skills training vs control	Interventions were technically feasible perioperatively and produced consistent anxiety and/or pain reductions in 8 of 9 studies; comparative superiority of one modality was not established.
2021	Yang et al. (2021)	China	RCT, $n=100$	Functional endoscopic sinus surgery	Computer-assisted CBT vs usual care	Lower state-anxiety and postoperative insomnia scores; reduced cortisol reactivity in the cCBT group.
2021	Patiyal et al. (2021)	Multiple (pooled)	Meta-analysis, 10 RCTs, $n=778$	Orthopaedic surgery	Music therapy vs standard care	SMD -0.40 ($p=.0009$) for anxiety; SMD -0.27 ($p=.002$) for pain.
2021	Guerrier et al. (2021)	France	RCT	Cataract surgery	Preoperative music intervention vs control	Significant reduction in preoperative anxiety and pain scores.
2022	Feninets et al. (2022)	Greece	Pilot RCT, $n=40$	Spinal decompression surgery	Structured nursing education (oral + leaflet) vs usual care	Lower STAI-state and APAIS anxiety scores in the education group at first postoperative assessment.
2022	Lanini et al. (2022)	Italy	Systematic review, 5 studies	Knee arthroscopy, breast cancer, lung resection, bariatric surgery (pooled)	Coping strategies, relaxation, mindfulness vs control	Synthesised neurochemical/metabolic-stress-response evidence: interventions were consistently linked to favourable cortisol, lymphocyte-subset and inflammatory-marker shifts alongside improved pain/anxiety outcomes.
2023	Msoma et al. (2023)	Tanzania	Prospective descriptive-analytical, $n=169$	General surgery and urology (elective)	No intervention - prevalence/predictor study using APAIS	Overall pre-operative anxiety prevalence 11.8% (markedly lower than most Euro-American estimates); information-related anxiety most prevalent (80.5% moderate-severe); admission/insurance category was the only significant predictor (public AOR 7.4; private cash-paying AOR 5.6).
2024	Bagle et al. (2024)	India	RCT, $n=90$	Elective surgery (mixed)	Verbal vs multimedia preoperative counselling	Multimedia counselling produced greater reduction in APAIS anxiety scores than verbal counselling alone, partly attributed to lower health literacy in the study population.

2024	Tung et al. (2024, J. Psychosomatic Research)	Multiple (pooled)	Meta-analysis of RCTs	Mixed elective surgery	Preoperative mindfulness-based intervention vs control	SMD -0.36 for preoperative anxiety; SMD -0.65 to -0.89 for postoperative pain across follow-up points.
2024	Verhoeven et al. (2024, Current Anesthesiology Reports)	Multiple (pooled)	PRISMA systematic review, 5 RCTs, n=337	Mixed elective surgery	Unimodal non-pharmacological prehabilitation vs control	Significant preoperative anxiety reduction in 3 of 5 trials.
2025	Yang et al. (2025, PLOS ONE)	Multiple (pooled)	Meta-analysis of RCTs	Gynaecological surgery	Perioperative music listening vs no music	WMD -6.78 (95% CI -7.54 to -6.03) for preoperative anxiety scores.
2025	Shebl et al. (2025)	Multiple (pooled, 24 studies)	Systematic review and meta-analysis, n=3,388	Mixed elective/emergency surgery (adult and paediatric)	Anxious vs non-anxious patients (predictor evidence, not an intervention trial)	Anxiety was associated with increased anaesthetic (SMD 0.67) and analgesic (SMD 0.89-1.02) requirements, higher odds of adult postoperative delirium (OR 1.89 overall; OR 2.03 in adults), and prolonged recovery (Modified Aldrete Score-9 MD 1.83 min; extubation MD 2.50 min); no significant pooled association with postoperative pain.
2026	Saray Kılıç et al. (2026, BMC Psychology)	Türkiye	RCT, n=68	Inguinal hernia repair	Mindfulness-based preoperative education vs standard education	Lower postoperative fear-of-pain and cognitive-intrusion scores in the mindfulness group.

Risk of Bias

Across the primary trials identified, common methodological limitations included small single-centre samples, inconsistent blinding of outcome assessors (particularly for subjective anxiety measures), and variable reporting of allocation concealment. Several of the larger meta-analyses (e.g., the mindfulness-based intervention meta-analysis and the music-therapy meta-analyses in gynaecological and orthopaedic surgery) applied formal risk-of-bias frameworks such as the Cochrane RoB 2 tool or the modified Jadad scale and generally rated the certainty of evidence as low to moderate, chiefly due to performance and detection bias inherent to non-blinded behavioural interventions. The Cochrane review of psychological preparation for general anaesthesia (Powell et al., 2016) similarly rated most included trials as being at unclear or high risk of bias, contributing to the modest and inconsistent pooled effects reported. Among the predictor/observational literature, the 2025 meta-analysis of anxiety's clinical consequences applied the Newcastle-Ottawa Scale to its 24 constituent studies, rating 17 as low risk and the remaining 7 as intermediate risk (Shebl et al., 2025); the single Tanzanian prevalence study included in the present synthesis (Msoma et al., 2023) was a prospective, non-randomised descriptive-analytical study and was therefore appraised narratively rather than via RoB 2, consistent with its observational rather than interventional design.

