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The state of evidence in acupuncture: A review of metaanalyses and systematic reviews of acupuncture evidence (update 2017–2022)

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ABSTRACT

Introduction: Over the last decades, acupuncture research has increased drastically. As a result, it has become more and more difficult to oversee the amount of evidence concerning its effect in various medical conditions. Different comparative reviews aimed to roughly assess individual strength of acupuncture evidence, covering the years 2005–2017. Our review intends to assess the level of acupuncture evidence for any medical condition available, concerning the years 2017–2022.

Methods: We searched the pubmed database for 'acupuncture' and filtered the results towards systematic reviews and metanalyses (SR/MA). Results were allocated towards medical disciplines and sorted to medical conditions. Each SR/MA was rated concerning *quality of review* (QoR), *quality of data* (QoD), and *quality of evidence* (QoE). To facilitate a rough overview, results were assessed into either of four categories: i) *evidence of positive effect*, ii) *evidence of potential positive effect*, iii) *insufficient/unclear evidence*, iv) *no evidence of effect/evidence of no effect*.

Results: After considering exclusion criteria, 862 SR/MA remained for evaluation. Results were allocated and sorted as described, resulting in 184 medical conditions. Of these, in ten medical conditions SR/MA supported *evidence of positive effect*: chronic pain, low-back pain, knee osteoarthritis, postoperative nausea and vomiting (PONV), migraine, tension-type headache, cancer-related fatigue, menopausal symptoms, female infertility (additional to medical reproductive treatment), chronic prostatitis/chronic pelvic pain syndrome in men. In another 82 medical conditions SR/MA supported *evidence of potential positive effect,* in another 86 medical conditions SR/MA revealed *unclear/insufficient evidence,* and in another six medical conditions *no evidence of effect/evidence of no effect* was found. Compared with previous reviews until the year 2017, the number of medical conditions with higher quality evidence levels has increased, namely *evidence of positive effect* and *evidence of potential positive effect.*

Discussion and conclusion: Compared to previous years, the amount and quality of acupuncture evidence has increased in the years 2017–2022. In total, 862 included SR/MA resulted in a comparative review of 184 medical conditions. *Evidence of positive effect* was revealed ten medical conditions, another 82 showed *evidence of potential positive effect.* 86 medical indications showed *insufficient evidence* for a firm conclusion, six conditions showed *no evidence of effect/evidence of no effect.* Although general quality of evidence has dramatically increased compared to the previous years, lack of underlying high-quality trials in some cases seems to compromise a consistent comparability between SR/MA. This issue should be addressed for future studies and guidelines such as STRICTA and CONSORT should strictly be obtained.

1. Introduction

Over the last decades acupuncture has been established as a treatment option not only for pain[1] but for a great variety of diseases and indications.[2] Acupuncture has become very popular globally among patients and health-givers and is even accepted in some European, American, and Asian countries by either general insurance to some extend or by other health cost providers.[3,4]

Coming from an ancient empirical approach as part of Traditional Chinese Medicine (TCM) acupuncture has spread not only to Asian

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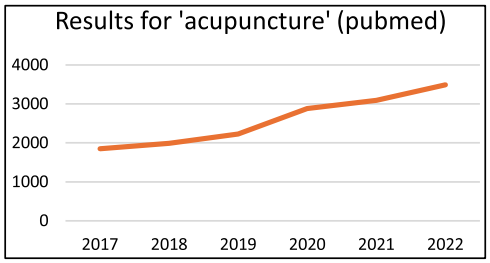

Fig. 1. Number of results for searching 'acupuncture' on pubmed 2017–2022.

medical cultures like Japan or Korea but worldwide. In 1979, the WHO published a treatment recommendation list, including a broad range of medical conditions from asthma to urticaria.[5] At this time, only very few well-designed studies with low or very low quality existed.

Since the NIH consensus statement in 1998[6] acupuncture research has increased exponentially, not only in number but also in quality of research (QoR).[7]

Not only observational studies and randomized controlled trials have been published but also a growing number of systematic reviews and metanalyses. As a result, reaching an overview in acupuncture evidence – particularly for people without research experience and the public – has become more and more difficult.

In 2010, the Australian Department for Veteran's Affairs published a review that summarized the current level of evidence acupuncture according to medical conditions.[8] This work was continued by the American Department of Veteran's Affairs who published the 'Evidence Map to Acupuncture' in 2013.[9] Finally, 'The Acupuncture Evidence Project' covered the period 2013–2017 and was published by the Australian Acupuncture and Chinese Medicine Association Ltd. (AACMA).[10] The publications above summarize the respective evidence towards medical conditions and may be described as a 'review of reviews' or a 'comparative review'.

Since 2017 the amount of evidence in the field of acupuncture drastically increased, urging for a continuation of another comparative review (see Fig. 1).

Our work aims to update the list of systematic reviews and meta-analyses' (SR/MA) evidence of acupuncture sorted by medical conditions and covering the years 2017–2022. Evaluation process mainly relies on criteria that allows a rough mapping of acupuncture evidence into four groups. All available medical conditions will be included.

2. Methods

2.1. Database search

In the beginning of 2023, we searched the PubMed database with the general keyword 'acupuncture' in the period 01/01/2017–12/31/2022. We then set the filters for 'systematic review' and 'metanalysis'.

We included any SR/MA that investigated acupuncture as a treatment method in any medical condition.

We excluded study protocols, SR/MA with acupuncture not being used, SR/MA with acupuncture as one of various treatment methods, SR/MA with unusual/atypical acupuncture treatment techniques, SR/MA with animal studies, and results that did not meet the criteria for SR/MA.

Selection process and sorting towards medical condition was done by two independent reviewers, using a citation manager (EndNote 20).

2.2. Addition and inclusion of evidence from German AWMF guidelines

We included German guidelines when SR/MA alone delivered ambiguous results concerning arguable *evidence of positive effect* and when corresponding guidelines supported that evidence. In cases of questionable *evidence of positive effect* without supporting guidelines, the evidence level was downgraded.

Table 1
Assessment and description of evidence' levels.

