Title: Clinical hypnosis for Procedural Pain and Distress in Children: A Scoping Review

Short Title: Reviewing hypnosis for paediatric procedural pain

Authors:

Dr Dali Geagea, PharmD

Child Health Research Centre, Centre for Children's Burns and Trauma Research, The University of Queensland, Brisbane, Australia

Dr Zephanie Tyack, PhD

Child Health Research Centre, Centre for Children's Burns and Trauma Research, The University of Queensland, Brisbane, Australia

Australian Centre for Health Service Innovation and Centre for Healthcare Transformation, School of Public Health and Social Work, Queensland University of Technology, Brisbane, Australia

Professor Roy Kimble, MBChB, DMed [Res]

Centre for Children's Burns and Trauma Research, Queensland Children's Hospital, The University of Queensland, Brisbane, Australia

Dr Vince Polito, PhD

School of Psychological Sciences, Macquarie University, Sydney, Australia

Bassel Ayoub

Faculty of Health, Queensland University of Technology, Brisbane, Australia

Dr Devin B. Terhune, PhD

Department of Psychology, Goldsmiths University of London, London, United Kingdom

Department of Psychology, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, UK

Associate Professor Bronwyn Griffin, PhD

School of Nursing and Midwifery, Griffith University, Nathan, Queensland, Australia

Correspondence to:

Dr Dali Geagea, PharmD

Postal Address: Centre for Children's Health Research, Level 7, 62 Graham Street, South Brisbane, QLD, Australia, 4101

Email: d.geagea@uq.net.au

Phone: + 61 7 30697428

Disclosures

Acknowledgements

We would like to thank Lars Eriksson for his assistance with the database searches.

Competing Interests

The authors have declared no competing interests.

Funding Statement

The proposed research received no specific grant from any funding agency in public, commercial, or not-for-profit sectors.

Authors' Contributions

All authors contributed to the study design. DG drafted the manuscript. The screening was independently conducted by DG and BA. Data extraction and synthesis were conducted by DG and reviewed by BG, ZT, BA, DT, and VP. Critical review, editing, and approval of the final manuscript draft were conducted by all authors.

Abstract

Objective

Pain and distress are common in children undergoing medical procedures, exposing them to acute and chronic biopsychosocial impairments if inadequately treated. Clinical hypnosis has emerged as a potentially beneficial treatment for children's procedural pain and distress due to evidence of effectiveness and potential superiority to other psychological interventions. However, systematic reviews of clinical hypnosis for children's procedural pain and distress have been predominantly conducted in children undergoing oncology and needle procedures and are lacking in broader paediatric contexts. This scoping review maps the evidence of clinical hypnosis for children's procedural pain and distress across broad paediatric contexts while highlighting knowledge gaps and areas requiring further investigation.

Methods

Published databases (PubMed, Cochrane Library, PsycINFO, Embase, CINAHL, Scopus, and Web of Science) and grey literature were searched in addition to hand-searching reference lists and key journals (up to May 2022). Two independent reviewers screened the titles and abstracts of search results followed by a full-text review against eligibility criteria. Articles were included if they involved a clinical hypnosis intervention comprising an induction followed by therapeutic suggestions for pain and distress in children undergoing medical procedures. This review followed the Arksey and O'Malley (2005) methodology and incorporated additional scoping review recommendations by the Joanna Briggs Institute and *Preferred Reporting Items for Systematic Reviews and Meta-Analyses*.

Results

A total of 38 eligible studies involving 2,205 children were included after 4,775 articles were screened. Research on clinical hypnosis for children's procedural pain and distress was marked by a

lack of fidelity measures and qualitative data as well as by inadequate intervention reporting and high attrition rates. Evidence regarding the safety of clinical hypnosis, pain unpleasantness outcomes, factors influencing outcomes, as well as barriers and facilitators to implementing hypnosis and study procedures was also lacking. Clinical hypnosis has potential benefits for children's procedural pain and distress based on evidence of superiority to control conditions and nonpharmacological interventions (e.g., distraction, acupressure) with moderate to large effect sizes as reported in 76% of studies. However, heterogeneous interventions, contexts, study designs, and populations were identified, and the certainty of the evidence was not evaluated.

Conclusion

The review suggests potential benefits of clinical hypnosis for children's procedural pain and distress and thus provides a precursor for further systematic reviews and trials investigating the effectiveness of clinical hypnosis. The review also indicates the need to further explore the feasibility, acceptability, implementation, and safety of clinical hypnosis in children undergoing painful procedures. Based on the review, researchers implementing clinical hypnosis should adequately report interventions or use treatment manuals, follow recommended research guidelines, and assess the fidelity of intervention delivery to promote replicating and comparing interventions. The review also highlights common methodological shortcomings of published trials to avoid, such as the lack of implementation frameworks, small sample sizes, inadequate reporting of standard care or control conditions, and limited evidence on pain unpleasantness outcomes.

Keywords

Procedural Pain, Distress, Clinical Hypnosis, Children, Scoping Review

Introduction

Acute distress and pain are commonly experienced by children undergoing medical procedures, exposing them to acute and chronic biopsychosocial impairments. Distress involves physiological (e.g., increased blood pressure and pulse), behavioural (e.g., aggressivity), and psychological (e.g., fear, anxiety) changes in response to procedures that are perceived as unpleasant stimuli [1-3]. Pain refers to "an unpleasant experience associated with or resembling that associated with actual or potential tissue damage with sensory (e.g., intensity, severity), emotional (e.g., unpleasantness), cognitive (e.g., perceptions), and social components" [4,5]. Inadequately treated procedural pain and distress can exacerbate each other, amplify inflammation, delay recovery, and reduce compliance, which can extend hospitalisation and increase medications' requirements [6-12]. Inadequately treated procedural pain and distress can also cause chronic biopsychosocial impairments (e.g., social withdrawal, school problems, sleep disturbance, and chronic stress) that can negatively affect children's quality of life, psychological well-being, family, and subsequent pain management [9,13,14]. The adequate treatment of children's procedural pain and distress is a fundamental human right and is required to alleviate biopsychosocial impairments and their impact on children and families in addition to improving children's well-being, healthcare, and recovery [7,12,15,16].

Notwithstanding healthcare and research progresses, procedural pain and distress have been inadequately treated in more than half of hospitalised children [17,18]. Despite popularity and benefits, pain and distress medications are limited by side effects, high expenses, potential ineffectiveness, contraindications, inability to address all components of pain, as well as lack of tailoring and consensus regarding effective doses and regimens [19-22]. Thus, treating children's procedural pain and distress needs improvement in line with paediatric pain guidelines [23]. Effective, safe, and tailored psychological adjuncts to medications can optimise treating children's procedural pain and distress by targeting cognitive and emotional pain determinants while reducing concerns over medications' safety, addictive properties, and costs [24].

Clinical hypnosis is a safe and tailored psychological intervention with potential benefits and a long history of use in children undergoing painful procedures [25]. Clinical hypnosis mainly consists of an induction in a specific socio-cultural context followed by suggestions eliciting varied sensory, cognitive-perceptual, and/or behavioural alterations for therapeutic purposes [26]. Although research on clinical hypnosis has been primarily conducted in adults, children's higher hypnotic responsiveness, strong imagination, and motivation to learn new skills can make them more receptive to hypnosis than adults [25,27]. Consistently, a meta-analysis of 28 studies on clinical hypnosis for procedural distress reported larger effect sizes in children in comparison to adults [28]. Further, the effectiveness of clinical hypnosis for children's procedural pain is supported by systematic evidence of superiority (medium to large effect) to standard care, control conditions, and other psychological interventions in children [17,18,29-36]. Clinical hypnosis can be tailored to diverse settings and populations as well as delivered in varied modes and durations, which facilitates its application [28,37]. Thus, clinical hypnosis may be promising for children's procedural pain and distress due to safety, adaptability, evidence of effectiveness, and wide clinical use [25].

Despite evidence suggesting the effectiveness of clinical hypnosis for children's procedural pain and distress, research is lacking in the broader contexts of children undergoing painful medical procedures. Systematic reviews of clinical hypnosis for children's procedural pain have focused on needle-related and oncology procedures, disregarding other medical contexts. Further, based on a scoping review of systematic reviews, clinical hypnosis has not been systematically reviewed in the broad context of paediatric procedural pain and distress within the last 10 years [38]. Hence, a review of recent studies on clinical hypnosis for procedural pain and distress in broader paediatric contexts is warranted.

Furthermore, despite supporting the effectiveness of clinical hypnosis for children's procedural pain and distress, systematic reviews have inadequately reported areas with relevance to research conduct and intervention delivery. Firstly, mapping evidence on interventions is warranted to reduce the bias of inadequately reporting hypnotic components, enhance the understanding of

clinical hypnosis, and guide treatment delivery and tailoring [36,39,40]. Secondly, factors that can influence the implementation and outcomes of clinical hypnosis have not been adequately reported and thus require further examinations that follow interventional and implementation research guidelines [18,27,29,31,35-37,39-42]. Thirdly, reviews have mainly investigated the effectiveness of clinical hypnosis for pain intensity in children, omitting other components of pain that warrant examination, such as pain unpleasantness [32,33,35,36,43-45]. Fourthly, data on the safety of clinical hypnosis have been reported in both adult and children's studies (e.g., [29,45,46]) but are lacking in systematic reviews of clinical hypnosis for children's procedural pain and distress [17,18,30-36]. Mapping evidence on the safety of clinical hypnosis is important to ensure the protection of children and assist clinical decision-making. Further, despite their important and increasing use to guide study conduct and justify research significance, theoretical frameworks remain inadequately reported [47]. Thus, mapping evidence on areas relevant to clinical hypnosis research and intervention delivery, including interventions, influencing factors, safety, and theoretical frameworks, is warranted.

Whereas systematic reviews appraise and synthesise evidence to address specific research questions, scoping reviews broadly map the scope and nature of evidence to specify research gaps and areas requiring further investigation [48,49]. Thus, scoping reviews are useful precursors to systematic reviews and trials, which allows the targeting of research funding to areas with a paucity of experimental research [50]. Two scoping reviews of clinical hypnosis for pain have been published to date, entailing a review examining chronic neuropathic pain while disregarding acute procedural pain [51] and a review mapping recent systematic reviews from 2014 [38]. The latter review included only a single systematic review on clinical hypnosis for children's procedural pain [52]. Both reviews did not map evidence on areas with relevance to clinical hypnosis research entailing adverse effects, distress and pain unpleasantness outcomes, influencing factors, as well as barriers and facilitators to implementing hypnosis and study procedures. This scoping review is conducted to address this paucity of knowledge.

Aims and Objectives

The overall aims of this review were to map the scope and nature of available evidence on clinical hypnosis for children's procedural pain and distress, explore areas relevant to research conduct and intervention delivery, and identify knowledge gaps to guide future studies and systematic reviews.

The specific aims of the review were to summarise evidence on clinical hypnosis pain and distress outcomes (e.g., pain unpleasantness and intensity) with their measurement methods and time-points as well as related perceived and actual influencing factors, including hypnotic suggestibility; barriers and facilitators to implementing hypnosis and study procedures; the safety of clinical hypnosis; interventions' characteristics (e.g., components, duration, provider, treatment manual, delivery mode, the fidelity of delivery); and theoretical frameworks guiding the study design, intervention reporting, barriers and facilitators, collection, analysis, interpretation, and dissemination of data. Although evaluating the quality of evidence and effectiveness is beyond the scope of this review, the effects of clinical hypnosis were reported to identify potentially relevant outcomes and underpin systematic reviews at the preliminary and evidence-based scoping stage [49].

Methods

To ensure transparency and accuracy, the scoping review follows the recommendations of Arksey and O'Malley [53] and Joanna Briggs Institute (JBI) [54]. Data charting and reporting are in line with the *Preferred Reporting Items for Systematic reviews and Meta-Analyses for Scoping Reviews (PRISMA-ScR)* [55] and JBI [54] guidelines. Population, Concept, and Context (PCC) elements were used to guide the scoping review (e.g., eligibility criteria, research questions, data charting, and data synthesis) [54]. For transparent data reporting and to avoid publication bias, a protocol detailing the conduct of the scoping review was published [56].

Research Questions

Research questions were developed following a preliminary review of the systematic evidence of clinical hypnosis for children's procedural pain and distress in line with the objectives of the scoping review.

Eligibility Criteria

Articles' eligibility was evaluated based on research questions as mapped to PCC elements and study characteristics [54].

Population

Studies including participants under 18 years were considered for inclusion in line with the United Nations' definition of children and systematic reviews of clinical hypnosis for children's procedural pain and distress [33,52,57,58]. Studies including both adults and children were considered for inclusion only if children's outcomes were analysed or reported separately.

Concept

***Clinical hypnosis interventions*:** Clinical hypnosis comprises an induction followed by therapeutic suggestions eliciting sensory, cognitive-perceptual, affective and/or behavioural alterations [25,59]. Inductions typically involve describing the procedure as *hypnosis* followed by instructions for relaxation, receptiveness to suggestions, and attention focused on external objects (eye-fixation) and/or internal experiences (pleasant imagery) [59]. Suggestions entail invitations to perform motor and/or cognitive actions to elicit changes in emotions, cognitions, perceptions, sensations, and/or behaviours experienced during or beyond hypnosis [25]. In clinical hypnosis, therapeutic suggestions are provided to alleviate symptoms or promote desired therapy outcomes. Studies were considered for inclusion if they examined an intervention labelled as *clinical hypnosis* or a close synonym (e.g., *hypnosis, hypnotherapy*) or met the criteria to be qualified as clinical hypnosis based on literature [26]. Accordingly, studies examining interventions involving essential clinical hypnosis components (i.e., at least an induction element and suggestions for pain and/or distress) were considered for inclusion [60-62].

***Procedural pain and distress outcomes*:** Studies examining procedure-related (pre, post, or intra-procedural) distress and/or pain outcomes (e.g., pain intensity and/or unpleasantness) or markers (e.g., analgesics doses, satisfaction, comfort) were considered for inclusion, except studies examining solely physiological measures of pain and/or distress (e.g., heart rate) [63,64].

Context

Studies conducted in a medical context or examining pain related to medical procedures, implying a medical context, were considered for inclusion. Studies on experimental pain were excluded as they involve nociception, that is distinct from pain elicited by medical procedures, and are conducted in non-medical contexts.

Study characteristics

***Time*:** For a comprehensive review of recent and older relevant articles and to obtain the historical context of clinical hypnosis, the review was not limited in scope based on publication time.

***Source*:** In addition to peer-reviewed journal articles, grey literature that includes unpublished data that is more likely to include negative findings related to feasibility, acceptability (including safety), and effectiveness was considered for inclusion [65]. Including grey literature aimed to broaden the scope of the review as well as reduce study selection and publication bias by providing a more comprehensive review of the available evidence [65]. Conference proceedings and abstracts were considered for inclusion if they included sufficient data for extraction.

***Language*:** For broader research capture, no language limitation was used for abstract and title screening. Full-text articles in Arabic, English, French, German, Italian, and Spanish were considered for inclusion as the first author is fluent in these languages.

***Design*:** For a comprehensive overview of research to date, studies were considered for inclusion irrespective of design (e.g., retrospective, observational, and pre-post designs) except case studies and case reports that comprise individual reports and are thus less generalisable [66]. Review articles were excluded after checking their references to avoid duplication of information.

Procedures

Search strategy

Published and grey literature on clinical hypnosis for children's procedural pain and distress were searched using keywords and index terms identified in the initial search (variations of the terms *hypnosis/hypnotherapy*, *child*, *pain*, and *distress*) (Supplementary file 1) [56]. Databases searched included CINAHL, Cochrane Library, Embase, PsycINFO, PubMed, Scopus, and Web of Science. Searched grey literature included BioRxiv, ClinicalTrials.gov, MedRxiv, Open Grey, Open Science Framework, the Australian New Zealand Clinical Trials Registry, and the American Psychological

Association website (apa.org). All records up to May 2022 were included (the date last searched was 11/05/2022). To locate additional articles that might not have been captured in database searches, references of included papers and relevant systematic reviews were screened followed by hand-searching a key hypnosis journal entitled *the International Journal of Experimental and Clinical Hypnosis* [53].

Study selection

References found in searches were added to EndnoteX9® referencing software (Clarivate Analytics, Philadelphia, USA) where duplicates were removed by automation. After removing duplicates, to ensure transparent data management during study selection, search results were uploaded to Covidence® software (Veritas Health Innovation, Melbourne, Australia; available at www.covidence.org) where further duplicates were removed by automation [67]. Two reviewers (DG and BA) independently screened titles and abstracts to identify relevant studies for full-text screening using Covidence®. Studies were selected for full-text review or excluded if both reviewers agreed. Disputes in eligibility screening were resolved by full-text retrieval and review. In the absence of access to articles, corresponding authors were contacted to provide access. When full texts were not found, corresponding abstracts were used to extract relevant information if they contained sufficient information to enable assessing the articles' eligibility and extracting data. Two reviewers (DG and BA) independently screened full texts of selected studies using Covidence® [67]. In the case of disagreements regarding the selection of studies, other reviewers (BG and ZT) were consulted to discuss the eligibility of the studies in question until reaching a consensus. For full texts involving interventions not labelled as *hypnosis/hypnotherapy*, a reviewer (VP) with expertise in theoretical hypnosis was consulted to evaluate if the interventions met the eligibility criteria to be qualified as clinical hypnosis. Further duplicates and studies with identical data sets were removed during full-text screening by manual checking. A PRISMA flow diagram (Figure 1) illustrates the selection process and the flow of papers included and excluded at each stage [68].

Data charting

Authors created a charting form to record data, including characteristics of studies, populations, interventions, and outcomes, as relevant to the review questions (supplementary file 2) [56]. Two reviewers (DG and BA) independently charted and piloted 20% of the results following a discussion with a third reviewer (BG). Piloting the extracted data form led to alterations in consultation with a fourth reviewer (ZT) to ensure a logical and descriptive summary covering all relevant information [54]. The developed charting table was adjusted based on the supplementary extracted information to include more categories and chart headings following a discussion with 2 other authors (DT and VP). The remaining data was extracted by a reviewer (DG) and checked by a second reviewer (BG). Based on the review objectives, only outcomes related to pain and distress (e.g., distress constructs of anxiety, fear, discomfort, and physiological stress) were extracted [69]. In the absence of information on assessors of outcomes, medical records were considered as reported by observers, as these records are usually collected by medical staff, not parents or children. The Template for Intervention Description and Replication (TIDieR) framework was used to guide extracting data on interventions [40]. Barriers and facilitators to implementing hypnosis and study procedures were mapped to the integrated Promoting Action on Research Implementation in Health Services (i-PARIHS) framework [70]. After contacting the primary authors of included studies to provide or confirm information, missing data were recorded as such if not provided.

Data synthesis

Extracted quantitative and qualitative data were summarised and presented in tables accompanied by a narrative synthesis [54,55]. These data included publication year, author, design, context, population, interventions, barriers and facilitators to implementing hypnosis and study procedures, pain and distress-related outcomes, the safety of clinical hypnosis, and factors influencing outcomes (supplementary file 2). The correlation of factors with outcomes was considered weak or strong based on authors' reporting of effects' significance (e.g., F and t-tests) and Cohen's thresholds for

correlation strengths (Pearson's *r* .10, .30, and .50 respectively considered weak, moderate, and strong [71]).