Synthesis by Intervention Category

Psychoeducation and Preoperative Counselling

Structured preoperative education - delivered verbally, through leaflets, or via multimedia/audiovisual formats - was among the most widely studied interventions, and among the longest-standing. Mitchell's (2003) review of 34 studies (1990-2002, 3,754 patients) found that information-related interventions and dedicated anaesthetist visits reduced anxiety more reliably than distraction-based approaches alone, and identified female sex, novice (first-time) surgical status, and reduced preoperative information provision as recurring correlates of higher anxiety - a pattern that anticipated the later, more granular predictor analyses conducted in Tanzania (Msoma et al., 2023) and India (Bagle et al., 2024). A subsequent scoping review of nine studies (1,670 patients) found consistent, though variable, reductions in anxiety following educational intervention, with effectiveness dependent on the delivery format. An earlier systematic review of 14 trials (1,752 participants) similarly found that eight of 14 trials demonstrated statistically significant reductions in preoperative anxiety following educational intervention, with audiovisual and multimedia-supported formats generally outperforming verbal-only or leaflet-only education. In the Indian context, a randomised comparative trial found multimedia counselling more effective than verbal counselling alone in reducing APAIS anxiety scores, explicitly attributing part of this advantage to lower health literacy in the study population, which limited comprehension of verbal-only explanations of anaesthetic procedures (Bagle et al., 2024). A pilot RCT in spinal decompression surgery similarly found lower state-anxiety and APAIS scores following a brief structured nursing education session compared with usual care (Feninets et al., 2022). By contrast, information-related anxiety was found to be the most prevalent anxiety subtype (80.5% moderate-to-severe) in the Tanzanian cohort, exceeding both surgery-related (26%) and anaesthesia-related (17.2%) anxiety, reinforcing psychoeducation's continued relevance even in a setting with comparatively low overall anxiety prevalence (Msoma et al., 2023).

Relaxation Techniques and Guided Imagery

Relaxation-based interventions, including progressive muscle relaxation and guided imagery, showed consistent benefit across the identified trials and across four decades of study. Roykulcharoen et al. (2004) demonstrated that systematic relaxation reduced postoperative pain sensation and distress by 56% versus 5% in controls ($n = 102$, abdominal surgery), while Good et al. (2010, $n = 517$) found a 24-25% reduction in postoperative pain scores with relaxation and music. Rejeh et al. (2013, $n = 124$, older adults) reported significantly lower pain, anxiety, and analgesic requirement with relaxation training. A triple-blind RCT in bariatric surgery patients found that guided imagery relaxation therapy produced a statistically significant reduction in both STAI state-anxiety scores ($p = .005$) and serum cortisol levels (falling from 9.9 to 7.9 micrograms/dL, $p < .001$) relative to standard care (Felix et al., 2018) - a finding corroborated within the Lanini et al. (2022) mechanistic synthesis, which additionally reported that Zhao et al.'s (2016) relaxation trial in lung resection patients produced lower VAS pain scores (2.7 vs 4.2) alongside favourable shifts in CD3+ and CD4+ lymphocyte subpopulations, and that Rosenberger et al.'s (2004) comparison of active versus avoidant coping strategies in knee arthroscopy patients found active coping associated with greater cortisol reduction and lower pain on the West Haven-Yale Multidimensional Pain Inventory at both 1 and 24 weeks post-surgery. An earlier systematic review of relaxation interventions for pain and anxiety in adult surgical patients similarly concluded that relaxation training reliably reduced self-reported anxiety, with more variable effects on postoperative pain (Kwekkeboom & Gretarsdottir, 2006). A brief relaxation intervention has also been shown to reduce physiological stress markers and measurably improve surgical wound-healing response (higher

wound hydroxyproline deposition), providing biological plausibility for the broader claim that psychological intervention influences surgical recovery through neuroendocrine and immune pathways (Broadbent et al., 2012; Gouin & Kiecolt-Glaser, 2011).

Mindfulness-Based Interventions

Mindfulness-based interventions (MBIs) - including brief mindfulness education, mindful breathing, and structured mindfulness-based stress reduction protocols - showed some of the more robust quantitative effects identified in this review. A meta-analysis of RCTs in patients undergoing elective surgery reported a statistically significant reduction in preoperative anxiety (SMD = -0.36, 95% CI -0.62 to -0.11) and in postoperative pain at multiple follow-up points, with the largest effect at 28 days postoperatively (SMD = -0.89). Within the Lanini et al. (2022) synthesis, Mirmahmoodi et al.'s (2020) trial in breast cancer surgery patients found that the mindfulness group's anxiety score fell from 31.2 to 23.5, versus a rise from 25.4 to 35.0 in the control group ($p < .05$ between groups), with parallel, favourable shifts in cortisol and C-reactive protein. A Solomon four-group RCT in inguinal hernia repair patients (Saray Kılıç et al., 2026) found that mindfulness-based preoperative education was associated with a significant pre-to-post reduction in cognitive intrusion of pain in the pretested experimental group relative to the pretested control group ($p = .005$, $r = .49$), but posttest-only comparisons across all four groups showed no statistically significant differences in cognitive intrusion or fear-of-pain scores; the authors themselves characterise the pretest-independence hypothesis as only partially supported and urge cautious interpretation. Broader meta-analytic evidence for mindfulness-based and acceptance-based interventions in clinically anxious populations (not specific to surgery) similarly supports moderate effect sizes for anxiety symptom reduction, lending convergent support to the surgical-specific findings (Haller et al., 2021).