Overall Effect	Description	Quality of Evidence
Evidence of positive effect	Reviews, which consistently demonstrate statistically significant positive effects and recommend the intervention, constitute compelling evidence of its efficacy.	high quality
Evidence of potential positive effect	Reviews portray all individual RCTs or combined effects across RCTs in a positive light, yet the reviewers find the evidence lacking for drawing definitive conclusions. There's a moderate indication of positivity in the evidence.	Moderate to high quality
Unclear/ insufficient evidence	Reviews primarily comprised weak positive evidence or conflicting findings among reviews or among authors within a review, leading reviewers to characterize the evidence as inconclusive.	Low or very low quality; or conflicting levels of evidence within or between reviews
No evidence of effect/Evidence of no effect	Reviews found little or no support for acupuncture	Consistently low or very low quality

2.3. Evaluation procedure

2.3.1. Quality of review (QoR)

We sorted all SR/MA into three groups: First, Cochrane reviews and German guidelines published by the AWMF working group were considered of particular high standard and quality were rated therefore as grade 1. Secondly, SR/MA which used an appropriate bias tool such as the Cochrane Collaboration bias tool were rated as grade 2. Thirdly, if none of the criteria of group 1 or 2 applied or if SR/MA were not published in English they were rated as grade 3.

2.3.2. Quality of data (QoD)

Risk of bias of included trials was estimated by the trials' authors and graded into very low – low – moderate – high – very high. We documented risk of bias of each study's included data.

2.3.3. Quality of evidence (QoE)

If specified in the included SR/MA we documented quality of evidence, following Cochrane's GRADE-System with very low/no– low – moderate – high – very high evidence.

Qualities of review (QoR), data (QoD), and evidence (QoE) are specified at the respective citations if applicable (see Addendum).

Continuing the work of the previous projects,[8–10] grading criteria was fully adopted (Table 1).

2.4. Review process

Between October 2023 and May 2024 two reviewers independently assessed all acupuncture SR/MA strictly following the given criteria. All SR/MA had been passed through a rigorous review procedure to clarify QoR, QoE, QoD. In an open process between the two reviewers, divergent results were cleared. We analyzed and compared all data's individual QoR, QoE, QoD, followed by evaluation according to the criteria shown in Table 1.

Table 2
Exemplary illustration of evaluating procedure. 'Effect' corresponds with first column of Table 1 (1: Evidence of positive effect; 2: Evidence of potential positive effect; 3: Unclear/insufficient evidence; 4: No evidence of effect/Evidence of no effect).

Literature	QoR	Summary	Effect
SR/MA #1	2	13 RCTs, 567 patients; acu superior to sham and standard medication; moderate QoD, low- to moderate QoE; more data needed	2
SR/MA #2	1	28 RCTs, 3029 patients; acu effective in medical condition; good QoD, moderate to good QoE	1
SR/MA #3	2	9 RCTs, 422 patients; acu beneficial in medical condition; good QoD, good QoE	1
Overall effect for exemplary medical condition			**1**

2.5. Estimating overall efficacy

In order to evaluate the extend of acupuncture's effect in a medical condition we proceeded as follows. All specific SR/MA that refer to a condition were listed, individually given grades for its QoR as well as given a short summary of its key messages, including number of included patients, RCTs, and the main findings. To conclude, an overall effect was given to the SR/MA, following the criteria described in Table 1 (1: *Evidence of positive effect;* 2: *Evidence of potential positive effect;* 3: *Unclear/insufficient evidence;* 4: *No evidence of effect/Evidence of no effect;* corresponds with first column in Table 1).

A medical condition's overall effect was calculated by taking the grades' mean of all available individual SR/MA. If, however, individual SR/MA resulted in conflicting evidence, parameters such as quality of SR/MA (estimated by QoR) and number of included patients as well as number of included RCTs contributed to the final decision. Table 2 exemplifies the procedure.

3. Results

Following the inclusion criteria and excluded studies as shown in Fig. 2, 862 SR/MA were used. The flow chart shows the results of the selection process.