Results

Study Characteristics

Thirty-eight studies investigating clinical hypnosis for children's procedural pain and/or distress were included. Characteristics of included studies are summarised in table 1 and detailed in table 2. All studies were published in English between 1975 and 2022, with 39% published since 2010 (Figure 2. Number of included studies per decadeFigure 2) [45,72-85]. Studies were conducted predominantly in America and Europe (Figure 3, Table 2). Studies were published mainly as journal articles except for a conference abstract and 3 dissertations. Most included studies used controlled designs (76%) that were predominantly prospective (71%) and randomised (68%), except 2 controlled retrospective studies (5%) (Table 1). No models, theories, or frameworks for study design or collection, analysis, interpretation, and dissemination of data were reported except in a study in which participants' age range (3-10 years) was based on Piaget's cognitive theory (Table 1). According to this theory, age is inversely linked to anxiety, in that younger children (3-6 years) display more behavioural and physical distress than older children [86].

Outcomes

Only 3 studies (8%) reported on the safety of clinical hypnosis, with all indicating the absence of adverse effects [45,89,101]. Pain and distress-related outcomes of clinical hypnosis examined across studies with corresponding assessment sources (assessors) and tools are detailed in table 2. Pain and distress-related outcomes were mainly pain intensity and indicators (e.g., analgesic requirements) as well as distress-related constructs, such as behavioural distress, anxiety, fear, stress biomarkers (blood pressure, heart rate), discomfort, satisfaction, and anxiolytics requirements. Most studies (76%) involved multiple assessors, including children, parents, and observers (13%) [45,74,81,103,108]; children and parents (5%) [84,105]; children and observers (55%) [72,75,76,78,83,85,86,88,91-93,95-100,102,104,106,107]; parents and observers (3%) [87]. A few studies involved single assessors entailing observers (18%) [73,79,80,82,89,90,101] or children

(3%) [77]. Assessors were unknown in a study examining procedural pain (3%) [94]. Data collection methods were mainly quantitative and included numeric scales for parent proxy reports; numeric and faces scales for children's self-reports; numeric scales, medical records, as well as distress checklists and questionnaires for observer proxy reports.

Pain and distress-related outcomes of clinical hypnosis as a sole treatment are summarised in table 3. Indirect and direct clinical hypnosis respectively entailing direct (e.g., instructions) or indirect (e.g., metaphors and analogies) suggestions were similarly effective [91]. Clinical hypnosis without comparators was linked to pain relief [95]. Three pre-post control studies [84,92,94] and a repeated measures study [77] reported a significant and non-significant superiority of clinical hypnosis versus baseline conditions. The effects of clinical hypnosis were also significantly and non-significantly superior to distraction in an observational study [74] and to standard care in 2 retrospective studies [78,83]. An observational study reported tolerability, willingness to repeat the procedure, satisfaction, anxiety, and low pain with clinical hypnosis alone or combined with sedatives (midazolam and inhaled anaesthetics) [76]. Clinical hypnosis across RCTs was significantly superior to standard care [72,80,81,85,86,96,102,108]; distraction [86,103]; control [73,106]; acupressure and audio-visual aids [73]; play [93]; support and attention control [105]. Despite lower parental treatment days and doses with clinical hypnosis, oral analgesics requirements were higher in an RCT due to earlier discharge [101]. RCTs also reported that the effects of clinical hypnosis were non-significantly superior to active cognitive strategies [104], distraction [86], control [106], and progressive muscle relaxation [85], or similar to standard care [80,107], counselling [107], and play [93].

Clinical hypnosis was also examined as an adjunct treatment without comparators in 2 observational studies [75,88] or compared to standard care and psychological interventions in 9 RCTs [45,79,82,87,89,97-100] and a cross-over study [90] (Table 4). An observational study indicated the absence of procedural fear or panic and the reduced need for pain medications post-operatively when clinical hypnosis was combined with general anaesthesia [88]. Another observational study showed relaxation and cooperation during procedures when clinical hypnosis

was combined with midazolam [75]. Clinical hypnosis combined with placebo was as effective as standard pharmacological care for procedural pain and discomfort and significantly more effective for procedural anxiety and post-procedural behavioural disorders [87]. Clinical hypnosis as an adjunct to standard care yield similar (for procedural pain, post-procedural anxiety, and morphine use) or superior (non-significantly for post-procedural stress biomarkers, analgesics, and anxiolytics, or significantly for procedural anxiety) effects than standard care [45,82,89]. Clinical hypnosis with standard care was significantly superior to both standard care and cognitive behavioural therapy for procedural anxiety and behavioural distress, significantly superior to standard care and as effective as cognitive behavioural therapy for procedural pain [97]. When combined with standard care, direct and indirect clinical hypnosis were similarly effective and elicited significantly superior effects than standard care [98]. Clinical hypnosis as an adjunct to local anaesthetics was significantly superior to local anaesthetics alone or with attention control based on RCTs [79,99,100] and the cross-over study [90].

Factors influencing outcomes

Several studies (39%) did not report on factors influencing the pain and/or distress outcomes of clinical hypnosis [73,74,81-85,87-89,92,94,96,100,104,106]. Reported influencing factors included intervention timing (e.g., during subsequent procedure), hypnotherapist's presence (e.g., hetero or self-hypnosis), child baseline and procedural distress or anxiety, chemotherapy-induced emesis (i.e., vomiting process), rapport with the hypnotherapist, and parents' distress-promoting behaviour (Table 5) [45,72,77,78,91,93,98,99,105,107]. The type of suggestions had a non-significant effect on hypnosis pain, anxiety, and behavioural distress outcomes with both direct and indirect suggestions yielding similar effects [91]. The effect of age on hypnosis pain and distress outcomes was reportedly non-significant [80,97,102,105], significantly negative (significant effect for younger age) [45,79,86,90,107], and seldom significantly positive [86,95]. Children's female gender was weakly correlated with preprocedural anxiety and strongly correlated with the pain and distress outcomes of clinical hypnosis [93]. Endoscopy's success rated by the degree of completion and children's tolerability was linked to older age (13 versus 8 years), the type of procedures (esophagogastroduodenoscopy versus recto sigmoidoscopy), and parental presence (for esophagogastroduodenoscopy) [76]. Despite being linked to successful esophagogastroduodenoscopy, parental presence did not significantly influence the outcomes of clinical hypnosis in that study [76]. Children's willingness to repeat procedures was linked to procedures' success and tolerability [76].

A few studies involved anecdotal assumptions and clinical observations regarding potential influencing factors without assessing their relation to pain and distress outcomes of clinical hypnosis. Children's exacerbated distress and vocalisation of difficulties were observed with parents' distress-promoting behaviour (e.g., denying, minimising, or reinforcing children's experiences) or children's previous difficulty with procedures [95,108]. Authors postulated that nurses' delivery or knowledge of clinical hypnosis may have influenced results by using reassuring words or similar communication techniques in non-hypnotic interventions [82,86]. Increased oral

narcotic requirements with clinical hypnosis despite reduced doses of intravenous narcotics and pain treatment duration were postulated to be due to earlier hospital discharge [101]. Factors proposed to affect pain outcomes entailed low hypnotic suggestibility and abnormal pain pathways inducing hyperalgesia (i.e., increased sensitivity to painful stimuli [109]) and/or allodynia (i.e., pain with non-painful stimulus [5]) causing burning sensations during procedure rehearsal [77]. Pain and distress outcomes were postulated to be influenced by reduced hypnotic engagement due to procedure-related instructions as well as exacerbated fears linked to the inexperience of the hypnosis provider, parents' behaviours, and children's history of frequent procedures [81]. When using hypnosis with midazolam and inhaled anaesthetics, reduced post-procedural pain and improved mood were presumably linked to midazolam's related amnesia, children's coping strategies, positive conditioning (at the second treatment session), and parental presence whereas reduced cooperativeness was linked to anaesthesia [75].

Hypnotic suggestibility, referring to the capacity to respond to hypnotic suggestions, has been postulated to be a strong predictor of clinical hypnosis outcomes [31,32,36,110]. The correlation between hypnotic suggestibility level and the pain and distress outcomes of clinical hypnosis was reported to be strong in 7 studies [91-93,97-99,103] and weak in 3 studies [104,106,108] (Table 5). The majority of studies (66%) did not assess hypnotic suggestibility nor the relationship with outcomes [72-78,80-87,89,90,94-96,100-102,105,107], whereas 8% of studies assessed hypnotic suggestibility alone without assessing its relation to outcomes [45,79,88]. Hypnotic suggestibility was mainly assessed using the Stanford Hypnotic Clinical Scale [45,79,91,92,97-99,103,104,106] with few studies using other measures, including the hypnotic induction profile [108], the eye-roll test [88], and post-hypnotic response scale [93].

Population

The characteristics of the 2,205 child participants included in the scoping review are summarised in table 1 and detailed in table 6. The number of study participants ranged from less than 30 in 31% of studies to more than 90 in 13%. Participants' age varied between 4 and 22 years although data from adult participants were not included in this review, and 3 studies did not report participants' age range. Clinical hypnosis was examined in children undergoing diverse medical procedures in broad paediatric contexts, including oncology (42%), dental (18%), orthopaedic (8%), surgical and miscellaneous procedures (21%, e.g., lower abdominal surgery, burns dressing changes), and medical examination (11%).

Rates of refusal to participate reported in 42% of studies were between 0% and 52% [76,78,81,82,85,92,96-100,102,105-108]. Parents refused participation for the reasons of thinking that hypnotic discussion or training would bring undo attention to medical procedures and increase children's anxiety [107], not wanting a reminder of the illness, or claiming that children had no problem [105]. Children refused participation due to a lack of interest or religious reservation [96]; finding no need for interventions [102]; unsuccessful previous hypnosis [105].

Participants were reported to drop out in 21% of studies with attrition rates ranging from 2% to 52% [77,81,82,86,94,103,104,106]. Participants' consent withdrawal was due to rejecting hypnosis (perceived conflict with religion, feeling uncomfortable during hypnosis, insufficient motivation), perceived benefits, or parental interference (e.g., insisting on practice) [77,82,86,94,103,104,106]. Failure to complete studies was reportedly due to treatment changes (e.g., procedure cancellation, treatment end, reduced number of procedures) or relapses [77,82,86,94,103,104,106]. Unplanned children or parents' circumstances (e.g., child urgent hospital admissions or death, changes in parental work or schedule) and parents' difficulty in finding time for children's hypnosis were also reported to interrupt participation [77,82,86,94,103,104,106]. Higher baseline anxiety was observed in children rejecting hypnosis in a study [94]. However, their small number (n = 2) [94] and the

higher participation rate in children with higher anxiety expression reported in another study [92] precluded conclusions regarding the impact of anxiety on willingness to participate.

Clinical hypnosis interventions and comparators

The delivery mode, time, duration, frequency, provider, components, and context of clinical hypnosis and comparators are detailed in table 7. The context of delivering interventions was described in most studies (95%, except 2 [92,101]), with most interventions delivered in a single context (76%) and at metropolitan hospitals (65%).

Delivery modes, duration, and timing

Clinical hypnosis interventions varied in their delivery modes (taped/pre-recorded or live), providers (hetero-hypnosis guided by a clinician or experimenter or self-directed hypnosis), timing (pre, post, or intra-procedural), and doses (duration and frequency). Most studies (84%) entailed live interventions, including hetero-hypnosis (55%) [45,72-76,79,81,82,84-88,90,92,96,97,102,105,107] or self-hypnosis with live hypnosis training or hetero-hypnosis (29%) [77,78,91,93-95,98-100,106,108]. A minority of studies used taped hypnosis (5%) [80,89], both live and taped hypnosis (3%) [104], or self-hypnosis tapes as adjuncts to live hypnosis (8%) [83,101,103]. Clinical hypnosis was provided before (29%) [76,78,81,83,88,90,91,96,97,104,107], during (18.5%) [72-74,79,80,82,102], or both before and during procedures (47.5%) [45,75,77,86,87,89,92-95,98-101,103,105,106,108]. Intra and pre-procedural hypnosis either started before procedures and continued during procedures or were conducted both before (hypnosis training or hetero-hypnosis) and during (self-hypnosis) procedures. The duration of procedural hypnosis varied across the 3 studies that reported on this aspect (20, 40, and 45 minutes) [93,98,99]. Durations of pre-procedural hypnosis ranged from a few minutes (1-5 minutes) to 80 minutes. Two studies (5%) did not report the timing or duration of clinical hypnosis [84,85]. The duration of comparator interventions varied between procedures and was reported to be equal to clinical hypnosis or longer. Although the frequency of delivering interventions was seldom reported, the frequency of procedural interventions could be implied from the reported frequency of procedures.

Components and techniques

Clinical hypnosis was based on *tell-show-do* and *confusion* techniques [75]; *force-animal*, *colour*, *bird-swing,* and *magic arm* induction techniques [75]; Erickson's approach [72,76,77]; Gardner's self-hypnosis model [98-100,106]; Lobe's model [78,83]; a psychiatry book [112]; a book on hypnotherapy in children and adolescents. However, most studies inadequately reported clinical hypnosis by providing minimal details or not reporting interventions (3%) [87], inductions (32%) [73-75,82,84,86,89,96,102,103,107,108], the hypnotic context, therapeutic suggestions (content and phrasing style), and de-inductions. More than half of studies (58%) reported on pre-hypnosis interviews [45,72-75,78,82,87-89,91,94,96-99,103-108] and only few studies (10%) reported on post-hypnotic interviews [74,75,78,83].

Treatment manuals and fidelity measures

Several studies (29%) used a treatment manual or an equivalent, including clinical hypnosis tapes transcripts [89]; department standard care manual [72]; attention control and clinical hypnosis manuals [98-100]; hypnotic induction and arm levitation script [79]; aged matched manual [104] or training protocols for distraction and clinical hypnosis [103]; standardised prewritten clinical hypnosis [82]; a manual for self-hypnosis training, hypnotic induction, and suggestions [106]; or scripts including mental images from which participants could choose their favourite images for clinicalhypnosis [67].

A few studies (10%) used fidelity measures to assess adherence to treatment manuals as well as report modifications and deviations [98-100,103]. In recent studies, an independent observer rated therapists' adherence to manuals during randomly selected intervention procedures on a visual analog scale from 0 (completely different) to 10 (exactly as described) through direct observations and analysis of sessions [98-100]. In these studies, treatment fidelity as assessed by mean concordance between therapists' delivered treatments and manuals was high [98-100]. The most reported deviation from the manual was physical contact by therapists in response to children's requests and brief discussions about children's activities and interests (e.g., school and sports)

[98,99]. Authors considered the adherence rate satisfactory and minor deviations necessary for rapport with participants and ethical care. In the earlier study, parents delivering interventions assessed compliance with the training protocol by recording hypnosis practice on a chart for 7 daily intervention sessions [103]. This study reported a non-significant deviation in the amount of child intervention practice as determined by parents' reports except for a single case that was not included in the study due to child death (cause of death unknown) [103]. Videotapes and adherence checks showed that parents used clinical hypnosis and distraction faithfully and accurately although many parents stopped using the arm-lowering item from the hypnotic suggestibility scale during interventions [103]. Despite not using a treatment manual, a study reported that not all suggestions were given to each child [91] and another study indicated that hypnotic suggestions were shortened in subsequent sessions after hypnosis became familiar [92].

Tailoring

Several studies (76%) reported tailoring clinical hypnosis (i.e., delivering interventions that are not identical among participants [40]) [45,72-75,77,78,81-83,86,88,90-96,98-100,102-108]. Clinical hypnosis was tailored to children's preferences, including favourite places and activities [108]; favourite characters, stories, and mental images from scripts [73]; desired imagined journey [82]; and favourite therapeutic suggestions [74]. Tailoring was also based on children's age, sensory capacities, and cognitive development [74]; response and cooperation degree (until satisfactory outcomes) [88]; developmental level, interests, and individual needs [77]; interests [93]; interests and needs [94]; or needs [75]. Tailoring also involved including personal content in hypnotic stories or adventures [90] and adapting inductions to children's interests [72] or age, social-cognitive development, and interests [81]. The therapist's observation of child behaviour and clinical judgement of their needs was also used to guide tailoring wording and details of inductions, intensification techniques, and specific induction suggestions [45]. Further, clinical hypnosis was individualised despite following a basic pattern where procedure rehearsal was prominent (hypnotic induction, visualisation, hypnotic simulation of procedure) [92]. In a study, despite the absence of tailoring to each child, clinical hypnosis was adapted for children undergoing dental

extractions whereas the comparator (progressive muscle relaxation) was adapted to the general paediatric population [85].

Non-hypnotic comparator interventions were also tailored in a few studies (10%), including tailoring non-medical play [98] and distraction [104] to children's age and interests and preferences, and integrating children's preferred cartoons/TV shows or movies and sensory type in audio-visual distraction aids [73]. Distraction and breathwork were also tailored based on knowledge of children, family, and situational factors [102]. Intravenous analgesia or local anaesthetic infusion was chosen based on surgeons' preferences and patients' previous opioid experiences [78,83]. Analgesics doses were adjusted to promote pain relief and safe analgesic administration [78]. Adjunct interventions were also tailored by adapting sedative doses to children's body weight [76]; allowing children to choose the mode of administrating anaesthesia (inhaled or intravenous induction) [74] or the administration of midazolam and/or inhaled anaesthesia [76].

Barriers and facilitators

Barriers and facilitators to implementing clinical hypnosis and study procedures were seldom reported and were based on clinical observations without assessing their effect on implementation outcomes. Barriers related to children (e.g., age, desire to watch procedure, coping-strategies), hypnosis providers, and hypnotic components (using procedural landmarks, establishing a hypnotic relationship) were reported to affect intervention ease, therapeutic relationships, and therapy engagement. For instance, children's age and motivation for successful outcomes were linked to excellent cooperation, irrespective of children's hypnotic suggestibility [88]. Potential confounding factors postulated to exacerbate children's anxiety towards using new techniques (e.g., imagery) entailed the desire to watch the procedure or comfort in using well-established coping strategies [77]. Explaining procedural steps (e.g., needle insertion) was reported to assist in relieving child worries about unpleasant *surprises* for better fantasy involvement, especially that most children wanted to know about procedures [102]. Children's fantasy involvement was also promoted by

weaving humour, adventure, and magic within stories designed based on children (e.g., family and anxiety levels) [102]. Establishing a therapeutic relationship between one of the hypnotherapists and patients promoted hypnotherapists' interchangeability (allowing the other hypnotherapist to establish rapport with children following primary contact immediately before a procedure) and facilitated clinical hypnosis [94].

Parental presence

Several studies reported that parents were present during procedures with involvement (18%) or without reported involvement (26%). Parents actively participated in the pre-hypnotic discussion [104]; were instructed to assist child self-hypnosis [108]; and were encouraged to cue child self-hypnosis or participate in group child and parent hypnosis unless contraindicated [106]. Parents were also requested to actively comfort children, refrain from over-reassurance, as well as briefly encourage and cue children to practise clinical hypnosis [99,100]. Further, after observing children's clinical hypnosis training (coaching breathing, relaxation, and imagery), parents were trained to coach child hypnosis under the supervision of hypnotherapists who emphasised increased parent involvement at stress points to promote positive experiences [103,107].