Cognitive-Behavioural Therapy (CBT)

CBT-based interventions were most extensively studied in cardiac and bariatric surgical populations, where preoperative psychological distress is common and often clinically significant. A four-arm randomised trial protocol compared religious CBT, standard CBT, sertraline, and usual care in patients following coronary artery bypass graft (CABG) surgery, reflecting the clinical seriousness with which structured psychotherapy is regarded in this population (Hosseini et al., 2017). A computer-assisted CBT (cCBT) programme delivered before functional endoscopic sinus surgery significantly reduced state-anxiety scores and post-operative insomnia relative to usual care, alongside reduced cortisol reactivity, suggesting a measurable psychobiological effect. In bariatric surgery, ten-week preoperative CBT programmes produced short-term improvements in affective symptoms and disordered-eating behaviour, although benefits relative to usual care were not consistently sustained at one-year follow-up, indicating that CBT's advantage may be most pronounced in the immediate perioperative window rather than in longer-term postoperative adjustment.

Music Therapy

Music-based interventions produced some of the largest and most consistent effect sizes identified in this review, likely reflecting their low burden of implementation and broad applicability across surgical specialties. A meta-analysis in gynaecological surgery reported a weighted mean difference of -6.78 (95% CI -7.54 to -6.03) for preoperative anxiety following perioperative music listening. A meta-analysis of ten RCTs in orthopaedic surgery (778 patients) found significant reductions in both anxiety (SMD = -0.40, $p = .0009$) and pain (SMD = -0.27, $p = .002$). Similar benefits were reported in cataract surgery (Guerrier et al., 2021) and were corroborated by an umbrella review of systematic reviews, which concluded that music intervention has a consistent beneficial effect on preoperative anxiety across adult surgical

populations. The consistency of these findings across surgical specialties, patient populations, and cultural settings makes music therapy among the more generalisable interventions identified in this synthesis.

Multicomponent and Broader Psychological Preparation

The largest and most methodologically rigorous synthesis identified - the Cochrane review of psychological preparation for adults undergoing surgery under general anaesthesia, encompassing 34 trials of information-giving, relaxation, cognitive, hypnotic, and emotion-focused interventions - found modest and inconsistent benefits on pain, negative affect, and length of hospital stay, with the overall quality of evidence rated low to moderate (Powell et al., 2016). Villa et al.'s (2020) more narrowly focused systematic review of nine studies (1,126 patients) in abdominal and urologic surgery reached a similar conclusion: relaxation techniques, CBT, mindfulness, narrative medicine, hypnosis, and coping-skills training were all technically feasible perioperatively and were associated with improved anxiety and/or pain outcomes in most (but not all) trials, yet no single modality emerged as comparatively superior. This tempers the more optimistic single-intervention findings above: while individual well-conducted trials of mindfulness, music, or relaxation therapy show clear benefit, pooling across the full heterogeneous landscape of "psychological preparation" narrows the apparent effect, underscoring the importance of the present review's comparative, intervention-specific approach rather than treating psychological preparation as a single undifferentiated category.

Neuroendocrine and Inflammatory Mechanisms Underlying Intervention Effects

A distinct but complementary strand of evidence, synthesised most systematically by Lanini et al. (2022) and Villa et al. (2020), traces the biological pathway through which psychological intervention is thought to influence surgical outcome. The metabolic surgical stress response is sustained by trauma-induced activation of neuroendocrine pathways (increased secretion of epinephrine, cortisol, glucagon, growth hormone, and arginine-vasopressin via the hypothalamic-pituitary-adrenal axis) and by inflammatory mediators including cytokines, complement, and free oxygen radicals; an amplified or prolonged version of this response can overwhelm organ functional reserve and precipitate postoperative complications. Lanini et al.'s (2022) synthesis of five mechanistic studies found that psychological interventions were consistently associated with increased secretion of inhibiting hypothalamic hormones (e.g., somatostatin, dopamine) and decreased secretion of releasing hormones (thyrotropin- and corticotropin-releasing hormones, growth-hormone-releasing factor), with corresponding decreases in cortisol and increases in beta-endorphins across the included trials (Felix et al., 2018; Mirmahmoodi et al., 2020; Rosenberger et al., 2004; Thornton et al., 2009; Zhao et al., 2016). Complementary evidence from Villa et al.'s (2020) abdominal/urologic-surgery review linked psychological stress to reduced natural killer cell cytotoxicity, suppressed lymphocyte proliferation, and impaired wound repair via reduced tissue interleukin-1 and matrix metalloproteinase-9, with relaxation-treated patients in one trial showing measurably higher wound hydroxyproline deposition than controls (Broadbent et al., 2012). Together, this mechanistic layer provides biological plausibility for the clinical-outcome findings summarised in Section 3.6, and reframes psychological intervention not merely as a comfort measure but as a modulator of the same physiological pathways targeted by "enhanced recovery after surgery" protocols.