As the next step, manual sorting to medical disciplines followed by

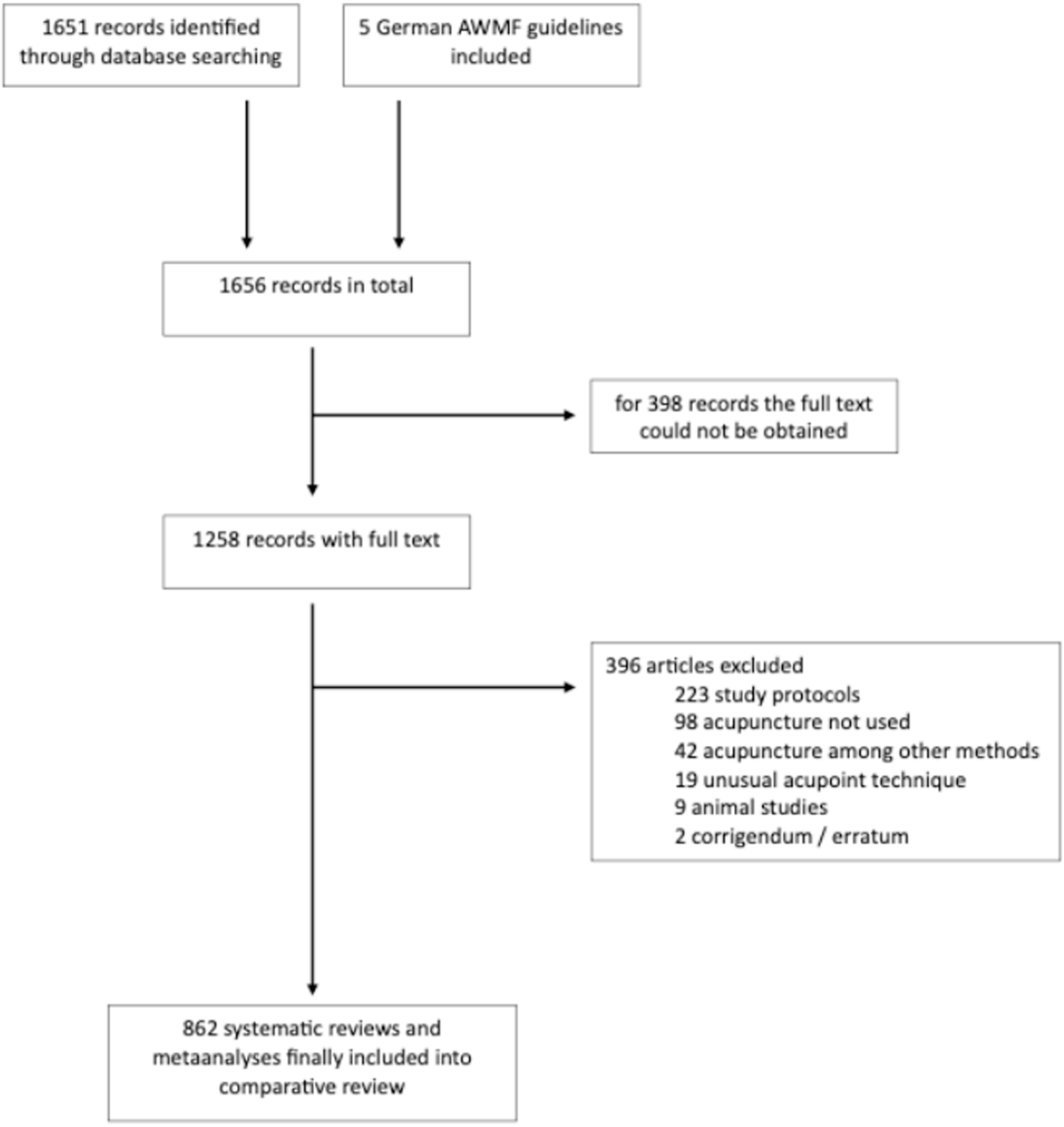

Fig. 2. Flow chart of selection process.

Table 3
Number of medical conditions sorted by strength of evidence.

Evidence strength	Number of medical conditions
Evidence of positive effect	10
Evidence of potential positive effect	82
Unclear/insufficient evidence	86
No evidence of effect	6
Total	**184**

assignment to medical condition was done according to topics of the included studies.

We sorted the evidence towards medical discipline and grouped the literature according to diagnoses. The resulting number of all medical conditions was 184 which exceeds the 'Acupuncture Evidence Project' by 62.[10]

Using the criteria described above, Table 3 shows medical conditions sorted by strength of evidence. All results are described in the addendum, sorted according to medical disciplines and medical conditions and containing references, a short description, and the overall assessment (see addendum).

3.1. *Evidence of positive effect*

Strictly following the criteria shown in Table 1, we identified ten medical conditions that were supported with SR/MA resulting in *evidence of positive effect.*

- **Chronic Pain**

  The assessment 'evidence of positive effect' is mainly based on two large meta-analyses.[11,12] At least four weeks lasting nonspecific back or neck pain, shoulder pain, chronic headache, or pain from osteoarthritis were researched in 20.827 patients multi-nationally, revealing effect sizes close to 0.5 in comparison to no acupuncture control and 0.2 for comparisons with sham".[11] Furthermore, the Acupuncture Trialists Collaboration revealed that in 17.922 patients' individual datasets pain reduction caused by a treatment session of acupuncture generally persisted for at least 12 months.[12]

- **Postoperative Nausea**

  A Bayesian network analysis, including 20 studies with 2.862 patients showed that acupuncture therapy outperformed both placebo and standard care, shown both pairwise and in a network meta-analysis. Various acupuncture treatment approaches may offer distinct benefits in different areas. Additionally, compared to postoperative vomiting (OR = 0,53), postoperative nausea appears to be easier to manage (OR = 0,42). These research findings could offer valuable insights for the prevention of postoperative vomiting and nausea.[13]

- **Low Back Pain**

  According to an updated Cochrane review[14] acupuncture did not lead to a clinically relevant pain reduction or improvement of functional status when compared with sham. As known by now, sham concepts are very controversial since the effect of real acupuncture is partly heavily underestimated. Compared with no treatment, acupuncture was clinically effective both for pain reduction (MD − 20,3) and functional improvement (SMD − 0,53). Other research supports the beneficial effects by acupuncture.[11,12] International guidelines recommend acupuncture as an effective treatment, especially when medication is not an option.

- **Knee Osteoarthritis (KOA)**

  Two meta-analyses were found.[15,16] Firstly, an analysis with 2.484 patients with knee osteoarthritis (KOA) showed a significant pain reduction after acupuncture (effect size 0,12) compared with sham.[15] Another publication analyzed 39 trials with 3.293 patients and found small but significant effects of moxibustion compared with no treatment or sham moxibustion.[16] However, considering German and international guidelines, acupuncture is recommended as an alternative treatment option and should be used.[17]

- **Migraine Prophylaxis**

  A systematic review showed that in 2.056 patients' acupuncture was more effective than sham acupuncture, even more beneficial when compared with no medication, and as effective as western medication with fewer side effects.[18] These findings are in line with a meta-analysis that included 3.380 patients. Acupuncture led to a decrease of migraine episodes compared with sham acupuncture (SMD − 0,29) and acupuncture was at least as effective as medication with fewer side effects (SMD − 0,21).[19]

- **Tension-type Headache (TTH)**

  In a meta-analysis that included four trials and 557 patients acupuncture showed a significant pain reduction (-0.41 in VAS scale) compared to sham in the long term.[20] A systematic review confirmed the beneficial effect of acupuncture compared to no treatment or sham.[21] The German TTH guideline recommends acupuncture if medication fails or is not an option.[22]

- **Cancer-related Fatigue (CRF)**

  Nine RCTs with 809 patients were included in a MA, showing significant improvement in fatigue scores after real acupuncture compared with both sham acupuncture and usual care.[23] These results were confirmed by another MA that included 10 RCTs with 1327 patients. Acupuncture was beneficial particularly in breast cancer patients regardless of concurrent anti-tumor treatment (SMD − 1,26).[24] Therefore, acupuncture is considered effective in patients with CRF.