Providers

Almost half of the studies (48%) inadequately reported the experience or training of clinical hypnosis providers due to absent (30%) or insufficient information (18%). In a study, an integrative medicine physician provided the post-hypnotic discussion, but the clinical hypnosis provider was not reported [83]. Clinical hypnosis was provided by medical personnel trained in hypnosis (39%), including doctoral students [45,103,107]; anaesthetists [72,87,88]; dentists [75,79,89,90], and nurses specialised in oncology-haematology, paediatric endoscopy, paediatrics, or anaesthesia [76,77,81,82,96]. Clinical hypnosis was seldom provided by psychologists trained in hypnosis (13%), including a psychologist experienced in the psychology of oncology and hypnosis [93], a research psychologist experienced in hypnosis for pain [97], or a medical student certified in psychiatry and trained by a psychiatrist [85]. Clinical hypnosis was also provided by specialists not

reported to receive a hypnosis training, including paediatric psychologists and paediatricians [94,102].

In 53% of studies, providers of comparator interventions were inadequately reported by absence of information on comparators [75,76,91,92,94,95,106] or providers [73,74,78,80,81,83-85,87,89,105], and labelling providers as therapists without adequately reporting their experience or training [100,108]. One of these studies reported that a therapist conducted clinical hypnosis and attention control without mentioning whether this was the same provider [100]. Medical staff [45,77,86,98,99,104,107], a dental student [72], and anaesthetists (providing anaesthesia) [88,101] provided standard care. A trained psychology-counselling student provided counselling [107], a therapist provided attention control [98], and experimenters provided distraction [86,104]. Clinical hypnosis providers also delivered comparator interventions [79,82,90,93,102,103]. For instance, in a study, cognitive-behavioural therapy was provided by the hypnosis provider who had received cognitive-behavioural therapy training whereas hospital staff provided standard care [97]. In another study, standard care was delivered by the hypnosis provider, nurse, and/or child life specialist [96].

Discussion

Main Findings and Implications

This review mapped evidence on clinical hypnosis for children's procedural pain and distress and explored areas relevant to research conduct and intervention delivery that have not been adequately reviewed, and thus has important research implications. Highly variable rates of attrition (2-52%) and unwillingness to participate (0-52%) were respectively reported in 21% and 42% of studies included in the review. Further, the safety of clinical hypnosis was reported in only 3 studies in the current review and has been inadequately examined in previous reviews e.g., [17,18,30-36]. Thus, the safety and acceptability of clinical hypnosis in children undergoing medical procedures warrant further examination to ensure protecting participants and promote their participation in clinical hypnosis research. Further, studies in this review mainly collected quantitative data, and thus qualitative research is warranted to further examine the acceptability of clinical hypnosis for children's procedural pain and distress by exploring children's misconceptions and hypnotic experiences in greater depth.

This review identified individual, interventional, and social influencing factors that warrant further attention. Based on this review, the level of hypnotic suggestibility was weakly (2 studies) or strongly (7 studies) correlated with superior pain and/or distress outcomes of clinical hypnosis. These results converge with previous reviews and meta-analyses reporting a weak to strong correlation between hypno-analgesia and hypnotic suggestibility in children undergoing medical procedures [28,32,34,36,113,114]. Other factors may have influenced the variability of the correlation between hypnotic suggestibility and clinical hypnosis outcomes. For instance, according to a meta-analysis including adults and children, labelling clinical hypnosis interventions as "hypnosis", smaller sample sizes, pre-procedural and live delivery of hypnosis were linked to less procedural pain and distress [28]. Consistently, this scoping review reported the influence of the hypnotherapist's presence (hetero-hypnosis) and intervention timing (in subsequent procedures) on

improved outcomes. However, this review did not report the effect of sample sizes nor identify the impact of labelling interventions on the outcomes of clinical hypnosis. Further, similarly to the other reviews focused on children, the current review identified other factors influencing clinical hypnosis outcomes, including child baseline distress or anxiety; female child gender; chemotherapy-related emesis; and parents' distress-promoting behaviour [29]. The heterogeneity of reported influencing factors related to clinical hypnosis interventions (e.g., timing, delivery mode) and population characteristics (e.g., age, sample size) in this review and previous reviews prevent determining the effect of these factors [28,29,34,52]. Thus, more research is needed to explore factors that may influence procedural pain and distress outcomes of clinical hypnosis in children. For instance, children's age may interact with hypnotic suggestions (tailored/standardised, direct/indirect), delivery mode (self-hypnosis), and adjunct standard treatment [29]. Considering inconsistent reports on the relationship between age and clinical hypnosis outcomes in this review and previous research [29,52], more research is required to determine at what age or ages clinical hypnosis is most effective. Self-hypnosis was linked to reduced clinical hypnosis effects on procedural pain and distress. However, considering the potential cost-effectiveness of self-hypnosis, further research could examine self-hypnosis in children of different ages and reduced baseline distress, as well as dose-related responses with increased self-hypnosis practice. Further, evidence regarding the impact of children's coping on the pain and distress outcomes of clinical hypnosis was not identified in the scoping review and warrants further research.

In line with previous reviews, this scoping review explored areas relevant to intervention delivery that require further investigation and highlighted problematic inconsistencies in reporting clinical hypnosis interventions that require careful attention in future studies [29]. Although treatment manuals are imperative in high-quality research to establish a therapy as empirically supported by enabling reliable treatment implementation, several studies in this review did not include treatment manuals, and most studies did not assess adherence to manuals. Further, clinical hypnosis interventions were inadequately reported with missing information on techniques, providers, duration, timing, and tailoring. Based on the limited information found, there was a large

heterogeneity in clinical hypnosis timing (pre, post, or intra-procedural), doses (frequency and duration), providers (training and experience), types (self or hetero hypnosis), and delivery modes (live or taped). Replicating and comparing clinical hypnosis interventions may be hindered by the heterogeneity and inadequate reporting of interventions as well as the lack of treatment manuals. As hypnosis is a complex intervention that can be delivered using varied techniques, delivery modes, and doses, further research with adequate intervention reporting is needed to evaluate the impact of intervention characteristics (e.g., delivery mode, dosage, and techniques) on outcomes and implementation [115]. Using treatment manuals or adequately describing interventions is imperative to avoid problems encountered in previous studies and can be done using intervention checklists, such as the Template for Intervention Description and Replication (TiDier) [40]. Assessing the fidelity of delivering interventions or adherence to treatment manuals is also imperative to understand how clinical hypnosis was delivered (e.g., dose, components). Researchers should also be aware of the heterogeneity of clinical hypnosis components when designing and conducting research by planning all aspects of interventions (dosage, provider, techniques, and delivery mode). For instance, future research tailoring the timing, duration, and mode of delivering interventions to study settings could help identify the most effective and feasible way to deliver clinical hypnosis for optimal procedural pain and distress outcomes in those settings. For adequate delivery of clinical hypnosis, it is also valuable to explore and address barriers and facilitators to intervention delivery. Based on this review, barriers and facilitators potentially affecting intervention ease, therapeutic relationships, and therapy engagement were related to children (e.g., age, desire to watch the procedure, coping strategies) as well as hypnosis providers and components (procedural landmarks, hypnotic relationship).

This scoping review also identified other methodological limitations in included studies, entailing small sample sizes (less than 30 in 31% of studies), inadequate reporting of randomisation procedures, and lack of use of theoretical frameworks consistent with previous systematic reviews [28,52]. Except for a study that used a theoretical framework (Piaget's cognitive theory) to choose participants' age range, studies included in this review did not use a theoretical or implementation

science framework to guide exploring and implementing clinical hypnosis and study procedures. Moreover, several included studies did not adequately report standard care used as an adjunct to clinical hypnosis. Considering the variability of standard care with different procedures and settings (e.g., general anaesthesia, local anaesthetics), providing more information on standard care is required in research examining the use of clinical hypnosis in combination and/or comparison to standard care.

This review indicates the potential benefits of clinical hypnosis for children's procedural pain and distress consistent with previous meta-analyses and systematic reviews e.g., [28,32,52]. Based on RCTs in this review, outcomes related to procedural pain and distress were superior with clinical hypnosis in comparison to standard care and other interventions (e.g., distraction). However, the superiority of hypnosis outcomes was sometimes reported as insignificant, particularly when clinical hypnosis was used as a sole treatment. Further, the review predominantly investigated the sensory components of pain, resulting in limited evidence regarding other components of pain, such as pain unpleasantness. Furthermore, evidence is inconsistent regarding clinical hypnosis for children's procedural distress due to the heterogeneity of reported physiological, psychological, and behavioural distress outcomes in included studies. There is also a great deal of heterogeneity in the types of painful procedures examined in this review, with most of these procedures involving paediatric oncology consistent with previous meta-analyses [52]. Thus, further research is required to examine the effectiveness of clinical hypnosis for procedural pain and distress, including pain unpleasantness and the multiple dimensions of distress in broad paediatric contexts beyond oncology. New research could also focus on pain and distress related to imaging procedures (MRI, CT scan) and relatively new procedures (e.g., brachytherapy, radiosurgery) that were not examined as part of the scoping review and were inadequately reported in previous reviews [38]. Also, positive outcomes, such as relaxation, satisfaction, and perceived self-efficacy, were seldom reported in this scoping review and were inadequately reported in previous reviews (e.g., [28,34,52]) and thus warrant greater attention.

Studies in the review did not include comparisons nor combinations of clinical hypnosis with other distraction techniques, such as virtual reality, that are supported by evidence of utility for children's procedural pain and distress [17,33]. None of the included studies investigated virtual reality hypnosis, a novel technology embedding clinical hypnosis in an audio-visual sensory experience that shifts the attention from pain and distress without requiring a hypnotherapist or imagination at cues [116]. Recent studies exploring virtual reality hypnosis in adults and children undergoing medical procedures have demonstrated a reduction in pain intensity and unpleasantness with virtual reality hypnosis in comparison to control groups [116-118]. Consequently, more studies are required to compare clinical hypnosis to other distraction techniques and explore the benefits of combining clinical hypnosis with distraction techniques. However, little is known about the costs of novel technologies that may pose a barrier to implementation within budged-constrained healthcare systems [119]. Thus, analysing the cost-effectiveness of clinical hypnosis and virtual reality hypnosis is imperative to justify the use of these interventions and promote their implementation.

Strengths and Limitations

The review included broad and comprehensive searches with a robust screening of several non-English studies and data extraction by 2 reviewers in consultation with expert hypnosis researchers. However, despite exploring areas that have been inadequately reported, the review omitted interventions with hypnotic elements (e.g., suggestions and hypnotic communication) and experimental pain conditions e.g., [58,120,121] that could be examined in future research. Although a protocol detailing the scoping review conduct was published for transparent data reporting and to avoid publication bias [56], there were minor deviations from the protocol. The population age range was proposed in the protocol as between 4 and 16 years to inform a feasibility study with children in this age range. However, due to the demographics of participants in the included studies, the age range was extended in the scoping review to all children below 18 consistently with the United Nations Convention of Child Rights [57,58]. In the scoping review protocol, research questions concerning factors influencing clinical hypnosis outcomes revolved around factors of

hypnotic responding. However, following data collection, the research questions in this review were extended to include factors influencing pain, distress, and hypnotic responding based on the extracted data. Following scoping review guidelines, minor deviations from protocols are deemed acceptable if they are based on collected data and conducted for research purposes [55]. Thus, the minor deviations in this review are considered unlikely to undermine the quality of the review or research transparency.

Conclusions

This review has important implications for future research and can help guide researchers and clinicians in delivering clinical hypnosis by identifying research gaps and areas relevant to research conduct and intervention delivery. Based on the review findings, further research investigating barriers and facilitators to implementing interventions and study procedures, as well as the feasibility and acceptability of clinical hypnosis in children undergoing painful procedures is warranted before examining effectiveness. Future acceptability research and surveys of attitudes towards hypnosis may enhance participation in clinical hypnosis research by exploring major misconceptions and negative attitudes that can be addressed following discussion with clinical opinion leaders. Qualitative research on clinical hypnosis in children undergoing medical procedures is also warranted to help further understand the acceptability of hypnosis by examining children's hypnotic experiences. The review also highlights the importance of adequately reporting interventions and measuring the fidelity of delivery to replicate and compare interventions. No conclusions can be drawn regarding effectiveness without assessing the risk of bias and the certainty of the findings across outcomes, including the inconsistency of findings related to sample sizes, populations, contexts, and interventions. Systematically examining the effectiveness of clinical hypnosis, including assessing the certainty of the evidence, was beyond the scope of the scoping review. However, this review indicated potential benefits of clinical hypnosis for procedural pain and distress by highlighting the growing research, including RCTs, that suggests effectiveness despite focusing on oncology procedures and sensory pain components and providing

inconsistent evidence regarding distress. Thus, the review provides a precursor to further research examining the effectiveness of clinical hypnosis for the multiple components of pain and distress in broad paediatric contexts. Further, evidence has been narratively summarised, which can be used to plan the development and evaluation of tailored clinical hypnosis interventions to optimise treating children's procedural pain and distress.

Ethics and dissemination

The scoping review does not necessitate ethical approval as it uses information from publicly available sources.

Word count (excluding title page, abstract, references, and disclosure statements): 7019

References

1. Ambuel B, Hamlett KW, Marx CM, Blumer JL. Assessing distress in pediatric intensive care environments: the COMFORT scale. J Pediatr Psychol. 1992;17(1):95-109. doi: 10.1093/jpepsy/17.1.95.

2. Kain ZN, Mayes LC, O'Connor TZ, Cicchetti DV. Preoperative anxiety in children: Predictors and outcomes. Arch Pediatr Adolesc Med. 1996;150(12):1238-45. doi: 10.1001/archpedi.1996.02170370016002.

3. Blount RL, Zempsky WT, Jaaniste T, Evans S, Cohen LL, Devine KA, et al. Management of pediatric pain and distress due to medical procedures. Handbook of pediatric psychology, 4th ed. New York, NY, US: The Guilford Press.; 2009. p. 171–88.

4. Raja SN, Carr DB, Cohen M, Finnerup NB, Flor H, Gibson S, et al. The revised International Association for the Study of Pain definition of pain: concepts, challenges, and compromises. Pain. 2020;161(9):1976-82. doi: 10.1097/j.pain.0000000000001939.

5. Turk D, Okifuji A. Pain terms and taxonomies of pain Bonica's Management of Pain. Fifth ed. Philadelphia, Pennsylvania: Wolters Kluwer; 2019.

6. Lethem J, Slade PD, Troup JD, Bentley G. Outline of a fear-avoidance model of exaggerated pain perception--I. Behav Res Ther. 1983;21(4):401-8. doi: 10.1016/0005-7967(83)90009-8.

7. Brennan F, Carr DB, Cousins M. Pain management: a fundamental human right. Anesth Analg. 2007;105(1):205-21. doi: 10.1213/01.ane.0000268145.52345.55.

8. Loncar Z, Bras M, Mickovic V. The relationships between burn pain, anxiety and depression. Coll Antropol. 2006;30(2):319-25.

9. Widgerow AD, Kalaria S. Pain mediators and wound healing--establishing the connection. Burns. 2012;38(7):951-9. doi: 10.1016/j.burns.2012.05.024.

10. Bayat A, Ramaiah R, Bhananker SM. Analgesia and sedation for children undergoing burn wound care. Expert Rev Neurother. 2010;10(11):1747-59. doi: 10.1586/ern.10.158.

11. Christian LM, Graham JE, Padgett DA, Glaser R, Kiecolt-Glaser JK. Stress and wound healing. Neuroimmunomodulation. 2006;13(5-6):337-46. doi: 10.1159/000104862.

12. Brown NJ, Kimble RM, Gramotnev G, Rodger S, Cuttle L. Predictors of re-epithelialization in pediatric burn. Burns. 2014;40(4):751-8. doi: 10.1016/j.burns.2013.09.027.

13. Nelson S, Conroy C, Logan D. The biopsychosocial model of pain in the context of pediatric burn injuries. Eur J Pain. 2019;23(3):421-34. doi: 10.1002/ejp.1319.

14. Weisman SJ, Bernstein B, Schechter NL. Consequences of inadequate analgesia during painful procedures in children. Arch Pediatr Adolesc Med. 1998;152(2):147-9. doi: 10.1001/archpedi.152.2.147.

15. Saxe G, Stoddard F, Courtney D, Cunningham K, Chawla N, Sheridan R, et al. Relationship between acute morphine and the course of PTSD in children with burns. J Am Acad Child Adolesc Psychiatry. 2001;40(8):915-21. doi: 10.1097/00004583-200108000-00013.

16. Sheridan RL, Stoddard FJ, Kazis LE, Lee A, Li NC, Kagan RJ, et al. Long-term posttraumatic stress symptoms vary inversely with early opiate dosing in children recovering from serious burns: effects durable at 4 years. J Trauma Acute Care Surg. 2014;76(3):828-32. doi: 10.1097/TA.0b013e3182ab111c.

17. Stinson J, Yamada J, Dickson A, Lamba J, Stevens B. Review of systematic reviews on acute procedural pain in children in the hospital setting. Pain Res Manag. 2008;13(1):51-7. doi: 10.1155/2008/465891.

18. Birnie KA, Noel M, Parker JA, Chambers CT, Uman LS, Kisely SR, et al. Systematic review and meta-analysis of distraction and hypnosis for needle-related pain and distress in children and adolescents. J Pediatr Psychol. 2014;39(8):783-808. doi: 10.1093/jpepsy/jsu029.

19. Stoddard FJ, Sheridan RL, Saxe GN, King BS, King BH, Chedekel DS, et al. Treatment of pain in acutely burned children. J Burn Care Rehabil. 2002;23(2):135-56. doi: 10.1097/00004630-200203000-00012.

20. Goodenough B, van Dongen K, Brouwer N, Abu-Saad HH, Champion GD. A comparison of the Faces Pain Scale and the Facial Affective Scale for children's estimates of the intensity and unpleasantness of needle pain during blood sampling. Eur J Pain. 1999;3(4):301-15. doi: 10.1053/eujp.1999.0136.

21. Duedahl TH, Hansen EH. A qualitative systematic review of morphine treatment in children with postoperative pain. Paediatr Anaesth. 2007;17(8):756-74. doi: 10.1111/j.1460-9592.2007.02213.x.

22. Nelson KL, Yaster M, Kost-Byerly S, Monitto CL. A national survey of American Pediatric Anesthesiologists: patient-controlled analgesia and other intravenous opioid therapies in pediatric acute pain management. Anesth Analg. 2010;110(3):754-60. doi: 10.1213/ANE.0b013e3181ca749c.

23. Lee GY, Yamada J, Kyololo O, Shorkey A, Stevens B. Pediatric clinical practice guidelines for acute procedural pain: a systematic review. Pediatrics. 2014;133(3):500-15. doi: 10.1542/peds.2013-2744.

24. Zieliński J, Morawska-Kochman M, Zatoński T. Pain assessment and management in children in the postoperative period: A review of the most commonly used postoperative pain assessment tools, new diagnostic methods and the latest guidelines for postoperative pain therapy in children. Adv Clin Exp Med. 2020;29(3):365-74. doi:

10.17219/acem/112600.

25. Kohen DP, Olness K. Hypnosis and Hypnotherapy with Children. 4 ed. New York: Routledge; 2011.

26. Elkins GR, Barabasz AF, Council JR, Spiegel D. Advancing research and practice: The revised APA Division 30 definition of hypnosis. Int J Clin Exp Hypn. 2015;63(1):1-9. doi: 10.1080/00207144.2014.961870.

27. Morgan AH, Hilgard ER. Age differences in susceptibility to hypnosis. Int J Clin Exp Hypn. 1973;21(2):78-85. doi: 10.1080/00207147308409308.