Comparative Effectiveness Across Intervention Categories

Drawing the intervention-specific findings together, three patterns emerge. First, interventions requiring minimal patient effort and literacy - music listening and guided imagery - showed the most consistent and, in several meta-analyses, the largest standardised effect sizes on preoperative anxiety, likely reflecting both genuine efficacy and ease of implementation across diverse patient populations. Second, mindfulness-based and CBT-based interventions showed strong effects where

delivered with adequate structure and session length, but demonstrated more variable durability, with some CBT benefits attenuating by one-year follow-up. Third, psychoeducation and counselling interventions showed the most context-dependent effectiveness, with delivery mode - verbal versus multimedia/audiovisual - moderating outcomes substantially, particularly in lower-literacy populations such as those studied in Indian settings (Bagle et al., 2024; Mehta et al., 2018), a pattern first flagged descriptively by Mitchell (2003) two decades earlier. No single intervention emerged as unequivocally superior across all surgical populations and outcome measures; rather, the evidence suggests that intervention choice should be matched to patient literacy, cultural and economic context (Msoma et al., 2023), and the practical constraints of the surgical care pathway, with multicomponent approaches - combining, for example, culturally adapted psychoeducation with a brief relaxation or mindfulness component - offering the most promising direction for future comparative trials.

Postoperative and Downstream Clinical Outcomes

Evidence on downstream postoperative outcomes was more heterogeneous than for preoperative anxiety itself. Reductions in postoperative pain were reported following mindfulness-based intervention, music therapy, and guided imagery/relaxation training, with mindfulness showing the largest and most durable pain-related effect sizes among the interventions reviewed. Evidence on length of hospital stay and broader recovery indicators remained inconsistent at the pooled level (Powell et al., 2016). A substantially larger evidence base on the clinical consequences of anxiety itself as distinct from the effects of intervention - was provided by a 2025 meta-analysis of 24 studies (3,388 patients), which found that preoperative anxiety was significantly associated with increased anaesthetic drug requirements (SMD = 0.67, 95% CI 0.32-1.01) and analgesic requirements (SMD = 0.89-1.02), a significantly increased time to reach a Modified Aldrete Score of 9 (mean difference = 1.83 minutes) and delayed extubation (mean difference = 2.50 minutes), and a positive correlation between state anxiety and propofol consumption ($r = 0.35-0.43$) (Shebl et al., 2025). In the adult subgroup, anxious patients had more than double the odds of postoperative delirium relative to non-anxious patients (OR = 2.03, 95% CI 1.49-2.76), although this association was not significant in the smaller paediatric subgroup (OR = 1.42, 95% CI 0.22-9.09), possibly reflecting differences in neuroplasticity, anxiety measurement, or the confounding effect of minor versus major procedure type (Shebl et al., 2025). Notably, this same meta-analysis found no significant pooled association between preoperative anxiety and postoperative pain - a finding that sits in apparent tension with the trial-level pain benefits reported for mindfulness and music-based interventions above, and is addressed further in Section 4. Taken together, this body of evidence suggests that while psychological interventions reliably reduce subjective distress and, in several trials, postoperative pain, the strongest and most consistent "hard" clinical signal associated with unmanaged anxiety is not pain but delirium, anaesthetic/analgesic consumption, and delayed recovery outcomes that carry direct implications for anaesthetic dosing, post-anaesthesia care unit throughput, and healthcare cost.

Generalisability Across Health-System and Cultural Contexts

A recurring theme across the included literature is that both the prevalence of preoperative anxiety and the relative effectiveness of intervention format vary by health-system and cultural context. The Tanzanian cohort (Msoma et al., 2023) recorded an overall anxiety prevalence of 11.8% - markedly lower than the 40-90% range typically cited in Euro-American literature - a difference the study's authors attributed partly to the high proportion of patients with prior surgical experience (63.3%, a factor previously associated with lower anxiety) and to the role of shared religious affiliation and prayer as a culturally available coping resource. Within that cohort, information-related anxiety was disproportionately high (80.5% moderate-to-severe) relative to surgery- or anaesthesia-related anxiety, and admission/insurance category -

rather than age, sex, education, or prior surgical history - was the only statistically significant predictor of anxiety, with public-sector and private cash-paying patients carrying 7.4 and 5.6 times the odds of anxiety, respectively, relative to privately insured, executive-category patients (Msoma et al., 2023). This economic gradient parallels, in a different domain, the health-literacy gradient identified in the Indian trial of Bagle et al. (2024), in which multimedia counselling outperformed verbal counselling specifically because it compensated for lower baseline health literacy. Read together, these two low- and middle-income-country studies suggest that the moderators of both anxiety prevalence and intervention effectiveness in resource-constrained settings may differ qualitatively from those emphasised in high-income literature (which has focused more heavily on personality traits, novice-patient status, and procedure type; Mitchell, 2003) - pointing toward economic access to information and care, rather than psychological trait variables alone, as an underexplored but potentially modifiable target for intervention design in such settings.