- **Menopause**

  The menopausal complex includes different symptoms. Among them is menopausal depression that was investigated in a meta-analysis, including 2.213 patients. The results revealed a clinically significant improvement over standard care.[25] Also, acupuncture's effect last longer compared to conventional anti-depressants and should therefore be used in routine care.[26] Moreover, hot flashes could be significantly reduced by acupuncture.[27] In line with these findings, the German AWMF guideline for perimenopausal symptoms recommends acupuncture with "should be used".[28]

- **Female Infertility (additional to medical reproductive treatment)**

  Acupuncture is largely being used as a complementary treatment in female patients with infertility. Different meta-analyses found beneficial effects of acupuncture when used additionally to IVF.[29,30] Thus, the AWMF guideline recommends acupuncture for stress reduction as an addition in women with reproductive medical treatment ("should be used").[31]

Table 4
Changes in 'evidence of positive effect' between 'The Acupuncture Evidence Project' (2017) and 'The State of Evidence in Acupuncture' (2022).

	'The Acupuncture Evidence Project' (2017)	**'The State of Evidence in Acupuncture' (2022)**
Chronic pain	(not implemented as a composite condition)	**Positive effect**
Postoperative nausea and vomiting (PONV)	Positive effect	Positive effect
Low-back pain	Positive effect	Positive effect
Knee osteoarthritis	Positive effect	Positive effect
Migraine prophylaxis	Positive effect	Positive effect
Tension-type headache	Positive effect	Positive effect
Cancer-related fatigue	Potential positive effect	**Positive effect**
Menopause symptoms	Potential positive effect	**Positive effect**
Female infertility	Not described	**Positive effect**
Chronic prostatitis	Potential positive effect	**Positive effect**
Allergic rhinitis	**Positive effect**	Potential positive effect
Chemotherapy-induced nausea and vomiting (CINV)	**Positive effect**	Potential positive effect
Postoperative pain	**Positive effect**	Potential positive effect

Table 5
Medical conditions with SR/MA supporting 'evidence of potential positive effect'. Abbreviations: CHD = coronary heart disease; COPD = chronic obstructive pulmonary disease; IBS-D = diarrhea-predominant irritable bowel disease; IVF = in-vitro fertilization; ME/CFS = myalgic encephalomyelitis/chronic fatigue syndrome.

Anesthesia and pain	**Metabolic diseases**	**Psychiatry**
• General anesthesia/Intensive care • Immediate pain relief • Myofascial pain • Post-hemorrhoidectomy pain • Postoperative pain • Postoperative sore throat	• Diabetic gastroparesis • Diabetic neuropathy • Obesity • Osteoporosis • Uremic pruritus • Weight loss	• Depression • Anorexia • Insomnia • Tics
Cardiovascular disease	**Musculoskeletal diseases**	**Pulmonology**
• Cardiovascular disease • Coronary heart disease (CHD), stable angina pectoris • HRV-Modulation • Hypertension • Premature ventricular complex • Supraventricular arrhythmia Atrial fibrillation	• Fibromyalgia • Lateral epicondylitis • Myofascial pain • Pain after knee arthroplasty • Osteonecrosis • Rheumatoid arthritis • Sciatica • Trigger points	• Asthma • COPD
Dermatology	**Nephrology**	**Urological diseases**
• Uremic pruritus	• Chronic kidney disease • Renal colic disease	• Benign prostatic hyperplasia • Erectile dysfunction • Urinary incontinence • Urinary retention • Urinary tract infection
ENT	**Neurological diseases**	
• Rhinosinusitis • Allergic rhinitis	• Alzheimer dementia • Bell's palsy • Chronic spinal pain • Herpes zoster neuralgia • ME/CFS • Post-stroke (not further specified) • Post-stroke aphasia • Post-stroke cognitive impairment • Post-stroke dysarthria • Post-stroke dysphagia • Post-stroke spasticity • Vascular dementia	
Gastroenterology	**Oncology (complementary treatment)**	
• Adhesive intestinal obstruction • Diarrhea predominant irritable bowel syndrome (IBS-D) • Functional dyspepsia • Functional gastrointestinal disorder • Postoperative ileus • Postprandial distress syndrome	• Cancer (general) • Radiotherapy (general) • Cancer-related anorexia • Aromatase-inhibitor-induced pain • Breast cancer therapy-related syndromes • Cancer-related insomnia • Cancer-related pain • Chemotherapy-induced hot flushes • Chemotherapy-induced leukopenia • Chemotherapy-induced Peripheral neuropathy • Therapy-related constipation Hormone therapy-related effects • Lung cancer	
Gynecology	**Ophthalmology**	
• Breech presentation • Chronic pelvic pain • Dysmenorrhea • Endometriosis • In vitro fertilisation (IVF) • Labour pain • Polycystic ovarian syndrome • Premenstrual syndrome	• Dry eye	

■ **Chronic Prostatitis**

Acupuncture leads to a decrease in patients with chronic prostatitis symptoms such as an impaired sexuality and chronic pelvic pain syndrome (CPPS).[32–34] Acupuncture showed a more beneficial effect in male patients with CPPS when compared with sham acupuncture or standard medical treatment.[33] These results that were discovered in a relatively small population were confirmed by a larger meta-analysis investigating 1188 patients with chronic prostatitis/CPPS. Compared to sham acupuncture and standard medication real acupuncture led to an improvement of typical symptoms.[34] These results are in line with a Cochrane review that confirmed the clinically meaningful effect of acupuncture in CPPS patients. The review found distinct beneficial effects on various symptoms of chronic prostatitis; however, sexual impairment was not improved.[32]

With respect to 'The Acupuncture Evidence Project' that has been published in 2017 and that included the research literature from 03/2013 to 01/2017[10] our review discovered multiple changes in evidence's strength regarding *evidence of positive effect* and *evidence of potential positive effect* (Table 4).

3.2. Evidence of potential positive effect

Following the assessment criteria (see Table 1), our research revealed 82 medical conditions to show *evidence of a potential positive effect* of acupuncture treatment (Table 5):

3.3. Unclear/insufficient evidence

Totally, 86 medical conditions met the criteria for *insufficient/unclear evidence* for acupuncture, mainly due to low to or very low quality of research (QoR) and quality of data (QoD) (Table 6).