28. Schnur JB, Kafer I, Marcus C, Montgomery GH. Hypnosis to manage distress related to medical procedures: A meta-analysis. Contemp Hypn. 2008;25(3-4):114-28. doi: 10.1002/ch.364.

29. Richardson J, Smith JE, McCall G, Pilkington K. Hypnosis for procedure-related pain and distress in pediatric cancer patients: a systematic review of effectiveness and methodology related to hypnosis interventions. J Pain Symptom Manage. 2006;31(1):70-84. doi: 10.1016/j.jpainsymman.2005.06.010.

30. Cheseaux N, de Saint Lager AJ, Walder B. Hypnosis before diagnostic or therapeutic medical procedures: a systematic review. Int J Clin Exp Hypn. 2014;62(4):399-424. doi: 10.1080/00207144.2014.931170.

31. Milling LS, Costantino CA. Clinical hypnosis with children: first steps toward empirical support. Int J Clin Exp Hypn. 2000;48(2):113-37. doi: 10.1080/00207140008410044.

32. Thompson T, Terhune DB, Oram C, Sharangparni J, Rouf R, Solmi M, et al. The effectiveness of hypnosis for pain relief: A systematic review and meta-analysis of 85 controlled experimental trials. Neurosci Biobehav Rev. 2019;99:298-310. doi: 10.1016/j.neubiorev.2019.02.013.

33. Gillum M, Huang S, Kuromaru Y, Dang J, Yenikomshian HA, Gillenwater TJ. Nonpharmacologic management of procedural pain in pediatric burn patients: A systematic review of randomized controlled trials. J Burn Care Res. 2022;43(2):368-73. doi: 10.1093/jbcr/irab167.

34. Wild MR, Espie CA. The efficacy of hypnosis in the reduction of procedural pain and distress in pediatric oncology: a systematic review. J Dev Behav Pediatr. 2004;25(3):207-13. doi: 10.1097/00004703-200406000-00010.

35. Tome-Pires C, Miro J. Hypnosis for the management of chronic and cancer procedure-related pain in children. Int J Clin Exp Hypn. 2012;60(4):432-57. doi: 10.1080/00207144.2012.701092.

36. Accardi MC, Milling LS. The effectiveness of hypnosis for reducing procedure-related pain in children and adolescents: a comprehensive methodological review. J Behav Med. 2009;32(4):328-39. doi: 10.1007/s10865-009-9207-6.

37. Yeh VM, Schnur JB, Montgomery GH. Disseminating hypnosis to health care settings: Applying the RE-AIM framework. Psychol Conscious 2014;1(2):213-28. doi: 10.1037/cns0000012.

38. Pathak A, Sharma S, Jensen M. Hypnosis for clinical pain management: A scoping review of systematic reviews. OBM Integr Compliment Med. 2020;5(1):1-. doi: 10.21926/obm.icm.2001005.

39. Rycroft-Malone J. The PARIHS framework-a framework for guiding the implementation of evidence-based practice. J Nurs Care Qual. 2004;19(4):297-304. doi: 10.1097/00001786-200410000-00002.

40. Hoffmann TC, Glasziou PP, Boutron I, Milne R, Perera R, Moher D, et al. Better reporting of interventions: template for intervention description and replication (TIDieR) checklist and guide. BMJ. 2014;348:g1687. doi: 10.1136/bmj.g1687.

41. McGrath PJ, Frager G. Psychological barriers to optimal pain management in infants and children. Clin J Pain. 1996;12(2):135-41. doi: 10.1097/00002508-199606000-00009.

42. Brown EA, De Young A, Kimble R, Kenardy J. Review of a parent's influence on pediatric procedural distress and recovery. Clin Child Fam Psychol Rev. 2018;21(2):224-45. doi: 10.1007/s10567-017-0252-3.

43. Vanhaudenhuyse A, Laureys S, Faymonville ME. Neurophysiology of hypnosis. Neurophysiol Clin. 2014;44(4):343-53. doi: 10.1016/j.neucli.2013.09.006.

44. Kuttner L. Pediatric hypnosis: pre-, peri-, and post-anesthesia. Paediatr Anaesth. 2012;22(6):573-7. doi: 10.1111/j.1460-9592.2012.03860.x.

45. Chester SJ, Tyack Z, De Young A, Kipping B, Griffin B, Stockton K, et al. Efficacy of hypnosis on pain, wound-healing, anxiety, and stress in children with acute burn injuries: a randomized controlled trial. Pain. 2018;159(9):1790-801. doi: 10.1097/j.pain.0000000000001276.

46. Iserson KV. An hypnotic suggestion: review of hypnosis for clinical emergency care. J Emerg Med. 2014;46(4):588-96. doi: 10.1016/j.jemermed.2013.09.024.

47. Rocco TS, Plakhotnik MS. Literature reviews, conceptual frameworks, and theoretical frameworks: Terms, functions, and distinctions. HRDR. 2009;8(1):120-30. doi: 10.1177/1534484309332617.

48. Colquhoun HL, Levac D, O'Brien KK, Straus S, Tricco AC, Perrier L, et al. Scoping reviews: Time for clarity in definition, methods, and reporting. J Clin Epidemiol. 2014;67(12):1291-4. doi: 10.1016/j.jclinepi.2014.03.013.

49. Munn Z, Peters MD, Stern C, Tufanaru C, McArthur A, Aromataris E. Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach. BMC Med Res Methodol. 2018;18(1):1-7. doi: 10.1186/s12874-018-0611-x.

50. Gough D, Thomas J, Oliver S. Clarifying differences between review designs and methods. Syst Rev. 2012;1(1):28. doi: 10.1186/2046-4053-1-28.

51. McKittrick ML, Connors EL, McKernan LC. Hypnosis for Chronic Neuropathic Pain: A Scoping Review. Pain Med. 2022;23(5):1015-26. doi: 10.1093/pm/pnab320.

52. Birnie K, Noel M, Chambers C, Uman L, Parker J. Psychological interventions for needle-related procedural pain and distress in children and adolescents. Cochrane Database Syst Rev [Internet]. 2018; (10). Available from: http://dx.doi.org/10.1002/14651858.CD005179.pub4. doi: 10.1002/14651858.CD005179.pub4

53. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. Int J Soc Res Methodol. 2005;8(1):19-32. doi: 10.1080/1364557032000119616.

54. Peters M, Godfrey C, McInerney P, Soares C, Khalil H, Parker D. The Joanna Briggs Institute reviewers' manual 2015: methodology for JBI scoping reviews. Adelaide, SA Australia: The Joanna Briggs Institute;; 2015.

55. Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. Ann Intern Med. 2018;169(7):467-73. doi: 10.7326/M18-0850.

56. Geagea D, Tyack Z, Kimble R, Eriksson L, Polito V, Griffin B. Hypnotherapy for procedural pain and distress in children: A scoping review protocol. Pain Med. 2021;22(12):2818-826. doi: 10.1093/pm/pnab038.

57. Unicef. Convention on the Rights of the Child. 1989.

58. Uman LS, Chambers CT, McGrath PJ, Kisely S. A systematic review of randomized controlled trials examining psychological interventions for needle-related procedural pain and distress in children and adolescents: an abbreviated cochrane review. J Pediatr Psychol. 2008;33(8):842-54. doi: 10.1093/jpepsy/jsn031.

59. Terhune DB, Cardena E. Nuances and uncertainties regarding hypnotic inductions: Toward a theoretically informed praxis. Am J Clin Hypn. 2016;59(2):155-74. doi: 10.1080/00029157.2016.1201454.

60. Elkins G, Marcus J, Rajab MH, Durgam S. Complementary and alternative therapy use by psychotherapy clients. Psychotherapy. 2005;42(2):232-5. doi: 10.1037/0033-3204.42.2.232.

61. Kekecs Z, Moss D, Elkins G, De Benedittis G, Palsson O, Shenefelt P, et al. Guidelines for the assessment of efficacy of clinical hypnosis applications. Int J Clin Exp Hypn. 2022;70(2):104-22. doi: 10.1080/00207144.2022.2049446.

62. Polito V, Barnier AJ, McConkey KM. Defining hypnosis: Process, product, and the value of tolerating ambiguity. The Journal of Mind-Body Regulation. 2014;2(2):118-20.

63. Young KD. Pediatric procedural pain. Ann Emerg Med. 2005;45(2):160-71. doi: 10.1016/j.annemergmed.2004.09.019.

64. Cohen LL, Lemanek K, Blount RL, Dahlquist LM, Lim CS, Palermo TM, et al. Evidence-based assessment of pediatric pain. J Pediatr Psychol. 2008;33(9):939-55. doi: 10.1093/jpepsy/jsm103.

65. Mahood Q, Van Eerd D, Irvin E. Searching for grey literature for systematic reviews: challenges and benefits. Res Synth Methods. 2014;5(3):221-34. doi: 10.1002/jrsm.1106.

66. Gagnier JJ, Kienle G, Altman DG, Moher D, Sox H, Riley D, et al. The CARE guidelines: Consensus-based clinical case reporting guideline development. J Med Case Rep. 2013;7(1):223. doi: 10.1186/1752-1947-7-223.

67. Babineau J. Product Review: Covidence (Systematic Review Software). J Can Health Libr Assoc. 2014;35(2):68-71. doi: 10.5596/c14-016.

68. Moher D, Liberati A, Tetzlaff J, Altman DG, Group P. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. PLoS Med. 2009;6(7):e1000097. doi: 10.1371/journal.pmed.1000097.

69. Barlow DH. Anxiety and its disorders: The nature and treatment of anxiety and panic: Guilford press; 2004.

70. Rycroft-Malone J, Seers K, Chandler J, Hawkes CA, Crichton N, Allen C, et al. The role of evidence, context, and facilitation in an implementation trial: implications for the development of the PARIHS framework. Implement Sci. 2013;8(1):28. doi: 10.1186/1748-5908-8-28.

71. Brydges CR. Effect Size Guidelines, Sample Size Calculations, and Statistical Power in Gerontology. Innovation in Aging. 2019;3(4):igz036. doi: 10.1093/geroni/igz036.

72. Huet A, Lucas-Polomeni MM, Robert JC, Sixou JL, Wodey E. Hypnosis and dental anesthesia in children: a prospective controlled study. Int J Clin Exp Hypn. 2011;59(4):424-40. doi: 10.1080/00207144.2011.594740.

73. Erappa U, Konde S, Agarwal M, Peethambar P, Devi V, Ghosh S. Comparative evaluation of efficacy of hypnosis, acupressure and audiovisual aids in reducing the anxiety of children during administration of local anesthesia. Int J Clin Pediatr Dent. 2021;14(Suppl 2):S186-S92. doi: 10.5005/jp-journals-10005-2113.

74. Juana Maria PP, Marcelino SC, Manuel QD, Jean Marc B, Francisco Javier EA. Effectiveness of hypnoanalgesia in paediatric dermatological surgery. Children (Basel). 2021;8(12):1195. doi: 10.3390/children8121195.

75. Rienhoff S, Splieth CH, Veerkamp JSJ, Rienhoff J, Krikken JB, Campus G, et al. Hypnosis and sedation for anxious children undergoing dental treatment: A retrospective practice-based longitudinal study. Children (Basel). 2022;9(5):611. doi: 10.3390/children9050611.

76. Tran LC, Coopman S, Rivallain C, Aumar M, Guimber D, Nicolas A, et al. Use of Hypnosis in Paediatric Gastrointestinal Endoscopy: A Pilot Study. Front Pediatr. 2021;9:719626. doi: 10.3389/fped.2021.719626.

77. Kashlak NL. The acceptability of imagery-hypnosis for management of pain, anxiety, and distress related to needle procedures in pediatric oncology-hematology patients: University of Virginia; 2012.

78. Manworren RC, Girard E, Verissimo AM, Ruscher KA, Santanelli JP, Weiss R, et al. Hypnosis for postoperative pain management of thoracoscopic approach to repair pectus excavatum: Retrospective analysis. J Pediatr Surg Nurs. 2015;4(2):60-9. doi: 10.1097/JPS.0000000000000061.

79. Oberoi J, Panda A, Garg I. Effect of hypnosis during administration of local anesthesia in six- to 16-year-old children. Pediatr Dent. 2016;38(2):112-5.

80. Ramirez-Carrasco A, Butron-Tellez Giron C, Sanchez-Armass O, Pierdant-Perez M. Effectiveness of Hypnosis in Combination with Conventional Techniques of Behavior Management in Anxiety/Pain Reduction during Dental Anesthetic Infiltration. Pain Res Manag. 2017;2017:1434015. doi: 10.1155/2017/1434015.

81. Baaleman DF, Vriesman MH, Koppen IJN, Osborne KM, Benninga MA, Saps M, et al. Hypnosis to reduce distress in children undergoing anorectal manometry: A randomized controlled pilot trial. J Neurogastroenterol Motil. 2022;28(2):312-9. doi: 10.5056/jnm20274.

82. Duparc-Alegria N, Tiberghien K, Abdoul H, Dahmani S, Alberti C, Thiollier AF. Assessment of a short hypnosis in a paediatric operating room in reducing postoperative pain and anxiety: A randomised study. J Clin Nurs. 2018;27(1-2):86-91. doi: 10.1111/jocn.13848.

83. Manworren RC, Anderson MN, Girard ED, Ruscher KA, Verissimo AM, Palac H, et al. Postoperative pain outcomes after nuss procedures: comparison of epidural analgesia, continuous infusion of local anesthetic, and preoperative self-hypnosis training. J Laparoendosc Adv Surg Tech A. 2018;28(10):1234-42. doi: 10.1089/lap.2017.0699.

84. Boggia B, Sencion A, Radesca D, Botto G. Magic glove, hypnoanalgesia technique for pain reduction in pediatric patients with severe hemophilia. Haemophilia. 2020;26(S4):117-18.

85. Sabherwal P, Kalra N, Tyagi R, Khatri A, Srivastava S. Hypnosis and progressive muscle relaxation for anxiolysis and pain control during extraction procedure in 8-12-year-old children: a randomized control trial. Eur Arch Paediatr Dent. 2021;22(5):823-32. doi: 10.1007/s40368-021-00619-0.

86. Kuttner L, Bowman M, Teasdale M. Psychological treatment of distress, pain, and anxiety for young children with cancer. J Dev Behav Pediatr. 1988;9(6):374-81.

87. Calipel S, Lucas-Polomeni MM, Wodey E, Ecoffey C. Premedication in children: hypnosis versus midazolam. Paediatr Anaesth. 2005;15(4):275-81. doi: 10.1111/j.1460-9592.2004.01514.x.

88. Crawford AH, Jones CW, Perisho JA, Herring JA. Hypnosis for monitoring intraoperative spinal cord function. Anesth Analg. 1976;55(1):42-4. doi: 10.1213/00000539-197601000-00009.

89. Enqvist B, Vonkonow L, Bystedt H. Stress reduction, preoperative hypnosis and perioperative suggestion in maxillofacial surgery - Somatic responses and recovery. Stress Med. 1995;11(4):229-33. doi: 10.1002/smi.2460110138.

90. Gokli MA, Wood AJ, Mourino AP, Farrington FH, Best AM. Hypnosis as an adjunct to the administration of local-anesthetic in pediatric-patients. J Dent Child. 1994;61(4):272-75.

91. Hawkins PJ, Liossi C, Ewart BW, Hatira P, Kosmidis VH. Hypnosis in the alleviation of procedure related pain and distress in paediatric oncology patients. Contemp Hypn. 1998;15(4):199-207. doi: 10.1002/ch.135.

92. Hilgard JR, LeBaron S. Relief of anxiety and pain in children and adolescents with cancer: quantitative measures and clinical observations. Int J Clin Exp Hypn. 1982;30(4):417-42. doi: 10.1080/00207148208407277.

93. Katz ER, Kellerman J, Ellenberg L. Hypnosis in the reduction of acute pain and distress in children with cancer. J Pediatr Psychol. 1987;12(3):379-94. doi: 10.1093/jpepsy/12.3.379.

94. Kellerman J, Zeltzer L, Ellenberg L, Dash J. Adolescents with cancer: Hypnosis for the reduction of the acute pain and anxiety associated with medical procedures. J Adolesc Health Care. 1983;4(2):85-90. doi: 10.1016/s0197-0070(83)80024-2.

95. Kohen DP, Olness KN, Colwell SO, Heimel A. The use of relaxation-mental imagery (self-hypnosis) in the management of 505 pediatric behavioral encounters. J Dev Behav Pediatr. 1984;5(1):21-5. doi: 10.1097/00004703-198402000-00005.

96. Lambert SA. The effects of hypnosis/guided imagery on the postoperative course of children. J Dev Behav Pediatr. 1996;17(5):307-10. doi: 10.1097/00004703-199610000-00003.

97. Liossi C, Hatira P. Clinical hypnosis versus cognitive behavioral training for pain management with pediatric cancer patients undergoing bone marrow aspirations. Int J Clin Exp Hypn. 1999;47(2):104-16. doi: 10.1080/00207149908410025.

98. Liossi C, Hatira P. Clinical hypnosis in the alleviation of procedure-related pain in pediatric oncology patients. Int J Clin Exp Hypn. 2003;51(1):4-28. doi: 10.1076/iceh.51.1.4.14064.

99. Liossi C, White P, Hatira P. Randomized clinical trial of local anesthetic versus a combination of local anesthetic with self-hypnosis in the management of pediatric procedure-related pain. Health Psychol. 2006;25(3):307-15. doi: 10.1037/0278-6133.25.3.307.

100. Liossi C, White P, Hatira P. A randomized clinical trial of a brief hypnosis intervention to control venepuncture-related pain of paediatric cancer patients. Pain. 2009;142(3):255-63. doi: 10.1016/j.pain.2009.01.017.

101. Lobe TE. Perioperative hypnosis reduces hospitalization in patients undergoing the Nuss procedure for pectus excavatum. J Laparoendosc Adv Surg Tech A. 2006;16(6):639-42. doi: 10.1089/lap.2006.16.639.

102. Olmsted RW, Zeltzer L, LeBaron S. Hypnosis and nonhypnotic techniques for reduction of pain and anxiety during painful procedures in children and adolescents with cancer. J Pediatr. 1982;101(6):1032-35. doi: 10.1016/s0022-3476(82)80040-1.

103. Smith JT, Barabasz A, Barabasz M. Comparison of hypnosis and distraction in severely ill children undergoing painful medical procedures. J Couns Psychol. 1996;43(2):187-95. doi: 10.1037/0022-0167.43.2.187.

104. Wall VJ, Womack W. Hypnotic versus active cognitive strategies for alleviation of procedural distress in pediatric oncology patients. Am J Clin Hypn. 1989;31(3):181-91. doi: 10.1080/00029157.1989.10402887.

105. Zeltzer LK, Dolgin MJ, LeBaron S, LeBaron C. A randomized, controlled study of behavioral intervention for chemotherapy distress in children with cancer. Pediatrics. 1991;88(1):34-42. doi: 10.1542/peds.88.1.34.

106. Hodel TV. Hypnosis for relief of pain and anxiety in leukemic children undergoing bone marrow aspirations: University of Cincinnati; 1983.

107. Schnee AD. Effect of psychological preparation on reducing behavioral distress and morbidity in children undergoing endoscopy [PhD]. Ann Arbor: Georgia State University; 1995.

108. Butler LD, Symons BK, Henderson SL, Shortliffe LD, Spiegel D. Hypnosis reduces distress and duration of an invasive medical procedure for children. Pediatrics. 2005;115(1):e77-85. doi: 10.1542/peds.2004-0818.