DISCUSSION

This review synthesised evidence on the comparative effectiveness of psychological interventions for stress and anxiety in surgical patients, drawing on primary trials and existing systematic reviews spanning psychoeducation, relaxation/guided imagery, mindfulness-based interventions, CBT, and music therapy, and extending the evidence base to include the underlying neuroendocrine/inflammatory mechanisms (Lanini et al., 2022; Villa et al., 2020) and the downstream clinical consequences of unmanaged anxiety (Shebl et al., 2025). Across intervention categories, active psychological intervention consistently outperformed standard perioperative care in reducing preoperative anxiety, with effect sizes generally in the small-to-moderate range and, for music-based and mindfulness-based interventions specifically, occasionally reaching the moderate-to-large range. These findings are broadly consistent with the biopsychosocial understanding of surgical stress articulated by Gouin and Kiecolt-Glaser (2011) and Kehlet (2000): psychological state is not merely a subjective accompaniment to surgery but is mechanistically linked, via the hypothalamic-pituitary-adrenal axis and autonomic nervous system, to measurable physiological outcomes including cortisol reactivity, cytokine expression, and wound-healing response.

The 2025 meta-analysis of anxiety's clinical consequences (Shebl et al., 2025) meaningfully sharpens the clinical case for intervention: rather than anxiety being framed only as a source of patient discomfort, it is now associated, at a pooled level, with objectively verifiable adverse events - increased anaesthetic and analgesic consumption, prolonged recovery, and, in adults, close to double the odds of postoperative delirium. This reframing has direct implications for anaesthetic and perioperative-nursing practice: routine, low-cost anxiety screening (e.g., using the APAIS or a short-form STAI) could plausibly be positioned alongside, rather than as an adjunct to, existing preoperative risk-stratification tools. At the same time, the absence of a significant pooled association between anxiety and postoperative pain in that same meta-analysis sits in tension with the trial-level pain benefits reported here for mindfulness-based intervention (SMD up to - 0.89 at 28 days) and music therapy (SMD -0.27). One plausible reconciliation is that the pain benefit observed in intervention trials may arise from active elements of the intervention itself (e.g., attentional redirection, endogenous opioid release, or reduced catastrophising) rather than from anxiety reduction per se; if so, anxiety level alone may be a poor proxy for who will benefit most from a pain-focused psychological intervention, and future trials should measure pain-relevant mediators (e.g., pain catastrophising, fear-avoidance beliefs) directly rather than assuming anxiety reduction is the active mechanism.

Clinically, the evidence supports the feasibility of integrating brief, low-cost psychological interventions into routine perioperative pathways. Music listening and guided imagery, in particular, require minimal staff training, impose negligible additional cost, and were among the most consistently effective interventions identified - an important consideration for resource-constrained health systems such as those in India, where the present author's own doctoral research is situated, and in Tanzania, where Msoma et al. (2023) documented a distinct anxiety profile dominated by information-related rather than procedure-related fear. The comparative advantage of multimedia over purely verbal psychoeducation in the Indian trial identified (Bagle et al., 2024) is particularly salient: it suggests that intervention format, not merely intervention content, substantially shapes effectiveness in populations with variable health literacy, and reinforces the rationale for context-specific, rather than directly imported, intervention design in Indian and other low- and middle-income surgical settings. The finding that admission/insurance category, rather than age, sex, or education, was the sole significant anxiety predictor in the Tanzanian cohort (Msoma et al., 2023) further suggests that structural, economic determinants of anxiety may be as important as psychological trait variables in such settings, and may require intervention strategies (e.g., ensuring equitable information provision regardless of payer category) that differ from those emphasised in high-income literature.

At the same time, the modest and inconsistent pooled effects reported in the largest, most methodologically rigorous synthesis available - the Cochrane review of psychological preparation (Powell et al., 2016) and, similarly, Villa et al.'s (2020) more focused review of abdominal/urologic surgery - caution against overstating the certainty of benefit when psychological interventions are considered collectively rather than by specific type. This review's intervention-specific, comparative approach addresses that limitation directly, and its findings, reinforced by the mechanistic detail supplied by Lanini et al. (2022), suggest that future research and clinical implementation would benefit from treating "psychological intervention" not as a single undifferentiated category but as a family of distinct techniques with different mechanisms, resource requirements, and moderators of effectiveness.

It is also worth situating this patient-focused literature within the broader psychosocial ecosystem of the surgical care environment. A Tehran-based comparative study of nurses working in critical care versus internal-surgical units found significantly higher depression and stress (though not anxiety) among critical-care nurses (Javadi Zaher et al., 2016). While this evidence concerns staff rather than patients and therefore falls outside the direct scope of the present review's intervention comparisons, it is a useful reminder that psychological interventions for surgical patients are delivered by a nursing and anaesthesia workforce that is itself subject to considerable occupational stress; the feasibility and fidelity of any low-cost, nurse-delivered intervention (such as the structured education studied by Feninets et al., 2022, or the relaxation training studied by Rejeh et al., 2013) may in practice depend on the wellbeing and workload of the staff delivering it, a contextual factor that is rarely measured in surgical-patient intervention trials and represents a further avenue for future research.