3.4. No evidence/negative evidence

Following the assessment's criteria (see Table 1), SR/MA supported *no evidence or negative evidence* for six medical conditions (Table 7).

Table 8 summarizes all medical conditions according to their evidence's strength, listed alphabetically. Furthermore, results of previous comparative reviews, starting from the year 2005 are included. Fig. 3 shows the number and strength of medical conditions, comparing the acupuncture evidence development in 2005–2022.

4. Discussion

Following the evaluation procedure, our review found evidence for acupuncture's positive effect in 10 medical conditions and evidence for

Table 6
Medical conditions with SR/MA supporting 'unclear/insufficient evidence of effect'. Abbreviations: IBD = inflammatory bowel disease; NAFLD = non-alcoholic fatty liver disease; PTSD = post-traumatic stress disorder.

Anesthesia and pain	**Gynecology**	**Oncology**
• Craniotomy • Emergency • Endoscopy • Pain • Pain in neonates • Post-thoracotomy pain • Recovery of consciousness • Rib fractures	• Hyperemesis gravidarum • Induction of labour • Postpartum depression • Premature ovarian failure	• Bowel dysfunction • Sleep disturbance • Xerostomia
Cardiovascular diseases	**Infectious diseases**	**Ophthalmology**
• Heart failure • Raynaud's syndrome	• Sepsis	• Hordeolum
Dermatology	**Metabolic diseases**	**Psychiatry**
• Acne • Atopic eczema • Psoriasis	• Diabetes mellitus • Diabetic peripheral neuropathy • Diabetic retinopathy • Gout • Insulin resistance • Metabolic syndrome • Osteoporotic vertebroplasty	• Addiction • Anxiety • Autism • Noctural crying • Noctural enuresis • PTSD • Schizophrenia
ENT	**Musculoskeletal diseases**	**Surgery**
• Obstructive sleep apnoea • Oral ulcer • Tinnitus • Xerostomia/ hyposalivation	• Ankle pain • Ankylosing spondylitis • Carpal tunnel syndrome • Fracture pain • Frozen shoulder • Hand and wrist pain • Hip osteoarthritis • Lumbar disc herniation • Neck pain • Osteoarthitis • Plantar fasciitis • Plantar heel pain • Sacroiliac pain • Shoulder adhesive capsulitis • Sport/muscles • Temporomandibular disorders	• Abdominal surgery • Knee arthroplasty
Gastroenterology	**Neurological diseases**	**Urological diseases**
• Acute pancreatitis • Discomfort after endoscopy • Functional constipation • Functional gastroparesis • Gastro-oesophageal reflux disease • Infantile diarrhea • Inflammatory bowel disease (IBD) • Nonalcoholic fatty liver disease (NAFLD) • Postcholecystectomy syndrome • Ulcerative colitis	• Epilepsy • Carpal tunnel syndrome • Mild cognitive impairment • Myasthenia gravis • Occipital neuralgia • Oculomotor nerve palsy • Parkinson's disease • Post-stroke depression • Post-stroke insomnia • Post-stroke motor impairment • Post-stroke shoulder pain • Post-stroke unilateral neglect	• Oligoasthenozoospermia • Overactive bladder
		• Restless legs • Trigeminal neuralgia • Vertigo

Table 7
Medical conditions with SR/MA supporting 'no evidence/negative evidence of effect'.

Gastroenterology	**Neurological diseases**
• Infantile colic	• Neuropathic pain • Post-stroke hiccups
Infectious diseases	**Ophthalmology**
• Hepatitis	• Glaucoma • Optic atrophy

potential positive effect in another 82 indications, resulting in 92 medical conditions that show beneficial results when acupuncture was administered. In our opinion, this is proof for the improved quality of research and indicates increasing evidence for acupuncture's effectiveness since 'The Acupuncture Evidence Project' in 2017 and since the years before (see Fig. 3). The increase of evidence is in line with other areas of Chinese medicine. Recently, a large review on toxicity of Chinese herbal medicine has been published.[45]

We found some indication for a beneficial effect of acupuncture in another 86 medical conditions but due to low quality of research no definite conclusion could be reached, resulting in unclear/insufficient evidence for effectiveness. No evidence of effectiveness or evidence of no effect was found in 6 medical conditions.

Table 4 contrasts medical conditions with *evidence of positive effect* found in 'The Acupuncture Evidence Project', covering the period 2013–2017[10] to 'The State of Evidence in Acupuncture' (period 2017–2022). Comparison shows that most of the conditions' effectiveness remained unchanged. Those conditions that showed an improvement (menopause symptoms, cancer-related fatigue, female infertility) were more intensely investigated since 2017 and SR/MA concluded in higher levels of evidence, resulting in an upgrading of their effect. This development is in line with the general tendency of acupuncture's overall improving evidence over the years. Interestingly, for some conditions effect estimation needed to be downgraded, based on available SR/MA. Given the nature of our work being a 'review of reviews' that strictly focused on the SR/MA published in 2017–2022 only resulting evidence in this period was decisive for our work. Reasons for the downgrading of single conditions include little evidence, low QoR, small number of included RCTs or patients. Concerning the general comparability with previous results, it is important to note that we did not analyze included data of 'The Acupuncture Evidence Project', covering data 2013–2017[10] but relied on the authors' effect estimation.

Acupuncture has been considered as a safe treatment in the hands of a well-trained physicians and therapists. If reported, side effects are at a minimum and easy to manage.[35] Moreover, acupuncture has been found to be cost effective in some conditions before,[10] however, this aspect was not a particular focus in this review.

Some considerations and problems need to be addressed: Placebo-controlled clinical trials, mainly using sham acupuncture, were often used in SR/MA that were included in this review. As known by now, using sham controls are considered problematic since the effect of real acupuncture is often underestimated resulting in a misinterpretation of results.[36] Several devices had been invented to facilitate a placebo process like Streitberger's needle[37,38] or Park's placebo device.[38] However, so far none showed to be an inert procedure (i.e. without any effect). A variety of network meta-analyses show that acupuncture is superior to sham acupuncture at sham points but results in little or no difference at real acupuncture points.[39,40] Placebo- or sham-controlled

Table 8
Summary of results. Abbreviations: ADHD = attention deficit hyperactivity syndrome; ART = assisted reproductive technology; CINV = chemotherapy-induced nausea and vomiting; IBD = inflammatory bowel disease; IBS-D = diarrhea-predominant irritable bowel syndrome; IVF = in-vitro fertilization; ME/CFS = myalgic encephalomyelitis/chronic fatigue syndrome; NAD = neck pain and associated disorders; NAFLD = non-alcoholic fatty liver disease; PONV = post-operative nausea and vomiting; PTSD = post-traumatic stress disorder; WAD = whiplash associated disorders.