109. Meller ST, Gebhart GF. Spinal mediators of hyperalgesia. Drugs. 1994;47 Suppl 5(5):10-20. doi: 10.2165/00003495-199400475-00004.

110. Hilgard ER. Hypnotic susceptibility: Oxford, England: Harcourt, Brace & World; 1965.

111. Orne MT. Demand characteristics. In: Banyard P, Grayson A, editors. Introducing Psychological Research. London: Macmillan Education UK; 1996. p. 395-401.

112. Axelrad AB, D; Wain, HJ. Hypnosis. In: Sadock BJ SV, Ruiz P, editors, editor. Kaplan & Sadock's comprehensive textbook of psychiatry. 9 ed. Philadelphia: Lippincott Williams & Wilkins; 2009. p. 2804–31.

113. Montgomery GH, DuHamel KN, Redd WH. A meta-analysis of hypnotically induced analgesia: how effective is hypnosis? Int J Clin Exp Hypn. 2000;48(2):138-53. doi: 10.1080/00207140008410045.

114. Tomé-Pires C, Miró J. Hypnosis for the management of chronic and cancer procedure-related pain in children. International Journal of Clinical and Experimental Hypnosis. 2012;60(4):432-57. doi: 10.1080/00207144.2012.701092.

115. Craig P, Dieppe P, Macintyre S, Michie S, Nazareth I, Petticrew M. Developing and evaluating complex interventions: the new Medical Research Council guidance. BMJ. 2008:337. doi: 10.1136/bmj.a1655

116. Patterson DR, Wiechman SA, Jensen M, Sharar SR. Hypnosis Delivered Through Immersive Virtual Reality for Burn Pain: A Clinical Case Series. Int J Clin Exp Hypn. 2006;54(2):130-42. doi: 10.1080/00207140500528182.

117. Patterson DR, Jensen M, Wiechman S, Sharar S. Virtual reality hypnosis for pain associated with recovery from physical trauma. Int J Clin Exp Hypn [Internet]. 2010; 58(3):[288-300 pp.]. Available from: https://www.cochranelibrary.com/central/doi/10.1002/central/CN-00751523/full. doi: 10.1080/00207141003760595

118. Okur kavak EK, Van Berlaer G, Diltoer M, Malbrain M. Medical hypnosis and virtual reality glasses are safe and effective tools to alleviate pain and anxiety in patients undergoing medical procedures. Crit Care. 2020;24. doi: 10.1186/s13054-020-2772-3.

119. Brown NJ, Kimble RM, Rodger S, Ware RS, Cuttle L. Play and heal: randomized controlled trial of Ditto intervention efficacy on improving re-epithelialization in pediatric burns. Burns. 2014;40(2):204-13. doi: 10.1016/j.burns.2013.11.024.

120. Ogez D, Aramideh J, Mizrahi T, Charest MC, Plante C, Duval M, et al. Does practising hypnosis-derived communication techniques by oncology nurses translate into reduced pain and distress in their patients? An exploratory study. Br J Pain. 2021;15(2):147-54. doi: 10.1177/2049463720932949.

121. Fricton JR, Roth P. The effects of direct and indirect hypnotic suggestions for analgesia in high and low susceptible subjects. Am J Clin Hypn. 1985;27(4):226-31. doi: 10.1080/00029157.1985.10402612.

List of figure captions

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram for literature search and selection

Figure 2. Number of included studies per decade

Figure 3. Percentage of included studies per country

Table 1. Summary of included studies

Study characteristics	Number of studies [references]
Publication type	
Conference abstract	1 [84]
Published journal article	34 [45,72-76,78-83,85-105]
Dissertation	3 [77,106,107]
Study design	
Controlled	Total = 29
Prospective parallel RCT	26 [45,72,73,79-82,85-87,89,91,93,96-108]
Prospective cross-over trial	1 [90]
Retrospective analysis of medical records	2 [78,83]
Uncontrolled (no comparator)	Total = 9
Design not reported/observational	5 [74 -76,88,95]
Prospective (non-randomised) repeated measures	1 [77]
Prospective pre-post	3 [84,92,94]
Medical procedure	
Medical examination: anorectal manometry for constipation, voiding cystourethrography, endoscopy	4 [76,81,107,108]
Surgical/unspecified/miscellaneous	Total = 8
Unspecified varied medical procedures inducing pain and anxiety	1 [95]
Elective surgeries (e.g., spinal fusion; orthopaedic procedures; cardiac, thoracic, and general surgery)	1 [96]
Burns dressing changes	1 [45]
Nuss procedure for pectus excavatum	3 [78,83,101]
Abdominal surgery	1 [87]
Dermatological surgery	1 [74]
Orthopaedic: idiopathic scoliosis operation; major orthopaedic surgery, spinal fusion, or osteotomy for scoliosis; orthognathic maxillofacial surgery	3 [82,88,89]
Oncology	Total = 16
Chemotherapy	1 [105]
LP	3 [91,98,99]
BMA	6 [86,92-94,97,106]
BMA and LP	1 [102]
Needle-procedures for oncologic-hematologic and related disorders	1 [77]
Venepuncture (in oncology and haemophilia)	2 [84,100]
Repeated venepuncture or infusa-port access	2 [103,104]
Dental: restorations or primary teeth pulpotomies, pulp therapies for primary mandibular molars, unspecified treatment, primary molars extraction	7 [72,73,75,79,80,85,90]
Sample size	
< 30	12 [72,77,78,84,88,90,92,94,101,103,104,106]

30 - 90	21 [45,74,80,81,83,85-87,89,91,93,95-100,102,105,107,108]
> 90	5 [73,75,76,79,82]
Participants' minimum age	
2 years	1 [87]
3 years	4 [75,86,95,103]
4 years	5 [45,81,84,90,108]
5 years	7 [74,80,97,104-107]
6 years	11 [73,76,77,79,91-93,98-100,102]
7 years	2 [72,96]
8 years	1 [85]
10 years	2 [82,83]
12 years	2 [88,101]
Unspecified	Total = 3
$\bar{x}$ [σ] in years = 19.1 [8.1] with H; 19.7 [10.1] with C	1 [89]
$\bar{x}$ [σ] in months = 192.87 [19.19] with H; 186.64 [24.99] without H	1 [78]
$\bar{x}$ [σ] in years = 14 [1.6]	1 [94]
Model, theory, or framework	1 [86]

BMA: bone marrow aspiration; **LP**: lumbar puncture; **RCT**: randomised controlled trial; $\bar{\mathbf{x}}$: mean; **σ**: standard deviation

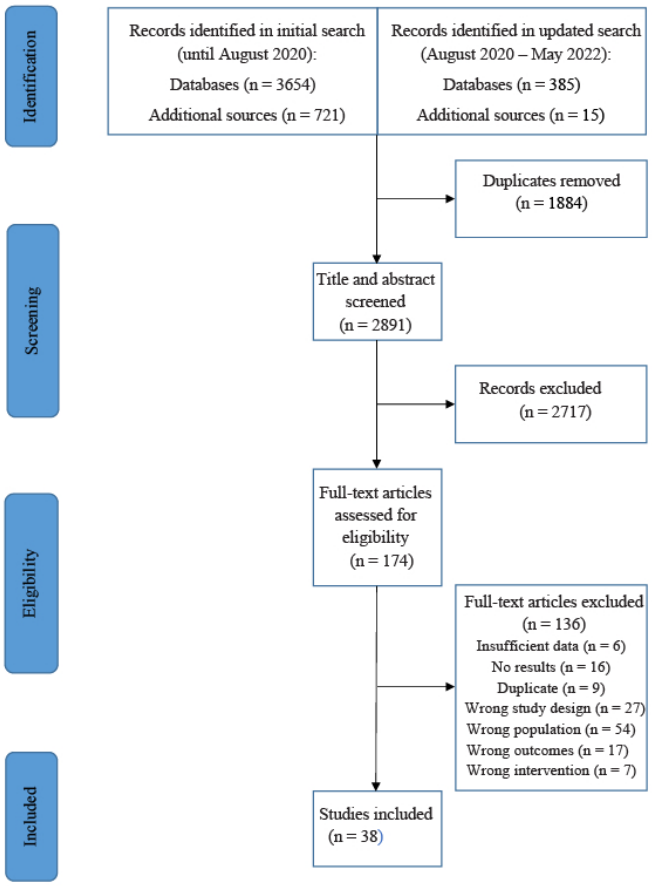

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram for literature search and selection.

255x361mm (72 x 72 DPI)

Table 2. Characteristics and outcomes of included studies

1st author, year, country (type)	Design: n comparators	Outcomes related to child pain and distress		
		Outcome measures	**Measurement tools**	**H versus comparators**
Baaleman, 2022, USA (journal article) [81]	RCT: 15 H vs 17 SC	1. PR procedural pain 2. SR procedural pain 3. OR procedural behavioural distress 4. PR procedural distress (nervousness, unpleasantness, anxiety) 5. SR procedural distress (nervousness, fear) 6. PR and SR procedural relaxation 7. SR perceived procedure difficulty Time points: phase 1 (pre-procedure), phase 2 (catheter insertion to questions), phase 3 (questions to catheter removal)	1. 0-10 NRS 2. 0-10 NRS 3. 0-3 Likert scale (blind), OSBD (nonblind) 4. 0-4 Likert scale 5. 0-4 Likert scale 6. 0-4 Likert scale 7. Rating "somewhat difficult" to "difficult"	1. ≈ 2. < 3. << in phase 1, ≈ in phases 2 and 3 4. < unpleasantness and anxiety (ns ≠), ≈ nervousness 5. ≈ fear, < nervousness 6. 92% of children and 92.9% of parents reported relaxation with H 7. < (23.5% with SC vs 6.7% with H)
Boggia, 2020, Uruguay (conference abstract) [84]	Pre-post control: 15 [H vs baseline]	SR and PR (by father) pain perception in observational phase and 2nd phase (3 ratings per phase)	Face scale for < 7 years old, NRS for > 7 years old	< (significance unclear)
Butler, 2005, USA (journal article) [108]	RCT: 21 H vs 23 SC/ recreational therapy	1. SR procedural distress 2. PR distress 3. PR trauma of present versus prior VCUG 4. OR distress behaviour	1. 5-point poker-chips for each of fear and pain, pictural VAS for crying 2. 5-point scale for each of fear, pain, and crying 3. 6-point scale 4. 8-point mTGMS	1. < 2. << 3. << 4. <<
Calipel, 2005,	RCT: 23 H (+	1. Nurse OR op anxiety	1. mYPAS	1. <<

France (journal article) [87]	placebo) vs 27 SC/ medication	2. PR post-op hospitalisation behaviour (1,7, 14 POD) 3. Op pain and discomfort	2. PHBQ 3. OPS	2. << disorders rate; << aggression to parents 3. ≈
Chester, 2018, Australia (journal article) [45]	RCT: 27 H (+ SC) vs 35 SC	1. SR procedural pain intensity 2. PR procedural pain intensity 3. OR procedural pain behaviour 4. Procedural heart rate 5. Procedural and 3 months post-burn stress biomarkers 6. SR PTSD 3 months post-burn 7. PR PTSD 3 months post-burn 8. SR procedural anxiety	1. FPS-R 2. 11-point NRS 3. FLACC 4. NR 5. Salivary α-amylase and cortisol 6. CPSS for ≥ 7 years old 7. YCPC for < 7 years old 8. VAS-Anxiety	1. < 2. << at 3rd COD 3. << at 3rd COD 4. << 5. ≈ 6. < 7. >> 8. <<
Crawford, 1976, USA (journal article) [88]	NR: 18 [H + GA]	1. SR op fear or panic 2. Post-op pain medication (2-3 PODs)	1. NR 2. NR	1. No recalls or signs 2. ↓ with H
Duparc-Alegria, 2018, France (journal article) [82]	RCT: 59 H (+ GA) vs 60 SC/GA	1. OR anxiety from op day -1 to POD 1 2. OR post-op pain (POD 1) 3. ∑ morphine to POD 1	1. FPS-R, 0-10 NRS for POD, VAS-Anxiety for day -1 2. FPS-R, 0-10 NRS 3. NR	1. ≈ post-op anxiety and anxiety reduction between day -1 and POD (significant reduction in both H and SC) 2. ≈ 3. ≈
Enqvist, 1995, Sweden (journal article) [89]	RCT: 19 H (+ SC) vs 19 SC *only child data reported	1. $\bar{x}$ procedural systolic blood pressure (per 15 seconds) 2. $\bar{x}$ heart rate in procedure and 12 hours post-procedure 3. Post-procedure analgesics and anxiolytics 4. Tape cooperation and opinion on H	NR	1. ≈ 2. < 3. < analgesics, << anxiolytics 4. Good cooperation and positivity to listening to the tape
Erappa, 2021, India (journal article) [73]	Cross-sectional RCT: 50 H vs 50 acupressure	1. Heart rate* 2. Respiratory rate* 3. Anxiety level*	1. Pulse recording 2. Counting chest movements per minute	1. << acupressure and AV aids << C (≈ acupressure and AV aids from LA to post-op) 2. << acupressure << C, ≈ AV aids (≈ acupressure

	vs 50 AV aids vs 50 C	*Pre, intra, and post LA	3. VAS	from LA to post-op) 3. << acupressure << C (≈ acupressure from pre to post op), ≈ AV
Gokli, 1994, USA (journal article) [90]	Cross-over: LA vs H (+ LA) [14 in 1st visit and 15 in 2nd visit]	1. OR procedural behavioural distress 2. Heart rate at baseline and LA	NR	1. < (≠ significant in crying) 2. <<
Hawkins, 1998, Greece (journal article) [91]	RCT: 30 [direct H vs indirect H]	1. SR procedural pain 2. SR anxiety 3. OR procedural behavioural distress	1. 6-point faces scale 2. 6-point faces scale 3. Checklist	1. ≈ 2. ≈ 3. ≈
Hilgard, 1982, USA (journal article) [92]	Pre-post control: 24 [H vs baseline]	1. OR procedural pain behaviours 2. SR and OR procedural pain 3. OR procedural anxiety behaviours	1. 0-10 scale 2. 0-10 scale, faces scale if child cannot report numbers 3. NR	1. << 2. << 3. <<
Hodel, 1983, USA (dissertation) [106]	RCT: 5 in group A (1st BMA + H, 2nd BMA w/o H); 4 in group B (1st BMA w/o H vs 2nd BMA + H)	1. OR procedural behavioural distress 2. SR pain 3. SR anxiety 4. Nurse OR pre/intra/post-procedural anxiety 5. Nurse OR pre/intra/post-procedural discomfort	1. NR 2. Drawing *hurt* level on scale 3. Rating *being scared* on 7-point Likert face scale 4. NR 5. NR	1. << 2. << 3. < (except 1 rating 7 in group B) 4. << 5. <<
Huet, 2011, France (journal article) [72]	RCT: 14 H vs 15 SC	1. SR procedural pain 2. OR pain-related behaviours 3. OR anxiety behaviours	1. VAS 2. MOPS 3. mYAPS	1. << 2. << 3. <<
Juana María, 2021, Spain (journal article) [74]	Prospective, longitudinal, observational study: 33 H vs 32 distraction	1. Propofol dose (mg) 2. Additional opioid op needs (mg/kg body weight) 3. SR pain (post-op and POD) 4. Need for analgesics (post-op, POD)	1. Records 2. VAS in >10 years, FPS-r in 5-9 years 3. Records 4. Questionnaire	1. << 2. < 3. < in post-op and << in POD 4. << 5. >

		5. SR and PR satisfaction		
Kashlak, 2012, USA (dissertation) [77]	Repeated measures: 20 [H vs baseline]	1. SR procedural pain 2. SR procedural anxiety 3. SR procedural distress	1. VAS 2. VAS 3. VAS	1. < 2. < 3. <
Katz, 1987, USA (journal article) [93]	RCT: 17 H vs 19 play vs baseline	1. OR procedural behavioural distress 2. OR procedural anxiety 3. SR procedural pain 4. SR procedural fear	1. PBRS-r 2. 1-5 Likert scale 3. 0-100 graphic scale 4. 0-7 faces scale	1. ns ≠ 2. ns ≠ 3. H and play in 3 postbaseline BMAs << baseline 4. H in 3rd postbaseline BMA << play in 1st, 2nd, and 3rd postbaseline BMAs << baseline
Kellerman, 1983, USA (journal article) [94]	Pre-post control: 16 [H vs baseline]	Procedural anxiety and discomfort (assessor NR)	1-5 scales	<<
Kohen, 1984, USA (journal article) [95]	NR: 48 H	OR and SR suturing pain; procedure and cancer-related anxiety reactions from 4 months to 2 years	0-3 scales	100% anxiety symptoms relief in 36%; ↓ pain intensity in 16%
Kuttner, 1988, Canada (journal article) [86]	RCT: 16 H vs 16 distraction vs 16 SC	1. OR procedural behavioural distress 2. OR procedural pain 3. OR procedural anxiety 4. SR procedural pain and anxiety	1. PBRS-r 2. 1-5 rating scale 3. 1-5 Likert scale 4. 1-5 pictorial scales	1. << 2. << 3. << 4. <
Lambert, 1996, USA (journal article) [96]	RCT: 25 H vs 25 SC	1. SR pain just post-procedure, hourly and intermittently until discharge 2. Post-procedural pain medication (∑ mg/kg morphine or equivalent) 3. SR pre/post-procedural state anxiety	1. NRS 2. NR 3. STAI/STAIC	1. << 2. ≈ 3. <
Liossi, 1999, Greece (journal article) [97]	RCT: 10 H (+ SC) vs 10 CBT (+ SC) vs 10 SC	1. SR procedural pain 2. SR procedural anxiety 3. OR procedural behavioural distress	1. 6-point WBFS 2. 6-point WBFS 3. PBCL	1. ≈ CBT << SC 2. << CBT << SC 3. << CBT << SC