The relative scarcity of head-to-head comparative trials - studies directly randomising surgical patients to two or more distinct psychological interventions within the same population, rather than comparing a single intervention against usual care - represents the most significant gap identified in this review. Most of the comparative evidence currently available compares delivery formats within a single intervention type (e.g., verbal versus multimedia counselling) rather than comparing fundamentally different intervention types (e.g., relaxation training versus structured counselling versus mindfulness-based practice) against one another. This gap directly motivates the need for comparative, adequately powered trials of the kind proposed in the author's own doctoral research examining psychoeducation, relaxation techniques, guided

imagery, and mindfulness-based practices among elective cardiac and orthopaedic surgical patients in the Kanyakumari district of Tamil Nadu, India.

LIMITATIONS

- The present synthesis was built from an initial representative literature search rather than an exhaustive, date-stamped, multi-database search with duplicate-independent screening by two reviewers; the full PRISMA flow diagram and final reference list should be completed and verified against Scopus, PubMed, CINAHL, and PsycINFO records before journal submission.
- Marked heterogeneity in intervention protocols, comparator conditions, outcome measures, and follow-up time points across the included literature precluded formal meta-analytic pooling; effect sizes reported here are drawn from the primary studies' own analyses rather than independently re-calculated.
- The evidence base mixes interventional (RCT) and observational/predictor study designs (e.g., Msoma et al., 2023; Shebl et al., 2025); associations reported in the latter (e.g., between anxiety and delirium or anaesthetic consumption) describe correlation rather than the causal effect of a specific intervention, and should not be interpreted as equivalent in evidentiary strength to the randomised intervention trials summarised elsewhere in this review.
- The review was restricted to English-language publications, which may have excluded relevant regional-language literature, particularly from Indian, East African, and other South Asian and Sub-Saharan African sources.
- Several included trials had small sample sizes and single-centre designs, limiting generalisability; publication bias favouring positive findings cannot be excluded, particularly in the complementary and mind-body intervention literature.
- Direct comparative (head-to-head) trials of multiple psychological intervention types within a single surgical population remain rare, limiting the strength of conclusions about the relative superiority of one intervention category over another.
- Only one low-income East African setting (Tanzania) and one South Asian setting (India) were represented in the country-level comparative discussion (Section 3.7); broader multi-country replication is needed before firm conclusions can be drawn about how economic and cultural context moderates anxiety prevalence and intervention effectiveness.

CONCLUSION

Structured psychological interventions - psychoeducation, relaxation and guided imagery, mindfulness-based practices, cognitive-behavioural therapy, and music therapy - produce consistent, measurable reductions in preoperative stress and anxiety among adult surgical patients, with music-based and mindfulness-based approaches showing the most robust effect sizes and guided imagery and relaxation training additionally demonstrating favourable effects on physiological stress markers such as cortisol, lymphocyte subsets, and wound-healing biomarkers (Lanini et al., 2022; Villa et al., 2020). The clinical stakes of leaving this anxiety unaddressed are now better quantified than previously understood: a 2025 meta-analysis linking preoperative anxiety to increased anaesthetic and analgesic consumption, prolonged recovery, and close to double the odds of postoperative delirium in adults (Shebl et al., 2025) elevates psychological screening and intervention

from a comfort-oriented adjunct to a measurable patient-safety concern. Evidence on downstream postoperative pain and length of stay remains more heterogeneous and warrants further investigation, particularly given the apparent disconnect between anxiety-outcome meta-analyses and intervention-specific pain findings. Importantly, both the prevalence of anxiety and intervention effectiveness appear to be moderated by delivery format, health literacy, and economic/insurance context, with multimedia and culturally adapted approaches outperforming purely verbal methods in lower-literacy populations, and with structural/economic factors emerging as significant predictors of anxiety in at least one low-income setting (Msoma et al., 2023). The relative scarcity of comparative, head-to-head trials evaluating multiple psychological intervention types within the same surgical population - particularly in the Indian and wider low- and middle-income context - represents the principal gap in the current evidence base, and directly supports the case for comparative empirical research of the kind proposed in the author's ongoing doctoral study.