Australian DVA (Sept 2005–Sept 2010)	USVA Evidence map (Jan 2005–Mar 2013)	The Acupuncture Evidence Project (Mar 2013–Jan 2017)	The State of Evidence in Acupuncture (Jan 2017–Dec 2022)	
Effective	**Evidence of positive effect**			
• Allergic rhinitis (for up to 3 months) • Back or pelvic pain during pregnancy • Migraine prophylaxis (when used with routine care) • Vomiting after chemotherapy (with superseded anti-emetic drugs)	• Chronic pain • Headache • Migraine	• Allergic rhinitis (perennial & seasonal) • Chemotherapy-induced nausea and vomiting (CINV) (with anti-emetics) • Chronic low back pain • Headache (tension-type and chronic) • Knee osteoarthritis • Migraine prophylaxis • Postoperative nausea & vomiting (PONV) • Postoperative pain	• Chronic pain • Postoperative nausea • Low-back pain • Knee osteoarthritis • Migraine prophylaxis • Tension-type headache • Cancer-related fatigue • Menopausal symptoms • Female infertility • Chronic prostatitis	
Effective (possibly)	**Evidence of potential positive effect**			
• Lower back pain	• Ankle sprain • Anxiety • Cancer pain • Constipation • Depression • Dysmenorrhoea • General pain • Insomnia • Labour pain • Obesity • Osteoarthritic pain • Plantar heel pain • Postoperative nausea and vomiting • Post-traumatic stress disorder • Pregnancy pain • Prostatitis pain • Restless leg syndrome • Schizophrenia • Smoking cessation • Temporomandibular pain	• Acute low back pain • Acute stroke • Ambulatory anaesthesia • Anxiety • Aromatase-inhibitor-induced arthralgia • Asthma in adults • Back or pelvic pain during pregnancy • Cancer pain • Cancer-related fatigue • Constipation • Craniotomy anaesthesia • Depression (with antidepressants) • Dry eye • Hypertension (with medication) • Insomnia • Irritable bowel syndrome • Labour pain • Lateral elbow pain • Menopausal hot flushes • Modulating sensory perception thresholds • Neck pain (NAD, not WAD) • Obesity • Perimenopausal & postmenopausal insomnia • Plantar heel pain • Post-stroke insomnia • Post-stroke shoulder pain • Post-stroke spasticity • Post-traumatic stress disorder • Prostatitis pain/chronic pelvic pain syndrome • Recovery after colorectal cancer resection • Restless leg syndrome • Schizophrenia (with antipsychotics) • Sciatica • Shoulder impingement syndrome (early stage) (with exercise) • Shoulder pain • Smoking cessation (up to 3 months) • Stroke rehabilitation • Temporomandibular pain	• Adhesive intestinal obstruction • Allergic rhinitis • Alzheimer dementia • Anorexia • Aromatase-inhibitor-induced pain • Asthma • Bell's palsy • Benign prostatic hyperplasia • Breast cancer therapy-related syndromes • Breech presentation • Cancer (general) • Cancer-related anorexia • Cancer-related insomnia • Cancer-related pain • Cardiovascular disease • Chemotherapy-induced hot flushes • Chemotherapy-induced leukopenia • Chemotherapy-induced peripheral neuropathy • Chronic kidney disease • Chronic pelvic pain • Chronic spinal pain • COPD • Coronary heart disease (CHD), stable angina pectoris • Depression • Diabetic gastroparesis • Diabetic neuropathy • Diarrhea predominant irritable bowel syndrome (IBS-D) • Dry eye • Dysmenorrhea • Endometriosis • Erectile dysfunction • Fibromyalgia • Functional dyspepsia • Functional gastrointestinal disorder • General anesthesia/intensive care • Herpes zoster neuralgia	• Insomnia • Labour pain • Lateral epicondylitis • Lung cancer • ME/CFS • Myofascial pain • Obesity • Osteonecrosis • Osteoporosis • Pain after knee arthroplasty • Polycystic ovarian syndrome • Post-hemorrhoidectomy pain • Post-stroke (not further specified) • Post-Stroke aphasia • Post-Stroke cognitive impairment • Post-Stroke dysarthria • Post-Stroke dysphagia • Post-Stroke spasticity • Postoperative ileus • Postoperative pain • Postoperative sore throat • Postprandial distress syndrome • Premature ventricular complex • Premenstrual syndrome • Radiotherapy (general) • Renal colic disease • Rheumatoid arthritis • Rhinosinusitis • Sciatica • Supraventricular arrhythmia atrial fibrillation • Therapy-related constipation • Tics • Trigger points • Uremic pruritus • Urinary incontinence • Urinary retention • Urinary tract infection • Vascular dementia

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Table 8 (*continued*)