Liossi, 2003, Greece (journal article) [98]	RCT: 20 direct H (+ SC) vs 20 indirect H (+ SC) vs 20 attention C (+ SC) vs 20 SC	1. OR procedural behavioural distress 2. SR procedural pain 3. SR procedural anxiety Phases: baseline; LP + H, self-H post LP and in recovery (self-H1, self-H3, self-H6)	1. PBCL 2. WBFS 3. WBFS	1. Direct H ≈ indirect H << C in H, self-H1 and self-H3 (H < C in self-H6) 2. Direct H ≈ indirect H << C in H, self-H1 and self-H3 (H < C in self-H6) 3. Direct H ≈ indirect H << C in H, self-H1 and self-H3 (H < C in self-H6)
Liossi, 2006, Greece (journal article) [99]	RCT: 15 H (+ EMLA) vs 15 attention C (+ EMLA) vs 15 EMLA	1. SR procedural pain 2. SR procedural anxiety 3. SR pre-procedural anxiety 4. OR procedural behavioural distress	1. 6-point WBFS 2. 6-point WBFS 3. 6-point WBFS 4. PBCL	1. << EMLA and EMLA + attention 2. << EMLA and EMLA + attention 3. << EMLA and EMLA + attention 4. << EMLA and EMLA + attention
Liossi, 2009, Greece (journal article) [100]	RCT: 15 H (+ EMLA) vs 15 attention C (+ EMLA) vs 15 EMLA	1. SR procedural pain 2. Pre-procedural anxiety 3. Procedural anxiety 4. OR procedural behavioural distress	1. VAS 2. VAS 3. VAS 4. PBCL	1. << EMLA + attention << EMLA 2. << EMLA + attention << EMLA 3. << EMLA + attention << EMLA 4. << EMLA + attention << EMLA
Lobe, 2006, USA (journal article) [101]	RCT: 5 H vs 5 SC	1. $\bar{x}$ IV pain treatment days 2. IV narcotic doses 3. Oral narcotic doses	NR	1. < 2. < 3. >
Manworren, 2015, USA (journal article) [78]	Retrospective between groups: 8 H (+SC) vs 14 SC (CILA, epidural analgesia)	1. SR pain intensity (post-op to discharge) 2. LA, opioid IV PCA, IV NSAID then oral opioid and NSAIDs converted to mgs/hour morphine equivalents (post-op to discharge)	1. 0-10 NRS 2. NR	1. << (< in 1st 4 PODs); < max pain in 1st 4 and 5 PODs 2. << mgs/hr morphine equivalents (≈ PCA length, time to opioids start, time to opioid transition predischarge, and epidural infusion duration)
Manworren, 2018, USA (journal article) [83]	Retrospective between groups: 24 H (+SC) vs 29 SC (CILA, epidural	1. SR pain intensity 2. Analgesic: opioid and IV NSAIDs converted to mgs/hour morphine equivalents, post-procedural IV PCA or oral opioid (post-op to discharge)	1. 0-10 NRS 2. NR	1. H + epidural analgesia << CILA > H + CILA 2. Morphine equivalent: H + CILA < epidural analgesia and CILA

	analgesia)			
Oberoi, 2016, India (journal article) [79]	RCT: 100 H (+ LA) vs 100 LA	1. OR procedural physical or verbal resistance to LA 2. OR heart rate (baseline and intra-LA)	1. Recording 2. NR	1. << 2. <<
Olmsted, 1982, USA (journal article) [102]	RCT: 16 H vs 17 SC	1. SR and OR procedural pain (1-3 BMAs/LPs) 2. SR and OR procedural anxiety (1-3 BMAs)	1. 1-5 scale 2. 1-5 scale	1. << 2. <<
Ramírez-Carrasco, 2017, Mexico (journal article) [80]	RCT: 20 H vs 20 SC	1. OR pain behaviour 2. Pre/intra LA heart rate 3. Pre/intra LA skin conductance response	1. FLACC 2. NR 3. NR	1. ≈ 2. << 3. ≈
Rienhoff, 2022, Germany (journal article) [75]	Retrospective longitudinal observational: H + midazolam (1 session for 183, 2 for 103, 3 for 250)	1. OR procedural anxiety behaviour 2. SR Procedural well-being	1. 0-5 Venham Scale 2. 4-point WBFS	1. ≈ relaxed behaviour in sessions (low scores), peak scores in 2nd and 3rd sessions >> 1st session (<< cooperation) 2. ns ≠ pre-post treatment between sessions (during midazolam administration >> improvement at 2nd session)
Sabherwal, 2021, India (journal article) [85]	RCT: 20 H vs 20 PMR vs 20 SC	1. Procedural SR anxiety 2. Procedural heart rate 3. Procedural blood pressure 4. OR procedural pain 5. Post-procedural analgesic	1. VFSA 2. NR 3. NR 4. WBFS 5. NR	1. H and PMR << C 2. H and PMR << C 3. H ≈ PMR << C 4. H and PMR << C 5. 100% needed analgesic in C vs 45% in H and 50% in PMR
Schnee, 1995, USA (dissertation) [107]	RCT: 22 H vs 11 counselling vs 20 SC	1. OR procedural distress 2. Pain and sedative medication dose 3. SR procedural/post-procedural anxiety 4. SR procedural pain 5. Morbidity and post-hospital behaviour	1. OSBD 2. NR 3. Procedural CAPS, post-procedural STAI-C 4. CAPS	≈ counselling and SC

		6. Heart rate	5. PBQ 6. NR	
Smith, 1996, USA (journal article) [103]	RCT: 14 H vs 13 distraction	1. SR procedural pain and anxiety 2. PR procedural pain 3. PR and OR procedural anxiety 4. OR procedural distress behaviours 5. Autonomic arousal by a painful stimulus	1. CGRS each 2. 5-point Likert scale 3. 5-point Likert scales 4. OSBD-revised 5. Skin conductance response	1. Significant condition effects 2. Significant condition effects 3. Significant condition effects 4. Significant condition effects 5. Arousal in response to a painful stimulus (no statistical analysis)
Tran, 2021, France (journal article) [76]	Prospective observational: 136 H + SC sedatives (EMONO ± midazolam); 4 H alone	1. Procedure success 2. Conversion to GA 3. Satisfaction of child, endoscopist and nurse with endoscopy under H 4. Child cooperation with the procedure 5. SR procedural pain 6. SR and OR (by nurse) preprocedural anxiety	1. % of successful procedures (completed, well tolerated) 2. % of procedures requiring conversion to GA 3. Questionnaire (“good” or “bad”) 4. VAS 5. VAS	1. Success in 82.9% (100% with H, 93.8% with H + EMONO, 71.8% with H + EMONO + midazolam); failure in 17.1% due to poor tolerance 2. 7.9% rescheduled under GA 3. 92% of children stated that endoscopy went well. On repeating procedure under H, positive answers by 81.95 % of nurses, 83.1% of endoscopists, and 81.2% of children; 80.7% of doctors/nurses and 81.4% of children willing to repeat 4. Good cooperation reported as 88.4 % by endoscopists and 86.9% by nurses 5. In successful procedures < failed 6. Children anxiety: 68.3% SR (76.2% OR): 38.1% mild anxiety (27% OR), 15.9% moderate (20.6% OR), and 14.3% severe (28.6% OR)
Wall, 1989, USA (journal article) [104]	RCT: 11 H vs 9 ACS	1. SR pre-procedural anxiety 2. SR and OR procedural anxiety 3. SR and OR procedural pain intensity 4. SR affective and procedural pain	1. VAS 2. VAS, STAIC, STAI in ≥ 12 years old 3. VAS 4. MPQ in ≥ 12 years old	1. ≈ 2. ≈ (OR significant ↓ in H and ACS) 3. < (significant ↓ in H and ACS) 4. ≈ (significant ↓ in H and ACS)

Zeltzer, 1991, USA (journal article) [105]	RCT: 21 H vs 16 support vs 17 attention C	1. SR and PR procedure-related distress 2. SR and PR functional score	1. 0-10 scale 2. Disruption of school, eating, sleep and play	1. << 2. ns ≠

ACS: active cognitive strategy; **AV**: audio-visual; **BMA**: bone marrow aspiration; **C**: control; **CAPS**: Children's Anxiety and Pain Scale; **CBT**: cognitive behavioural therapy; **CGRS**: Children's Global Rating Scale; **CILA**: continuous infusion of local anaesthetic; **COD**: change of dressing; **CPSS**: Child PTSD Symptom Scale; **EMLA**: Eutectic Mixture of Local Anaesthetics; **EMONO**: equimolar mixture of oxygen and nitrous oxide; **FLACC**: Face, Legs, Activity, Cry, Consolability; **FPS-R**: Faces Pain Scale-Revised; **GA**: general anaesthesia; **H**: hypnosis; **IV**: intravenous; **kg**: kilograms; **LA**: local anaesthesia; **LP**: lumbar puncture; **max**: maximum; **mg**: milligrams; **MOPS**: Modified Objective Pain Score; **MPQ**: McGill Pain Questionnaire; **mTGMS**: modified Torrance Global Mood Scale; **mYPAS**: Modified Yale Preoperative Anxiety Scale; **NR**: not reported; **NRS**: Numeric Rating Scale; **ns**: nonsignificant; **NSAID**: non-steroidal anti-inflammatory drugs; **op**: operative; **OPS**: Objective Pain Score; **OR**: observer report; **OSBD**: Observational Scale of Behavioural Distress; **PBCL**: Procedure Behaviour Checklist; **PBQ**: Personality Beliefs Questionnaire; **PBRS-r**: Paediatric Behaviour Rating Scale-Revised; **PCA**: patient-controlled analgesia; **PHBQ**: Posthospitalization Behavioural Questionnaire; **PMR**: progressive muscle relaxation; **POD**: post-operative day; **PR**: parent proxy report; **PTSD**: post-traumatic stress disorder; **RCT**: randomised controlled trial; **SC**: standard care; **SR**: self-report; **STAI**: strait-trait inventory; **STAIC**: strait-trait inventory for children; **VAS**: Visual Analog Scale; **VCUG**: voiding cystourethrography; **VFSA:** Visual Facial Anxiety Scale; **YCPC:** Young Child PTSD Checklist; **WBFS**: Wong-Baker FACES Scale; **w/o**: without; $\bar{\mathbf{x}}$: mean; ≈: similar; <: inferior; <<: significantly inferior; >: superior; >> : significantly superior; ≠: difference

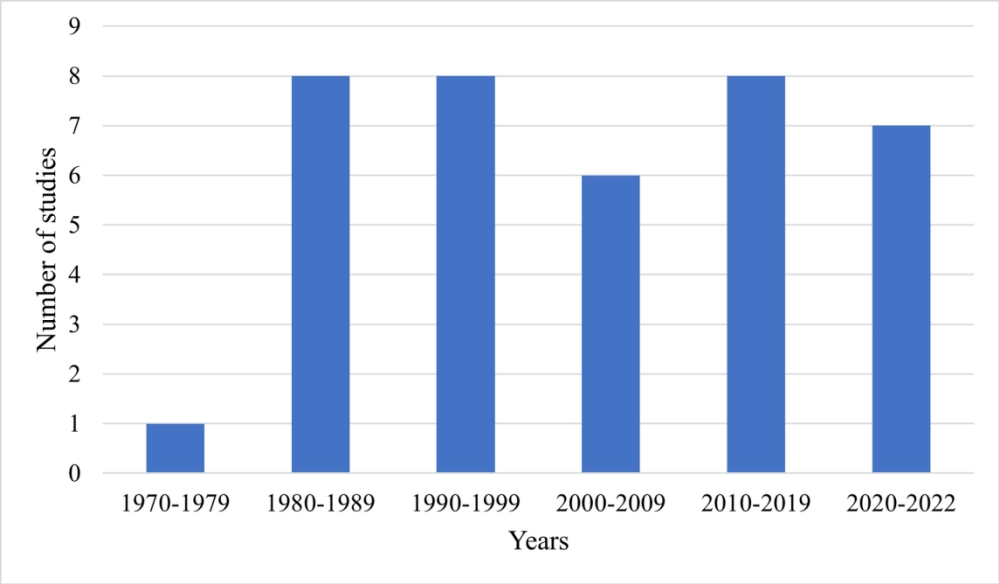

Figure 2. Number of included studies per decade

152x88mm (300 x 300 DPI)

Table 3. Summary of outcomes with clinical hypnosis used as a sole treatment

Study design	Delivery mode	Comparators	Hypnosis outcomes (versus comparators)	Studies %, number (N), sample size n [references]
NR	Hetero-H + SH	No comparator	Pain and anxiety relief with H	3% (N = 1), n = 48 [95]
RCT	Hetero-H + SH	Direct vs indirect H	Similar procedural pain, anxiety, and behavioural distress	3% (N = 1), n = 30 [91]
Retrospective	Hetero-H + SH [83] or hetero-H	SC	Significantly lower procedural pain and less analgesics requirement	5% (N = 2), n = 15 [78,83]
RCT	Hetero-H + SH [108], hetero-H		Significantly lower procedural pain, distress (behavioural distress, anxiety, fear) and trauma (ns difference in post-procedural pain medication doses)	18% (N = 5), n = 188 [72,81,96,102,108]
RCT	Taped hetero-H		Similar skin conductance and OR pain behaviour, significantly lower HR	3% (N = 1), n = 40 [80]
RCT	Live hetero-H + taped SH		Lower IV narcotic doses and IV analgesics administration days, higher oral narcotic doses	3% (N = 1), n = 10 [101]
Pre-post control	Hetero-H + SH [94], hetero-H	Baseline conditions	Significantly lower distress-related constructs (e.g., anxiety, discomfort) and procedural pain, lower pain perception	8% (N = 3), n = 55 [84,92,94]
Repeated measures	Hetero-H + SH		Lower procedural pain, distress, and anxiety	3% (N = 1), n = 20 [77]
RCT	Live + taped hetero-H	Active cognitive strategies	Lower pain intensity; similar pain affect and anxiety	3% (N = 1), n = 20 [104]
RCT	Live hetero-H + taped SH	Distraction	Significantly lower procedural pain, distress behaviour, and anxiety	3% (N = 1), n = 27 [103]
Observational			Significantly lower analgesics and POD pain, lower post-op pain and additional opioids needs; higher satisfaction	3% (N = 1), n = 65 [74]
RCT	Hetero-H + SH	Progressive muscle relaxation vs SC	Procedural pain and distress-related constructs (e.g., anxiety, pulse, blood pressure) and post-procedural analgesics with H and progressive muscle relaxation significantly lower than SC	3% (N = 1), n = 60 [85]
RCT	Hetero-H	Counselling vs SC	Similar procedural pain, distress behaviour, and anxiety, post-hospital behaviour, sedatives, and pain medications doses	3% (N = 1), n = 53 [107]

RCT	Hetero-H	SC vs distraction	Significantly lower OR procedural pain, behavioural distress, and anxiety; lower SR pain and anxiety	3% (N = 1), n = 48 [86]
RCT	Hetero-H + SH	C vs follow-up (2nd procedure)	Significantly lower procedural pain, behavioural distress, discomfort, and OR anxiety; lower SR procedural anxiety	3% (N = 1), n = 9 [106]
RCT	Hetero-H + SH	Play vs baseline	Similar OR procedural anxiety and behavioural distress; significantly lower SR procedural pain and fear	3% (N = 1), n = 36 [93]
RCT	Hetero-H	Attention control vs support	H efficacy supported for procedural distress but not for functional ratings of play, school, sleep and eating	3% (N = 1), n = 54 [105]
RCT	Hetero-H	Acupressure vs audio-visual aids vs C	Significantly lower procedural heart rate, respiratory rate, and anxiety (similar HR and respirator rate from LA to post-op; similar anxiety from pre-op to post-op)	3% (N = 1), n = 200 [73]

C: control; **H**: hypnosis; **Hetero-H**: hetero-hypnosis (i.e., hypnosis guided by a clinician or experimenter); **HR**: heart rate; **IV**: intravenous; **LA**: local anaesthesia; **NR**: not reported; **op**: operation; **OR**: observer reported; **POD**: post-operative day; **RCT**: randomised controlled trial; **SC**: standard care; **SH**: self-hypnosis (i.e., self-directed hypnosis); **SR**: self-reported

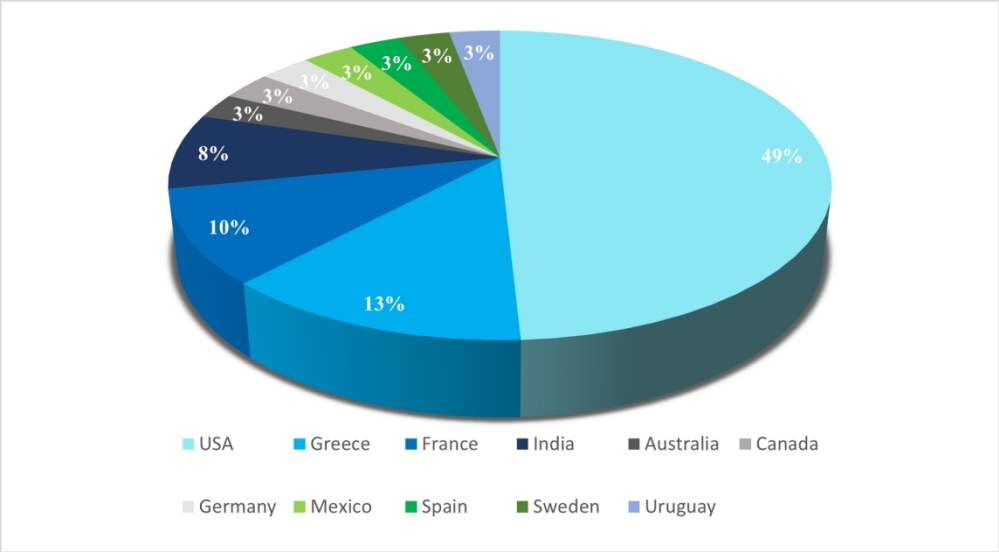

Figure 3. Percentage of included studies per country

152x84mm (300 x 300 DPI)

Table 4. Summary of outcomes with clinical hypnosis used as an adjunct treatment

Study design	Adjuncts	Delivery mode	Comparator	Clinical hypnosis outcomes (versus comparators)	Studies %, number (N), sample size n [references]
NR	+ GA	Hetero-H	Nil	No signs of procedural fear or panic, less post-op pain medication	3% (N = 1), n = 18 [88]
Retrospective	+ midazolam	Hetero-H	Nil	Significantly less cooperation in 2nd and 3rd sessions; similar wellbeing in sessions	3% (N = 1), n = 311 [75]
Observational	± midazolam ± EMONO (H alone: n = 4)	Hetero-H	Nil	82.9% successful procedures with 7.9% rescheduled under GA; 92% of children stated that procedures went well, more than 80% would repeat procedures, more than 85% had good cooperation and low procedural pain (median 2.5) that decreased with successful procedures (median 2), 68.3% were anxious	3% (N = 1), n = 140 [76]
RCT	+ placebo	Hetero-H	SC medication	Similar procedural pain and discomfort; significantly less procedural anxiety and post-procedural behavioural disorders	3% (N = 1), n = 50 [87]
RCT	+ SC/GA	Taped [89] or live hetero-H	SC/GA alone	Similar procedural pain and blood pressure, post-procedural anxiety and morphine use; lower procedural and post-procedural heart rate, post-procedural analgesics and anxiolytics, stress biomarkers; significantly lower procedural anxiety; PTSD significantly higher for children above 7 years old and significantly lower for children below 7 years	8% (N = 3), n = 219 [45,82,89]
RCT		Hetero-H	CBT vs SC	Procedural anxiety and behavioural distress significantly lower than CBT or SC; procedural pain similar to CBT and significantly lower than SC	3% (N = 1), n = 30 [97]
Cross-over	+ LA	Hetero-H	LA	Lower procedural behavioural distress (ns ≠ except for crying), significantly lower pre-intra procedural heart rate	3% (N = 1), n = 29 [90]
RCT				Significantly lower heart rate, verbal/physical resistance to LA	3% (N = 1), n = 200 [79]
RCT	+ EMLA	Hetero-H + SH	EMLA vs EMLA + attention C	Significantly lower pre-procedural and procedural anxiety; procedural pain and behavioural distress	5% (N = 2), n = 90 [99,100]

RCT	+ SC	Hetero-H + SH	Attention C + SC vs SC	Procedural behavioural distress, pain and anxiety significantly lower than control and similar between direct and indirect H	3% (N = 1), n = 80 [98]

C: control; **CBT**: cognitive behavioural therapy; **EMLA**: Eutectic Mixture of Local Anaesthetics; **EMONO**: equimolar mixture of oxygen and nitrous oxide **GA**: general anaesthesia; **H**: hypnosis; **Hetero-H**: hetero-hypnosis (i.e., hypnosis guided by a clinician or experimenter); **LA**: local anaesthesia; **NR**: not reported; **ns**: non-significant; **op**: operation; **OR**: observer reported; **PTSD**: post-traumatic stress disorder; **RCT**: randomised controlled trial; **SC**: standard care; **SH**: self-hypnosis (i.e., self-directed hypnosis); **SR**: self-reported