REFERENCES

1. Abhishek, H. N., Shah, C. D., Acharya, K., Roma, J., Garg, R., Nidhal, S. M., & Shetti, A. N. (2022). Evaluation of preoperative anxiety among surgical patients in Indian tertiary care hospital. *Clinical Schizophrenia & Related Psychoses*, 17S2, 100146. <https://doi.org/10.3371/CSRP.17.S2.100146>
2. Dietzel, J., Cummings, M., Hua, K., Hahnenkamp, K., Brinkhaus, B., & Usichenko, T. I. (2020). Auricular acupuncture for preoperative anxiety—Protocol of systematic review and meta-analysis of randomized controlled trials. *Medicines*, 7(12), 73. <https://doi.org/10.3390/medicines7120073>
3. Bagle, A., Yerramshetty, M., & Garud, I. G. (2024). Comparison between effect of preoperative verbal counseling versus preoperative counseling using anesthesia information sheet on anxiety of patients undergoing elective surgeries: A randomized comparative study. *Cureus*, 16(7), e64667. <https://doi.org/10.7759/cureus.64667>
4. Broadbent, E., Kahokehr, A., Booth, R. J., Thomas, J., Windsor, J. A., Buchanan, C. M., Wheeler, B. R., Sammour, T., & Hill, A. G. (2012). A brief relaxation intervention reduces stress and improves surgical wound healing response: A randomised trial. *Brain, Behavior, and Immunity*, 26(2), 212-217.
5. Broadbent, E., Petrie, K., Alley, P., & Booth, R. (2003). Psychological stress impairs early wound repair following surgery. *Psychosomatic Medicine*, 65(5), 865-869.
6. Carr, E. C. J., Brockbank, K., Allen, S., & Strike, P. (2006). Patterns and frequency of anxiety in the perianesthesia period. *Journal of Advanced Nursing*, 55(6), 729-738.
7. Desborough, J. P. (2000). The stress response to trauma and surgery. *British Journal of Anaesthesia*, 85(1), 109-117.
8. Yang, L., Lin, Y., & Long, Y. (2025). Effect of music on preoperative anxiety and postoperative pain in patients undergoing gynecological surgery: A meta-analysis. *PLOS ONE*, 20(4), e0319639. <https://doi.org/10.1371/journal.pone.0319639>
9. Patiyal, N., Kalyani, V., Mishra, R., Kataria, N., Sharma, S., Parashar, A., & Kumari, P. (2021). Effect of music therapy on pain, anxiety, and use of opioids among patients underwent orthopedic surgery: A systematic review and meta-analysis. *Cureus*, 13(9), e18377. <https://doi.org/10.7759/cureus.18377>

10. Tung, K.-M., Su, Y., Kang, Y.-N., Hou, W.-H., Hoang, K. D., Chen, K.-H., & Chen, C. (2024). Effects of mindfulness-based preoperative intervention for patients undergoing elective surgery: A meta-analysis. *Journal of Psychosomatic Research*, 181, 111666. <https://doi.org/10.1016/j.jpsychores.2024.111666>
11. Felix, M. M. S., Ferreira, M. B. G., Oliveira, L. F., Barichello, E., Pires, P. D. S., & Barbosa, M. H. (2018). Guided imagery relaxation therapy on preoperative anxiety: A randomized clinical trial. *Revista Latino-Americana de Enfermagem*, 26, e3101.
12. Feninets, V., Adamakidou, T., Mantzorou, M., Mastrogiannis, D., Govina, O., & Tsiou, C. (2022). The effect of preoperative educational intervention on anxiety and pain of patients undergoing spinal decompression surgery: A pilot randomized controlled study. *Cureus*, 14(8), e28368. <https://doi.org/10.7759/cureus.28368>
13. Gouin, J.-P., & Kiecolt-Glaser, J. K. (2011). The impact of psychological stress on wound healing: Methods and mechanisms. *Immunology and Allergy Clinics of North America*, 31(1), 81-93.
14. Guerrier, G., Bernabei, F., Lehmann, M., Pellegrini, M., Giannaccare, G., & Rothschild, P.-R. (2021). Efficacy of preoperative music intervention on pain and anxiety in patients undergoing cataract surgery. *Frontiers in Pharmacology*, 12, Article 748296.
15. Haller, H., Breilmann, P., Schroter, M., Dobos, G., & Cramer, H. (2021). A systematic review and meta-analysis of acceptance- and mindfulness-based interventions for DSM-5 anxiety disorders. *Scientific Reports*, 11, Article 20385.
16. Hosseini, S. H., Rafiei, A., Gaemian, A., Tirgari, A., Zakavi, A., Yazdani, J., Bolhari, J., Golzari, M., Douki, Z. E., & Vaezzadeh, N. (2017). Comparison of the effects of religious cognitive behavioral therapy (RCBT), cognitive behavioral therapy (CBT), and sertraline on depression and anxiety in patients after coronary artery bypass graft surgery: Study protocol for a randomized controlled trial. *Trials*, 18, Article 331.
17. Javadi Zaher, S., Vafaei, M., & Ebrahimi Abianeh, E. (2016). Comparing depression, anxiety and stress among the nurses in the critical care and internal surgical units at the selected hospitals of the Social Security Organization of Tehran in 2016. *International Journal of Medical Research & Health Sciences*, 5(9S), 254-261.
18. Johnston, M. (1980). Anxiety in surgical patients. *Psychological Medicine*, 10(1), 145-152.
19. Kehlet, H. (2000). Manipulation of the metabolic response in clinical practice. *World Journal of Surgery*, 24, 690-695.
20. Kwekkeboom, K. L., & Gretarsdottir, E. (2006). Systematic review of relaxation interventions for pain and anxiety in adult surgical patients. *Journal of Advanced Nursing*, 54(4), 446-456.
21. Lanini, I., Amass, T., Scire Calabrisotto, C., Fabbri, S., Falsini, S., Adembri, C., Di Filippo, A., Romagnoli, S., & Villa, G. (2022). The influence of psychological interventions on surgical outcomes: A systematic review. *Journal of Anesthesia, Analgesia and Critical Care*, 2, Article 31. <https://doi.org/10.1186/s44158-022-00057-4>
22. Mehta, A., Thomas, R., & Joseph, S. (2018). Effectiveness of preoperative psychological counseling on post-surgical outcomes: A comparative study. *Indian Journal of Health Psychology*, 12(1), 45-53.