Australian DVA (Sept 2005–Sept 2010)	USVA Evidence map (Jan 2005–Mar 2013)	The Acupuncture Evidence Project (Mar 2013–Jan 2017)	The State of Evidence in Acupuncture (Jan 2017–Dec 2022)	
			• Hormone therapy-related effects • HRV-modulation • Hypertension • Immediate pain relief • In vitro fertilization (IVF)	• Weight loss
Insufficient evidence • Assisted conception (when used on the day of embryo transfer) • Asthma • Bell's palsy • Breathlessness • Chronic neck pain • Cocaine addiction • Depression • Glaucoma • Induction of labour • Insomnia • Irritable bowel syndrome • Labour pain • Lateral elbow pain • Postnatal depression • Postoperative nausea and vomiting • Restless leg syndrome • Rheumatoid arthritis • Schizophrenia • Shoulder pain • Smoking cessation (up to 3 months) • Stroke • Uterine fibroids • Vascular dementia	**Unclear evidence** • Back pain • Cancer adverse effects • Chronic fatigue syndrome • Drug addiction • Dry eye • Erectile dysfunction • Exercise • Fibromyalgia pain • Gastrointestinal disease • High blood pressure • Irritable bowel syndrome • Menopausal symptoms • Neck pain • Opiate addiction • Postoperative pain • Premenstrual syndrome • Quality of life • Rheumatoid arthritis pain • Rhinitis • Shoulder pain • Surgical analgesia • Tinnitus • Xerostomia	**Unclear/insufficient evidence** • Acupuncture in emergency department • Acute ankle sprain in adults • Alzheimer's disease • Angina pectoris • Assisted conception in ART • Asthma in children • Atopic dermatitis • Attention deficit hyperactivity disorder (ADHD) • Autism spectrum disorder • Bell's palsy • Bladder pain syndrome • Cancer-related insomnia • Cancer-related psychological Symptoms • Carpal tunnel syndrome • Chemotherapy-induced peripheral Neuropathy • Chronic fatigue syndrome • Chronic kidney disease • Chronic obstructive pulmonary disease (COPD) • Chronic urinary retention due to spinal cord injury • Chronic urticaria • Dysmenorrhoea • Dyspepsia in diabetic gastroparesis • Erectile dysfunction • Exercise performance & post-exercise recovery • Fatigue in systemic lupus erythematosus • Fibromyalgia • Functional dyspepsia • Gag reflex in dentistry • Glaucoma • Heart failure • Hot flushes in breast cancer • Hyperemesis gravidarum • Hypoxic ischemic encephalopathy in neonates • Induction of labour • Inflammatory bowel disease • Itch • Lumbar spinal stenosis • Melasma • Meniere's disease/syndrome • Menopausal syndrome • Multiple sclerosis • Mumps in children • Myelosuppression after chemotherapy • Oocyte retrieval pain relief • Opiate addiction • Opioid detoxification • Parkinson's disease • Polycystic ovarian syndrome	• Abdominal surgery • Acne • Acute pancreatitis • Addiction • Ankle pain • Ankylosing spondylitis • Anxiety • Atopic eczema • Autism • Bowel dysfunction • Carpal Tunnel Syndrome • Carpal tunnel syndrome • Chemotherapy-induced nausea • Craniotomy • Diabetes mellitus • Diabetic peripheral neuropathy • Diabetic retinopathy • Discomfort after endoscopy • Emergency • Endoscopy • Epilepsy • Fracture pain • Frozen shoulder • Functional constipation • Functional gastroparesis • Gastro-oesophageal reflux disease • Gout • Hand and wrist pain • Heart failure • Hip osteoarthritis • Hordeolum • Hyperemesis gravidarum • Induction of labour • Infantile diarrhea • Inflammatory bowel disease (IBD) • Insulin resistance • Knee arthroplasty • Lumbar disc herniation • Metabolic syndrome • Mild cognitive impairment • Myasthenia gravis • Neck pain • Noctural crying • Noctural enuresis • Nonalcoholic fatty liver disease (NAFLD) • Obstructive sleep apnoea • Occipital neuralgia • Oculomotor nerve palsy	• Osteoarthitis • Osteoporotic vertebroplasty • Overactive bladder • Pain • Pain in neonates • Parkinson's disease • Plantar fasciitis • Plantar heel pain • Post-stroke depression • Post-stroke insomnia • Post-Stroke Motor Impairment • Post-stroke shoulder pain • Post-stroke unilateral neglect • Post-thoracotomy pain • Post-cholecystectomy syndrome • Postpartum depression • Premature ovarian failure • Psoriasis • PTSD • Raynaud's syndrome • Recovery of consciousness • Restless legs • Rib fractures • Sacroiliac pain • Schizophrenia • Sepsis • Shoulder adhesive capsulitis • Sleep disturbance • Sport/muscles • Temporomandibular disorders • Tinnitus • Trigeminal neuralgia • Ulcerative colitis • Vertigo • Xerostomia • Xerostomia/hyposalivation

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Table 8 (*continued*)

Australian DVA (Sept 2005–Sept 2010)	USVA Evidence map (Jan 2005–Mar 2013)	The Acupuncture Evidence Project (Mar 2013–Jan 2017)	The State of Evidence in Acupuncture (Jan 2017–Dec 2022)
		• Poor sperm quality • Postnatal depression • Postoperative gastroparesis syndrome • Postoperative ileus • Post-stroke hiccoughs • Premenstrual syndrome • Primary ovarian insufficiency • Primary Sjogren's syndrome • Psoriasis vulgaris • Rheumatoid arthritis • Slowing progression of myopia • Spinal cord injury • Stress urinary incontinence in adults • Sudden sensorineural hearing loss • Surgery analgesia • Tinnitus • Traumatic brain injury • Urinary incontinence • Uterine fibroids • Vascular cognitive impairment without dementia • Vascular dementia • Whiplash associated disorder (WAD) • Xerostomia in cancer	• Oligoasthenozoospermia • Oral Ulcer
Not effective • Assisted conception • Epilepsy • Smoking cessation	**Evidence of no effect** • Alcohol dependence • Carpal tunnel syndrome pain • Cocaine addiction • Nausea in pregnancy	**No evidence of effect** • Alcohol dependence • Cocaine addiction • Epilepsy • Nausea in pregnancy • Smoking cessation	**No evidence of effect/Evidence of no effect** • Glaucoma • Hepatitis • Infantile colic • Neuropathic pain • Optic atrophy • Post-stroke hiccups