Table 5. Factors influencing clinical hypnosis outcomes

1st author	Child HS		Other factors potentially influencing H outcomes
	Test and scores	Relation to H outcomes	
Baaleman [81]	NR	NR	NR (clinical assumptions)
Boggia [84]	NR	NR	NR
Butler [108]	0-10 HIP	- Weak ρ to distress (r = .22) - 2 dropouts had low HS (2.5 and 4.5) < group scores ($\bar{x}$ = 5.33; σ = 2.5; range = .5 - .9)	Not measured (clinical observations)
Calipel [87]	NR	NR	NR
Chester [45]	0-7 SHCS - CHILD [in 10 of 27 in H group ⊂ 8 with high HS ≥ 6 (17 refused to spend 20 minutes post-COD)]	NR	- Anxiety at 2nd and 3rd CODs and maximum pain intensity at 3rd COD << SC in < 8 years old and ≈ SC for > 8 years old [finding needs cautious interpreting due to small subgroups size (n=3)] - << SR pre-procedural pain at 2nd COD
Crawford [88]	0-4 eye roll test [good-moderate HS in ≈ 2/3]	NR	NR
Duparc-Alegria [82]	NR	NR	Not measured (anecdotal assumptions)
Enqvist [89]	NR	NR	NR
Erappa [73]	NR	NR	NR
Gokli [90]	NR	NR	> H effects in < age (4 - 6 years): significant effect on heart rate ≠ [F = 6.1, p < .021] (ns effect for sex, race, or treatment order, p > .15)
Hawkins [91]	0-7 SHCS - CHILD	Significant effect on ↓ pain (F = 35.22, p < .001), anxiety (F = 20.54, p < .001), behavioural distress (F = 15.52, p < .001)	Ns effect of direct/indirect suggestions for pain (F = .05, p = .83), anxiety (F = .1, p = .92), and behavioural distress (F = .15, p = .69)
Hilgard [92]	0-7 SHCS -	Pain and anxiety in high HS (5-7) < with	NR in study sample (factors reported beyond study sample)

	CHILD	low (0-4) HS ($p < .05$ for pain, $p < .01$ for anxiety)	
Hodel [106]	0-7 SHCS - CHILD at start of 1st H [6 high HS, 3 low-moderate HS]	Weak ρ to ↓ OR behavioural distress (r = .37), SR (r = .20) and OR (r = .28) anxiety; strong ρ to ↓ OR discomfort (r = .54) and pain (r = .53)	NR
Huet [72]	NR	NR	0-10 MOPS scores > *2* are more frequent in anxious children with ≠ anxiety levels
Juana María [74]	NR	NR	NR
Kashlak [77]	NR	NR	- Parent anxiety not strongly ρ to child anxiety (r NR) - Strong ρ between child pre-procedural distress and anxiety at 1st (r = .781) and 2nd (r = .739) visits; procedural distress and anxiety at 1st (r = .810) and 2nd (r = .879) visits; procedural pain and anxiety at 1st (r = .843) and 2nd (r = .858) visits; procedural pain and distress at 1st (r = .819) and 2nd (r = .879) visits
Katz [93]	Therapist rated children's response to H on post-H 1-5 scale (1 = excellent, 5 = poor)	- HS pre 1st BMA strongly ρ to ↓ SR fear after 1st (r = -.57, $p < .05$) and 2nd postbaseline BMAs (r = -.51, $p < .05$) and SR pain after 3rd postbaseline BMA (r = -.54, $p < .05$) - HS pre 2nd BMA strongly ρ to: ↓ 1st postbaseline BMA OR behavioural distress (r = -.46, $p < .05$) and SR pain (r = -.65, $p < .01$); OR anxiety (r = -.49, $p < .05$) and SR pain (r = -.63, $p < .01$) after 2nd postbaseline BMA - Pre 3rd BMA HS weakly ρ to dependent measures (r NR)	- Rapport ratings strongly ρ to ↓ SR-pain on 1st (r = -.44, $p < .05$) and 2nd post-baseline BMA (r = -.45, $p < .05$) - Significant group-sex interactions indicating that girls tended to do better in H (F = 21.35, $p < .001$ for OR distress; F = 15.98, $p < .001$ for OR anxiety; F = 9.70, $p < .001$ for SR pain; F = 3.72, $p < .05$ for SR-fear)
Kellerman [94]	NR	NR	NR
Kohen [95]	NR	NR	> outcomes (not only pain and distress) with older age ⊄ 7-8 years
Kuttner [86]	NR	NR	- Significant effect for > age (7-17 years) on ↓ OR pain (F = 4.76, $p < .05$

			at 1st H, F = 4.28, p = .05 at 2nd H), OR anxiety (F = 4.94, p < .05 on 1st H, F = 4.92, p = .04 on 2nd H); significant effect for < age (3-7 years) on ↓ OR behavioural distress (F = 4.69, p < .05) - OR behavioural distress strongly ρ to SR pain (r = .62) and anxiety (r = .63) - Significant effect for 2nd H on ↓ SR pain (F = 8.32, p = .01), SR anxiety (F = 11.22, p < .01) and OR behavioural distress (F = 5.24, p = .03)
Lambert [96]	NR	NR	NR
Liossi, 1999 [97]	0-7 SHCS - CHILD (Greek version)	Strong ρ to ↓ pain, (r = .69, p < .05), anxiety (r = .63, p < .05) and behavioural distress (r = .60, p < .05)	Ns ≠ in pain, anxiety, and behavioural distress with age
Liossi, 2003 [98]	0-7 SHCS - CHILD (Greek version)	Strong ρ to ↓ pain (r = -.81, p < .01), anxiety (r = -.81, p < .01), behavioural distress (r = -.67, p < .01) with direct H and ↓ pain (r = -.82, p < .01), anxiety (r = -.85, p < .01) and behavioural distress (r = -.8, p < .01) with indirect H	Significant main effect for hetero-H phase on pain (F = 132.89, p < .001), anxiety (F = 131.96, p < .001) and behavioural distress (F = 63.77, p < .001)
Liossi, 2006 [99]	0-7 SHCS - CHILD (Greek version)	Strong ρ to ↓ pain (r = .50, p = .05), anxiety (r = .66, p = .01), preop anxiety (r = .66, p = .01), weak ρ to ↓ behavioural distress (r = .13, p = .63)	Significant main effects for time on ↓ anticipatory anxiety (F = 213.78, p < .001), procedural anxiety (F = 361.14, p < .001), and pain (F = 222.75, p < .001); treatment benefit maintained with self-H
Liossi, 2009 [100]	NR	NR	NR
Lobe [101]	NR	NR	NR (clinical observations)
Manworren, 2015 [78]	NR	NR	Significant pain ≠ at 48-60 and 72-84 hours may ρ to ≠ timing (time effect NR)
Manworren, 2018 [83]	NR	NR	NR
Oberoi [79]	0-7 SHCS - CHILD for 6-16 years old	NR	> age ρ to resistance to H (r = .337)
Olmsted [102]	NR	NR	Ns ≠ in responses to H in BMA/LP with ages (≥ 12 years vs 6-11 years)

Ramírez-Carrasco [80]	NR	NR	Ns ≠ in heart rate with 6-11 years ages (t = 1.12, *p* = .272)
Rienhoff [75]	NR	NR	Not measured (authors' assumptions)
Sabherwal [85]	NR	NR	NR
Schnee [107]	NR	NR	- Parent anxiety weakly ρ to child distress in phase 1 (r = -.24), 2 (r = .18) and 3 (r = .09); parent distress promoting behaviour ρ to child distress: strong in phases 1 (r = 0.61, *p* < .001), moderate in phase 3 (r = .31, *p* < .08), weak in phase 2 (r = .01, *p* NR); parent coaching behaviour weakly ρ to child distress in phases 1 and 2 (r = .05) and 3 (r = -.13)) - Preop anxiety in girls >> boys (r = .2 on STAIC, .29 on CAPS, *p* < .05) - Distress in phases 1 and 2 strongly ρ (r = .61); distress in phase 3 weakly ρ to distress in phases 1 (r = .14) and 2 (r = -.06) - Age negatively ρ to distress in phases 1 (r = -.35, *p* < .01) and 2 (r = -.32, *p* < .05) - Significant phase effect on distress that is the highest in phase 3 (F = 4.86, *p* < .001) - Distress phase 3 weakly ρ to pre-op anxiety rated in STAIC (r = -.13 phase 1, -.19 phase 2, .08 phase 3) and CAPS (r = -.1 phase 1, -.07 phase 2, .11 phase 3) *Procedure phases: IV (phase 1), throat spray (phase 2), endoscopy (phase 3)
Smith [103]	0-6 SHCS - CHILD for 4 - 8 years old [7 high HS and 7 low HS in H group]	Significant effect for ↓ SR pain (F = 13.52, *p* < .001) and behavioural distress (F = 24.31, *p* < .001). Significant condition × HS interaction on ↓ distress (F = 8.63, *p* < .001); SR (F = 23.17, *p* < .001) and PR pain (F = 18.77, *p* < .001); SR (F = 10.03, *p* < .001), PR (F = 8.16, *p* < .001) and OR anxiety (F = 21.24, *p* < .001)	NR: Failed to reveal demand characteristics (i.e., cues on research hypothesis that may affect participants' response or behaviour [111]) for children with low HS and parents that might have influenced dependent measures
Tran [76]	NR	NR	Procedure success ρ to older child age (13 vs 8 years, odds ratio = 1.34, *p* = .003) and procedure type (rectosigmoidoscopy vs. EGD, odds

			ratio = 16.34, p = .007), parents' presence (for EGD, p = .029; no ≠ in H success)
Wall [104]	0-7 SHCS - CHILD	Weak ρ with ↓ pain and anxiety	NR
Zeltzer [105]	NR	NR	- No age effects on symptoms (⊄ eating disruption in > 12-17 years, p < .05) - Significant effect for baseline somatic distress, chemo emesis, and anti-emetics on post-procedural somatic distress (R^2 = .29, p < .05) - Significantly emetic effect on functional disruption (R^2 = .13, p < .05) - Chemo emesis and antiemetics ρ to total symptom scores (R^2 = .2, p < .05) - Treatment (H, support, C) is the sole significant factor of somatic distress (R^2 = .3, p < .01), functional disruption (R^2 = .13, p < .05), and total symptoms score (R^2 = .25, p < .01)

BMA: bone marrow aspiration; **CAPS**: Children's Anxiety and Pain Scale; **Chemo**: chemotherapy; **COD**: change of dressing; **EGD**: esophagogastroduodenoscopy; **F**: variation between sample means or within the samples; **H**: hypnosis; **HS**: hypnotic suggestibility; **IV**: intravenous; **LA**: local anaesthesia; **LP**: lumbar puncture; **MOPS**: Modified Objective Pain Score; **NR**: not reported; **ns**: nonsignificant; **op**: operative; **OR**: observer report; **POD**: post-operative day; **PR**: parent proxy report; **r**: correlation coefficient; **R^2**: Coefficient of determination **SHCS**: Stanford Hypnotic Clinical Scale; **SR**: self-report; **STAIC**: strait-trait inventory for children; **t**: the size of the difference relative to the variation in the sample data; **VCUG**: voiding cystourethrography; **$\bar{x}$:** mean; **σ**: standard deviation; **ρ**: link/linked; **⊄**: except/excluding; ≠: difference

Table 6. Population characteristics

1st author	Sample size (attrition %)	Age range ($\tilde{x}$ [IQR], $\bar{x}$, σ)	Gender n F/M	Eligibility criteria (inclusion ⊂ and exclusion ⊄)	Required procedure and condition
Baaleman [81]	32 (9% declined, 6% left)	4 - 18 years ($\tilde{x}$ [IQR] = 8.2 [6.1-9.7] in C; 8.5 [6.5-10.1] in H)	19 F 13 M	⊂: 4 - 18 years old, scheduled for awake anorectal manometry ⊄: Psychiatric/behavioural disorders, severe physical illness (ASA ≥ III), cognitive delay, lack of English proficiency, organic constipation	Anorectal manometry for functional constipation
Boggia [84]	15	4 - 14 years	NR	NR	VP for severe haemophilia
Butler [108]	44 (4% declined)	4 - 15 years	29 F 15 M	⊂: English-speaking child and parent, > 1 past VCUG, age > 4 years in most recent VCUG, reported difficulty (e.g., crying, pain, and/or fear) in VCUG	VCUG
Calipel [87]	50	2 - 11 years	10 F 40 M	⊂: ASA I or II ⊄: ASA III or IV, surgery/hospitalisation in the last 6 months, emergency surgery, psychological delay	Ambulatory lower abdominal surgery
Chester [45]	62 (no saliva samples in 11%)	4 - 15 years	24 F 38 M	⊂: 4 - 16 years old, acute burn of any depth, treatment at study setting ⊄: Superficial burns; cognitive, physical, speech or memory impairment; child protection or inquiry for child protection; non-English speaker; on ventilator; 1st burn care in procedural room or under GA	Burns dressing change for acute burns
Crawford [88]	18	12 - 22 years	15 F 3 M	NR	Operation for idiopathic scoliosis
Duparc-Alegria [82]	119 (12% declined, 2% left)	10 - 18 years ($\tilde{x}$ [Q1; Q3] = 14.8 [13;105.9] in C; 14 [13.5; 15.7] in H)	85 F 34 M	⊂: 10 - 17 years old; GA; major surgery, spinal fusion, osteotomy for scoliosis; ASA I or II ⊄: Emergency surgery, deafness, non-French speaker, severe cognitive disability, or psychiatric disorders	Major orthopaedic surgery, spinal fusion, or osteotomy for scoliosis
Enqvist [89]	38 (data for < 18 years)	H:$\bar{x}$ = 19.1 years (σ = 8.1); C: $\bar{x}$ = 19.7 (σ = 10.1)	18 F 20 M	⊂: Matched surgery and sex between experimental groups	Orthognathic maxillofacial surgery

Erappa [73]	200	6 - 10 years	F + M	⊂: Healthy, 6 - 10 years old, prior parental consent, requiring inferior alveolar nerve blocks, undergoing LA for the 1st time ⊄: History of LA, H, allergy to LA, untoward experience in medical setting due to medical condition, nervous, or mental disorder; impaired psychological development; physical or mentally handicapping conditions; systemic disease	Dental treatment requiring inferior alveolar nerve block
Gokli [90]	29	4 - 13 years ($\bar{x}$ = 7.8, σ = 2.1)	18 F 11 M	⊂: No prior dental treatment, ASA I, English speaker	2 dental restorations
Hawkins [91]	30	6 - 16 years	18 F 12 M	⊂: 5-6 LPs before baseline pain measures ⊄: Prior H, analgesics/psychotropics in study, psychiatric disorder	LP for leukaemia and non-Hodgkin's lymphoma
Hilgard [92]	24 (38% declined)	6 - 19 years	F M	NR	BMA for cancer
Hodel [106]	9 (52% declined, 11% left)	5 - 12 years	5 F 4 M	⊂: 5 - 12 years, ≥ 1 pre-study BMA	BMAs for acute lymphocytic leukaemia
Huet [72]	29	7 - 12 years ($\tilde{x}$ = 8 in H, 9 in C)	13 F 16 M	⊂: Dental restoration or primary teeth pulpotomies requiring LA by buccal infiltration only ⊄: Allergy to LA, prior H, psychological impairment, *specific medical illnesses*, prior severe medical conditions potentially inducing fear of medical setting, oral surgery, deep endodontic treatment, parental/child refusal	Dental restorative treatments or primary teeth (canines and molars) pulpotomies
Juana María [74]	65	5 - 16 years with 50% < 8 years ($\bar{x}$ = 8, σ = 2 in H; $\bar{x}$ = 8, σ = 3 in C)		⊂: ASA class I or II; height and weight percentile between P3 and P97; No known drug allergies; fasting for 6 hours (solids) and 2 hours (liquids); speaking Spanish as mother tongue ⊄: Diagnosed behavioural disorders, attention deficit disorder, intellectual disability; history of H treatment, neurological pathology or psychomotor delays, painful pathology, obstructive sleep apnoea	Scheduled for outpatient dermatological surgery for nevus, local neoplasms, and other lesions)
Kashlak [77]	20 child-parent (10% of	6 - 15 years ($\bar{x}$ = 9.1, σ = 3.07)	8 F 12 M	⊂: English-speaker, 5 - 16 years old, with oncologic-hematologic disorders, requiring 2 needle procedures in 6 weeks modified from 4-week timeframe	Needle-procedures for oncologic-hematologic and related disorders (leukaemia,

	children, 15% of parents left)			⊄: Non-English speaker; with cognitive deficit; mental, behavioural and/or developmental disorder, and/or sensory or communication problems potentially hindering communication or participation	solid tumours, blood disorders, and other related diagnoses)
Katz [93]	36 (NR)	6 - 11 years ($\bar{x}$ = 8 years 3 months, σ = 1.68)	12 F 24 M	⊂: 0 - 100 SR pain > 50, 1 - 7 SR fear > 4, 0 - 33 procedural behaviour > 4, 1 - 5 anxiety > 3	Repeated BMAs (or LP in some cases) for acute lymphoblastic leukaemia
Kellerman [94]	16 (11% left)	$\bar{x}$ = 14 years, σ = 1.6	9 F 7 M	⊂: Referred by oncologists due to procedural distress during BMA, LP, and injections	BMA for cancers (acute lymphocytic leukaemia, acute myelocytic leukaemia, Hodgkin's disease, Ewing's sarcoma, non-Hodgkin's lymphoma, neuroblastoma, osteogenic sarcoma)
Kohen [95]	48 with pain and anxiety of 505 with varied problems	3 - 20 years	NR	NR	Wide problems range ⊂ pain and anxiety: needle-phobias, cancerphobia, and anxiety-inducing situations (e.g., medical procedures ⊂ pelvic examination)
Kuttner [86]	48 (19% left)	3 - 10 years	18 F 30 M	⊂: Requires BMA and finds it upsetting	BMA for leukaemia (acute lymphoblastic leukaemia or acute myeloblastic leukaemia)
Lambert [96]	50 (4% declined)	7 - 19 years	31 F 19 M	⊂: Scheduled for elective surgery ⊄: Inability to read or speak English; prior H or biofeedback; development delay	Elective paediatric surgery: spinal fusion, orthopaedic operation; cardiac, thoracic, and general surgeries
Liossi, 1999 [97]	30 (0% declined)	5 - 15 years	13 F 17 M	⊂: With leukaemia, 5 - 15 years old, requiring ≥ 2 BMAs in 2.5 months ⊄: Prior H and/or CBT; analgesics/psychotropics in study;	BMAs for leukaemia

				psychiatric disorder	
Liossi, 2003 [98]	80 child-parent (5% declined)	6 - 16 years		⊂: Leukaemia or non-Hodgkin's lymphoma, 6-16 years old, LPs required ⊄: Prior H treatment, analgesics/psychotropics in study, psychiatric disorder	LPs for leukaemia or non-Hodgkin's lymphoma
Liossi, 2006 [99]	45 child-parent (4% declined)	6 - 16 years	22 F 23 M	⊂: Greek-speaking, Leukaemia or non-Hodgkin's lymphoma, 6-16 years old, regular LP ⊄: Prior H treatment, analgesics/psychotropics in study, psychiatric disorder	LPs for leukaemia or non-Hodgkin's lymphoma
Liossi, 2009 [100]	45 child-parent (6% declined)	6 - 16 years (σ = 2.21)	25 F 20 M	⊂: Greek speaker, with cancer, 7-16 years old, off treatment, requiring VP, one parent present ⊄: Prior H treatment; analgesics/psychotropics in study; psychiatric disorder; no visible veins	VP for cancer
Lobe [101]	10	12 - 18 years		NR	Nuss procedure for pectus excavatum
Manworren, 2015 [78]	22 (0% declined)	H: $\bar{x}$ = 192.87 months, σ = 19.19; no H: $\bar{x}$ = 186.64 months, σ = 24.99	5 F 17 M	⊂: Ability to SR pain on NRS, post-procedural pain treatment protocol ⊄: Chronic opioid treatment	Nuss procedure for pectus excavatum
Manworren, 2018 [83]	53	10 - 21 years ($\bar{x}$ = 15, σ = ± 2.19)	6 F 47 M	⊂: Able to SR pain on NRS, postprocedural care protocol as required in study ⊄: Chronic opioid treatment	Nuss procedure for pectus excavatum
Oberoi [79]	200	6 - 16 years ($\bar{x}$ = 9.8)	106 F 94 M	⊂: No prior dental experience, ASA I	Pulp therapies with LA for primary permanent mandibular molars
Olmsted [102]	33 (27% declined	6 - 17 years ($\bar{x}$ = 10.06, σ = 3.17	16 F 17 M	⊂: SR baseline chemo-related nausea and/or vomiting (> 3 on 0-10 scale); consistent, independent SR chemo-related distress; prior chemo with ≈ drug types and dosages	BMA, LP or LP + BMA for cancer (leukaemia, non-Hodgkin lymphoma, neural tumours)