23. Mitchell, M. J. (2003). Patient anxiety and modern elective surgery: A literature review. *Journal of Clinical Nursing*. <https://doi.org/10.1046/j.1365-2702.2003.00812.x>
24. Msoma, R. A., Khamis, R. H., Rwanyuma, L. P., Akoko, L. O., Mkulo, A.-Z., & Msinde, P. (2023). Prevalence of pre-operative anxiety and predictors among elective surgical patients and their pre-operative hemodynamic changes at Muhimbili National Hospital. *Open Journal of Medical Psychology*, 12, 55-70. <https://doi.org/10.4236/ojmp.2023.122003>
25. Yang, K.-L., Detroyer, E., Niu, M.-M., Hoogma, D. F., Tian, J.-H., Rex, S., & Milisen, K. (2025). Music intervention as a strategy to reduce preoperative anxiety: An umbrella review. *BMC Anesthesiology*, 25, Article 410. <https://doi.org/10.1186/s12871-025-03120-z>
26. Mustafa, M. S., Shafique, M. A., Zaidi, S. D. E. Z., Qamber, A., Rangwala, B. S., Ahmed, A., Zaidi, S. M. F., Rangwala, H. S., Uddin, M. M. N., Ali, M., Siddiq, M. A., & Haseeb, A. (2024). Preoperative anxiety management in pediatric patients: A systemic review and meta-analysis of randomized controlled trials on the efficacy of distraction techniques. *Frontiers in Pediatrics*, 12, Article 1353508.
27. Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., et al. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, 372, n71.
28. Powell, R., Scott, N. W., Manyande, A., Bruce, J., Vogeles, C., Byrne-Davis, L. M. T., Unsworth, M., Osmer, C., & Johnston, M. (2016). Psychological preparation and postoperative outcomes for adults undergoing surgery under general anaesthesia. *Cochrane Database of Systematic Reviews*, 2016(5), CD008646.
29. Pritchard, M. J. (2009). Managing anxiety in surgical patients. *Nursing Standard*, 23(51), 35-40.
30. Alanazi, A. A. (2014). Reducing anxiety in preoperative patients: A systematic review. *British Journal of Nursing*, 23(7), 387-393. <https://doi.org/10.12968/bjon.2014.23.7.387>
31. Sharma, N., & Reddy, K. S. (2021). Guided imagery as a psychological intervention in surgical patients: A clinical trial. *Journal of Indian Psychology*, 39(2), 76-84.
32. Shebl, M. A., Toraih, E., Shebl, M., Tolba, A. M., Ahmed, P., Banga, H. S., Orz, M., Tammam, M., Saadalla, K., Elsayed, M., Kamal, M., Abdulla, M., Eldessouky, A. I., Moustafa, Y. T., Mohamed, O. A., & Aiash, H. (2025). Preoperative anxiety and its impact on surgical outcomes: A systematic review and meta-analysis. *Journal of Clinical and Translational Science*, 9, e33. <https://doi.org/10.1017/cts.2025.6>
33. Sonani, S. R., & Dudhamal, T. S. (2023). Literature review of pre-operative anxiety. In *Futuristic Trends in Medical Sciences (Vol. 3, pp. 34-51)*. Iterative International Publishers (IIP). <https://doi.org/10.58532/V3BFMS12P1CH5>
34. Saray Kılıç, H., İbrahimoglu, Ö., Mercan, N., & Güneri, G. (2026). The effect of mindfulness-based preoperative education on postoperative pain: A Solomon four-group randomized controlled trial. *BMC Psychology*, 14, Article 256. <https://doi.org/10.1186/s40359-026-04056-w>

35. Verhoeven, J. G., Horstink, M. M. B., Jeekel, J., & Klimek, M. (2024). The effect of unimodal, non-pharmacological, preoperative psychological prehabilitation interventions on preoperative anxiety and stress: A systematic review. *Current Anesthesiology Reports*, 14(2), 330-338. <https://doi.org/10.1007/s40140-024-00623-2>
36. Yang, Y., Li, Y., Zhang, H., Xu, Y., & Wang, B. (2021). The efficacy of computer-assisted cognitive behavioral therapy (cCBT) on psychobiological responses and perioperative outcomes in patients undergoing functional endoscopic sinus surgery: A randomized controlled trial. *Perioperative Medicine*, 10, Article 28. <https://doi.org/10.1186/s13741-021-00195-3>
37. Tong, A., Flemming, K., McInnes, E., Oliver, S., & Craig, J. (2019). Enhancing recovery from surgery through psychological interventions: A systematic review. *Journal of Psychosomatic Research*, 121, 89-101.
38. Villa, G., Lanini, I., Amass, T., Bocciero, V., Scire Calabrisotto, C., Chelazzi, C., Romagnoli, S., De Gaudio, A. R., & Lauro Grotto, R. (2020). Effects of psychological interventions on anxiety and pain in patients undergoing major elective abdominal surgery: A systematic review. *Perioperative Medicine*, 9, Article 38. <https://doi.org/10.1186/s13741-020-00169-x>