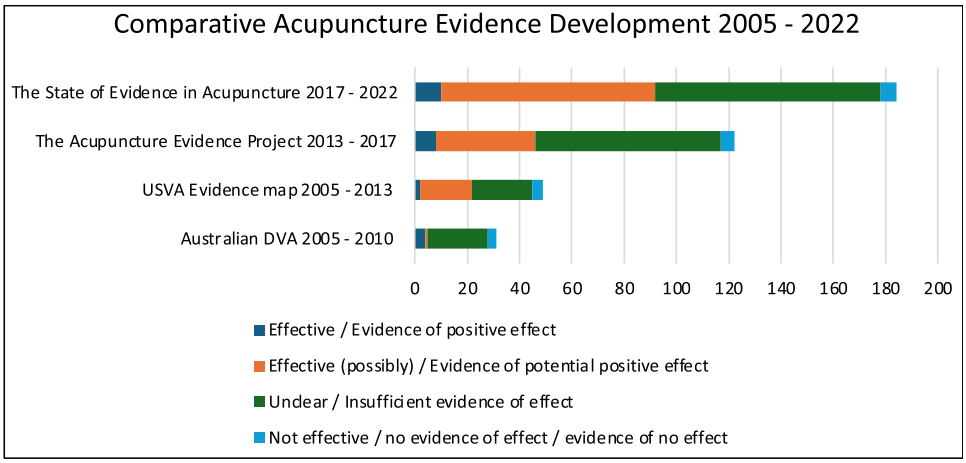

Fig. 3. Number of medical conditions their level of evidence (Table 1): Australian DVA 2005–2010 (n = 31;[8]); USVA Evidence map 2005–2013 (n = 49;[9]); The Acupuncture Evidence Project 2013–2017 (n = 122;[10]); The State of Evidence in Acupuncture 2017–2022 (n = 184).

clinical trials therefore consistently underestimate the true effect size of acupuncture and result in misinterpretation of true effect sizes.[36–40] In clinical practice, acupuncture has a high level of clinical effectiveness. It's nature of an invasive procedure and difficulties with sham controls occasionally compromise higher levels of evidence for its efficacy.

Nevertheless, in 92 medical conditions we found *evidence of positive effect* or *evidence of potential positive effect* of acupuncture, which thus might be eligible for clinical use. For another 86 medical conditions somewhat of an effect can be assumed, however, the evidence remains unclear.

In our review we encountered methodological weaknesses of SR/MA concerning selection and evaluation criteria, even Cochrane reviews have been criticized regarding its' "lack of attention about retrieval of negative studies, … statements about conflict of interests are a crucial point for the evaluation of therapeutic interventions according to EBM methodology".[41] However, we mainly relied on the SR/MA's author's evaluations and conclusions. On the other hand, SR/MA concerning the same medical indication make the comparability extremely difficult. Reasons include a great variation of outcome parameters (pain intensity scales, length of intervention and monitoring, quality of life), control groups in RCTs (sham, minimal acupuncture, standard medication, waiting list), different acupuncture methods, and point combination as well as point selection.

Many acupuncture trials follow the standards and apply CONSORT, GCP and STRICTA-guidelines. On the other hand, practical use of acupuncture follows various traditions (e.g. TCM, Japanese or Korean schools e.g.) and integrates other techniques (moxibustion, cupping, microsystem acupuncture etc.). This diversity complicates and could compromise the comparability of trials to a certain extend.

Hence, our review has several limitations. Although we adopted the assessment system described by the authors of 'The Acupuncture Evidence Project'[10] some concerns about objectiveness and comparability remain. Some SR/MA were eligible to be allocated into either one of two different groups of evidence' strength due to ambiguous authors' statements. Those cases were discussed between the two reviewers and a decision was made conformal. However, even after strict application of the rating criteria described above, a remnant of reviewers' subjectivity may have remained in some cases.

To include the German AWMF guidelines and to summarize their recommendations for ambiguous SR/MA results may weaken the methodology of our work. However, we believe that guideline discussions are at a high level and may even strengthen and support our results. Decisions were made according to the reviewers' best knowledge – but lacking full resources this work is not comparable to a Cochrane review. Given the reviewers' professional background some decisions might also be positively biased by their clinical experience.

Our findings are also limited by the mounting evidence that sham and placebo controls used in acupuncture trials are not inert, which is likely to lead to a consistent underestimation of the true effect size of acupuncture interventions.[36–40]

On the other hand, due to great diversity and variety of acupuncture methods, microsystems, and treatment approaches it still is challenging to compare results and effect sizes of RCTs, MAs, and SRs. Challenges with acupuncture trials have been described in detail.[46] We therefore urgently recommend following STRICTA, CONSORT, and other guidelines in future studies. In the great majority QoR, QoD, and QoE improved significantly, especially in trials from China: Chinese researchers had been trained in methodology by Western experts in the years 2010 – 2015 in special training programs, funded by the German Research Foundation (German: Deutsche Forschungsgesellschaft; DFG). Ever since, publications of higher quality had been a result. During implementation of CONSORT and STRICTA guidelines in 2018, MacPherson et al. reported about an increasing quality of Chinese publications.[42] This development is followed by more examples such as Ma et al.[43] or a well-designed Chinese multicenter RCT that was published in 2019 in a high-ranked journal.[44]

In **conclusion**, compared to previous years, acupuncture's quality of evidence has increased in the period 01/2017–12/2022. In total 862 included SR/MA resulted in a comparative review of 184 medical conditions. *Evidence of positive effect* was revealed in chronic pain, low-back pain, knee osteoarthritis, postoperative nausea and vomiting (PONV), migraine, tension-type headache, cancer-related fatigue, menopausal symptoms, female infertility (additional to medical reproductive treatment), chronic prostatitis/chronic pelvic pain syndrome in men. Another 82 medical conditions showed *evidence of potential positive effect*, followed by 86 indications that revealed insufficient data for a firm conclusion. Six medical conditions showed no evidence of effect/evidence of no effect. Although general quality of evidence has dramatically increased compared to the previous years, lack of underlying high-quality trials in some cases seems to compromise a consistent comparability between SR/MA. This issue should be addressed for future studies and guidelines such as STRICTA and CONSORT should strictly be obtained.

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CRediT authorship contribution statement

Hempen Moritz: Writing – original draft, Project administration, Methodology, Investigation, Conceptualization. **Hummelsberger Josef:** Writing – review & editing, Investigation.

Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Both authors are active members of the SMS – International Society for Chinese Medicine (Germany). The SMS funded the review. No other conflict of interest.

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Conflicts of Interests

Both authors are members of the SMS – International Society for Chinese Medicine and work with acupuncture as physicians.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.ctim.2025.103149.

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