Ramírez-Carrasco [80]	40	5 - 9 years ($\bar{x}$ = 90 months, σ = 17.15)	24 F 16 M	⊂: No prior dental care, 1st dental treatment at study setting with LA requirement	Dental treatment + LA
Rienhoff [75]	311	3 - 12 years ($\bar{x}$ = 74.22 months, σ = ± 24.71)	142 F 169 M	⊂: 3-12 years old; healthy with ASA I or II; ≥ 2 treatments under sedation; anxiety with willingness to cooperate; dental treatment with restorative measures (fillings, crowns, pulpotomies, root-canal treatments) or extractions ⊄: Serious general disease with ASA ≥ III, age < 3 or >12 years, only one treatment under sedation, treatment under GA, no sedation, unwillingness to cooperate, respiratory tract obstructions, severe overweight, weight < 10 kilograms, highly extensive treatment, and difficult surgical treatments	Dental treatment ± LA (e.g., restoration, extraction, steel crown, pulpotomy)
Sabherwal [85]	60 (12% declined)	8 - 12 years	24 F 36 M	⊂: 8 - 12 years old; primary molar extraction as 1st dental intervention (over-retained molars up to Grade-I mobility), anticipatory anxiety > mild ⊄: Allergy to LA; specific medical illnesses/ psychological impairments; child/parent refusal; teeth with extra-oral swelling; mobility (Grade II/III) or traumatic dental injury	Primary molar extractions for advanced dental caries
Schnee [107]	53 (5% declined)	5 - 13 years ($\bar{x}$ = 115 months)	27 F 26 M	⊄: Intelligence < average	
Smith [103]	27 (25% left)	3 - 8 years ($\tilde{x}$ = 4.5, $\bar{x}$ = 4.62, σ = 1.44)	17 F 19 M (initial sample)	NR	Repeated VP or infusa-port access for cancer treatment or diagnosis (leukaemia and solid tumour) or non-malignant blood disorders
Tran [76]	140 (5% declined)	6 - 18 years ($\tilde{x}$ [Q1-Q3] = 12 [9-14])	70 F 70 M	⊂: 6 - 18 years old, scheduled for gastro-intestinal endoscopy at study setting ⊄: < 6 years old, deaf w/o hearing aids, cognitive disorders and situations when H could not be fully understood, emergency	Diagnostic esophagogastroduodenoscopy or rectosigmoidoscopy

				procedure, unwillingness of parent/guardian to participate	
Wall [104]	20 (52% left)	5 - 18 years		NR	LP/BMA for cancer
Zeltzer [105]	54 (16% declined)	5 - 17 years ($\bar{x}$ = 11.67, σ = 3.35)	28 F 26 M	$\subset$: With high chemo-related baseline nausea and/or vomiting (> 3 on 0-10 scale); can consistently and independently SR chemo-related distress; requiring chemo $\geq$ 2 with $\approx$ drug types and dosages $\not\subset$: Too young, unobtainable reliable consistent SR	Chemotherapy for cancer (leukaemia, solid tumours)

ASA: American Society of Anaesthesiologists classification; **BMA**: bone marrow aspiration; **C**: control; **CBT:** cognitive behavioural therapy; **Chemo**: chemotherapy; **F**: female; **GA**: general anaesthesia; **H**: hypnosis; **IQR**: interquartile range; **IV**: intravenous; **LA**: local anaesthesia; **LP**: lumbar puncture; **M**: male; **NR**: not reported; **NRS**: numeric rating scale; **Q1**: quartile 1; **Q3**: quartile 3; **SR**: self-reported; **VCUG**: voiding cystourethrography; **VP**: venepuncture; $\bar{\mathbf{x}}$: mean; $\tilde{\mathbf{x}}$: median; $\subset$: including; $\not\subset$: excluding; $\boldsymbol{\sigma}$: standard deviation; > superior/above; < : inferior/under; $\geq$: superior or equal

Table 7. Description of interventions details

Author	Context and unit	Comparator [procedure time-point: pre/post/ intra; dose; duration]	Clinical hypnosis			
			Type, mode, provider [procedure time-point: pre/post/ intra; dose; duration]	Pre-hypnosis [± post-hypnosis]	Hypnosis components	
					Induction [± intensification]	Suggestions [± de-induction]
Baaleman [81]	Tertiary	SC	H by an advanced nurse practitioner trained in paediatric clinical H in a 3-day course [pre; for 1 - 3 minutes]	NR [*hypnotist cued distressed child in procedure by referring to initial moments]*	Induction for comfort; progressive relaxation [standard H deepening (e.g., special place imagery)]	[Ending session with a post-hypnotic suggestion to imagine a special place for comfort in procedure]
Boggia [84]	Hemotherapy	Baseline	H [post pain measures in 2nd study phase]	NR	*Magic glove* technique to ↓ pain perception and anticipatory anxiety	
Butler [108]	+ +	SC + RT by therapist ⊂ familiarisation with procedure, relaxation and breathwork (⊄ imagined focus away from procedure) [pre/intra]	SH training by hypnotist [1-week pre; for 1 hour]	- HS test - Introducing H and SH training	Teaching counting, deep breathing, eye closure, imagery for comfort, absorption in imagery	
			SH by parent and child [pre]		Practising SH several times per day in preparation for procedure	
			H exercises by hypnotist [intra]		≈ SH training	
Calipel [87]	Surgery	SC (oral midazolam) [pre; for 30 minutes]	H by hypnotist-anaesthetist [intra] + oral placebo (water + syrup) [30 minutes pre]	Creating H relation using child items, discussing fears/games	H until anaesthesia induction	

Chester [45]	Burns	Pharmacologic/ non-pharmacologic SC by medical staff [pre/intra]	H (+SC) by PhD medical student trained in H [pre/intra]		Explaining H, asking about preferences	Focused attention on favourite place imagery; suggestions for comfort, deep breathing, relaxation; permissive direct suggestions	Specific direct hypno-anaesthesia suggestions to alter/remove pain and dissociate from pain (replacing the word *burn* with *involved/injured area* when discussing the burn to avoid negative emotions due to preconceptions)
Crawford [88]		GA by anaesthetist [procedure day; for 5 - 6 hours]	H (+ GA) by hypnotist-anaesthetist [pre-op on op week; several times > 1/day until satisfactory outcomes]		Explaining procedure and H to dispel myths while stressing pain relief, HS test (1-week pre-op)	Verbal technique, muscle relaxation	Repeated posthypnotic suggestions *modelling op* to ↓ pre/intra/post-op fear on op day, ↑ relaxation (showing relaxation role in ↓ pain) and ↓ discomfort (+ info on analgesic availability) [suggestions to open eyes and signal understanding, instructions not to move ⊄ feet and legs while explaining the reasons for position]
Duparc-Alegria [82]		SC + analgesic by hypnotist [intra (pre-GA)]	H by anaesthetist nurse trained in hypno-analgesia [intra (post GA); for 5 - 10 minutes x 1]		Asking about children's imaginary journey to tailor suggestions	Suggestions for relaxation, visualisation, distraction, or dissociation	
Enqvist [89]	Maxillo-facial surgery	Medication + anaesthesia (≈ in children) [pre]	Taped H (+SC) by ortho-dontist-hypnotist	Played by child [pre; for 18 minutes daily]	Request to listen to tape daily and agree on tape in procedure	Tape content ≈ CB but mediated via H and relaxation, addressing all senses (visualising, internal talk, and relaxation) ⊂ posthypnotic suggestions for ↓ bleeding, ↓ procedural blood pressure, and ↑ relaxation	
				Played by ortho-dontist-hypnotist taping H/ another [intra]		Content ≈ pre-procedural tape to ↑ procedural control and safety; tape continuous running during procedure	

Erappa [73]	Paediatric and preventive dentistry	Acupressure, AV aids (cartoon/TV shows/movies played via virtual private theatre system to distract child), C w/o distraction [pre-LA for 2 - 3 minutes, intra-LA]	H [intra, during LA]		Recording detailed case history; asking child about favourite character and stories; teaching child to imagine a scenario with specific details, sound, aroma, and colourful scene to relax	Simple mental techniques of distraction, guided imagery, and H with positive suggestions to imagine having pleasant experiences or being in a soothing place	
Gokli [90]		LA by same dentists [intra]	H by dentist certified in H [pre 1st/2nd procedure/LA; x1]			Deep breathing, relaxation, focus on favourite imagery or sensations	Direct, indirect, and ego-strengthening suggestions for absorbing pleasant experiences (stories, adventures) [+ de-induction]
Hawkins [91]		None	DH	H by therapist [0 - 5 days pre]	Asking about child likes, dislikes, fears, and hopes; discussing ideas and clarifying misviews on H; answering questions	Favourite place imagery	Direct suggestions several minutes after H start (numbness, topical/LA, *glove anaesthesia*, *switchbox*), posthypnotic suggestions for procedural comfort with repeated H in the treatment room
				SH [pre, in procedural preparation]		Assisted H w/o formal induction	
			IH	H by therapist [0 - 5 days pre; duration ≈ DH]		Induction ≈ in DH	Indirect suggestions several minutes after H starts (metaphor), rest of session ≈ DH
				SH [pre, in procedural preparation]		Assisted H w/o formal induction	
Hilgard [92]	NR	None	H training (basic pattern			Eye-fixation, eye-	Procedure rehearsal + visualising and

			mainly ⊂ rehearsal) [pre, at baseline]		closure, imagery, blowing, squeezing mother's hand	squeezing mother's hand to ↓ unwanted feelings
			H [intra; ≥ 2 sessions in 19, > 10 in few]		Blowing on the therapist's fingers visualised as *birthday candles*	
Hodel [106]	 Outpatient psychology and haematology-oncology	NR	SH training [≈ 2.5 weeks pre; for 1 hour x1]	- With parents: brief H discussion, answering questions and invitation to be present - With children: ≈ to parents' + discussing child interests	HS test and induction [intensification]	Suggestions, post-hypnotic pictorial cues [+ de-induction then suggesting home SH (⊄ pictures)]
					Coin drop technique [metaphor, favourite place imagery, deep breaths] (± parents)	Post-hypnotic suggestion to use favourite place H when needed, inviting the child to add new images to SH [+ de-induction] (± parents)
			H training [≈ 1.5 weeks pre; for 1 hour x1]	Reviewing children's home SH practice	Assisting child SH; if difficulty/ boredom with prior techniques, teaching new induction [+ intensification]	Hypno-analgesia suggestions (direct, sensory alteration, fantasy, dissociation) and coping imagery; suggestions to ↓ anxiety; post-hypnotic suggestions to ↑ H involvement and SH ease, ↑ relaxation and control over distress; demonstration for parent
			H training [2 days pre-BMA; for 1 hour x 1]		- SH and rehearsing hypno-analgesia, anxiety reduction and coping imagery from prior H training (≥ 1 direct hypno-analgesia technique and 1 fantasy and/or dissociation); practising using hospital cues for relaxation - Doll play with the child playing nurse and hypnotist to ↑ a sense of mastery and control; ± desensitisation, dissociation + fantasy; direct analgesia suggestion (verbal description and gesture, procedure modelling)	
			H [20 minutes pre-BMA to BMA end or post-		Assisted SH (if trouble, switching to H): direct suggestion, distraction + suggestions for relaxation at cues, distraction	

			BMA/LP; x1]		in conversation with eyes open	
					Distraction, direct suggestion, and imagery [intensification with eyes closed]	Distraction and suggestions for intensification and relaxation at cues [de-induction and suggestions for future ↑ relaxation and H ease]
Huet [72]	Dentistry	SC by dental student [intra]	H by anaesthetist with 2 years of experience in Ericksonian H [intra]	Collecting info on children's favourite activities, family, and school	Instructions to focus on therapist voice and imagery to create hypnotic relation using room items, stories, and suggestions; predefined code for expressing discomfort [explaining procedure, noting muscle relaxation, breathing, and immobility as H signs]	H sustained by speaking during dental treatment [speaking little louder using items in the room to shift attention to the external setting]
Juana María [74]	Paraplegic centre	Distraction by care provider using cartoon or music video on digital tablet [intra to post-GA awakening]	H by care provider [intra to post-GA awakening] * Children ⊄ 3 chose inhaled GA induction fruit scented markers colouring anaesthetic mask inside out	- Creating therapeutic relation - Collecting info on children's sensory capacities and favourite experience - Behavioural interventions with children and parents to ↓ fear and anxiety and	Metaphor suggestion using children's imaginary thinking and sensory channels (visual, kinaesthetic, auditory) to alter perceptions (using "as if") and promote focused attention on imaginary safe place (e.g., instruction to use a *magic mask* through which mint scent enters airway as if they were sweets to make them laugh during H) to promote engagement in the procedure (H in calm tone and voice, ⊂ truisms to orient child to share similar reality and focus with respect of child's autonomy) [H emergence with suggestions in post-hypnotic period throughout surgery	

				dispel negative ideas about H	before returning to alert state]	
Kashlak [77]	 +  +  Outpatient oncology-haematology	SC ⊂ EMLA (n = 12, 1 forgot to use) by nurse [intra]	H by an oncology-haematology paediatric nurse trained in H and experienced in paediatric oncology-haematology imagery [pre]		Imagination and focused attention on favourite stories; breathwork and suggestions for relaxation [intensification of focused attention]	Indirect and direct suggestions for comfort and relaxation with guided imagery using visual, kinaesthetic, aural and movement senses [shift to peripheral awareness]
			SH [intra; x2]			
Katz [93]	 Haematology-oncology	Nondirected live play with same therapists to control time and child attention [pre for 30 minutes] and preparation [20 minutes pre-procedure + intra-procedure; x3] *Routine BMAs every 6 months (median 3 months)	SH training by 1 of 2 trained psychologists experienced in the psychology of oncology and H [pre; for 30 minutes]		Eye fixation ± eye closure; active imagery; muscle relaxation	Hypnotic suggestions ⊂ imagery to ↓ or reframe sensory/pain experience, for distraction, relaxation, > positive affect with procedures, > sense of mastery and control over sensory and affective experiences. Post-hypnotic suggestions for practising and re-entering H in procedure upon therapist cue
			SH with same SH training therapists [just pre to post; for 20 minutes x3]		Accompanying child and parent to treatment room then nonverbal cue for child SH	Verbal interaction: brief encouragements ≈ in treatment groups [post-H/procedure therapist left room]
Kellerman [94]	2 x  or  Outpatient haematology-oncology	None	SH training by 1 paediatrician and 3 psychologists [pre]	Explaining H while highlighting self-help, and dispelling misviews	Teaching induction (e.g., eye fixation or hand levitation)	Suggestions for PMR, slow rhythmic breathing, wellbeing, favourite place imagery (≠ images with ≠ children); after noting relaxation, posthypnotic suggestions for ↑ well-being, ↓ discomfort, and ↑ mastery in procedure
			H (± SH) [pre]	Encouraging child SH	Potential SH practice	

			SH + therapist suggestion [intra]		SH + suggestions for procedural comfort	
Kohen [95]	for teens	None	SH training [pre] SH [intra]		Imagery and relaxation	Teaching H ⊂ child imaginative skills
Kuttner [86]	outpatient, oncology	- SC by physician and nurse answering parents' questions [intra] - Distraction by investigator: preparation [pre; for 5 - 20 minutes] and active distraction to shift attention from pain [intra]	H training shifting attention in absorbing story or fantasy to change internal experience and pain perception and ↓ pain and anxiety [pre; for 2 - 5 minutes]		Indirect suggestions for hypnotic-like behaviours (e.g., time distortion); stories or adventures with direct, indirect, and ego-boosting suggestions for absorbing pleasant experiences; direct hypno-anaesthesia suggestions (*pain-switch* technique)	
			Informal H imaginative experience [intra]		*Weaving technique* in and out of H ⊂ favourite story/adventure imagery, info on the procedure, indirect/direct suggestions for comfort and coping (fantasy intensified in most painful procedure parts); analgesia suggestions via sensation dissociation or change (*pain switch* technique)	
Lambert [96]		SC by investigator, nurse, and/or child life specialist [pre; for 30 minutes]	H by investigator trained and experienced in child H [1-week pre; for 30 minutes x1]	Explaining relaxation and imagery; asking about child enjoyable feel-good images for relaxation	Procedure rehearsal with suggestions for enhanced recovery and minimal pain; instructions for relaxation, pleasant imagery and feelings; emphasising choices and suggestions for positive outcomes	
Liossi, 1999 [97]	Haematology-oncology	- CB coping skills training by H provider [5 days pre; for 30 minutes] - SC for pain by hospital staff [intra]	H by a research psychologist with extensive experience in H and CBT for pain [5 days pre; for 30 minutes]	Creating trust with child; collecting info (e.g., likes, dislikes) clarifying ideas and misviews about H	Relaxation and imagery (favourite place/activity); teaching PMR and abbreviated autogenic relaxation; imagery ⊂ references to, comfort and skills	Analgesic suggestions several minutes after H start for numbness, LA, g*love anaesthesia*; posthypnotic suggestion of procedural comfort with repeated H in the treatment room

Liossi, 2003 [98]	Haematology-oncology	- Attention C by therapist [5 days pre 1st LP, in LP preparation and 2 consecutive LPs; for 45 minutes] - SC for pain by hospital staff (no therapist) [intra; for 45 minutes]	DH and IH [5 days pre-1st LP and in LP preparation; for 40 minutes x3]	Asking about children (likes, dislikes, fears, hopes, experiences), clarifying children's ideas and misviews of H at 1 week pre-LP+H	References to well-being, strengths, competence	Analgesic suggestions: direct in DH (numbness, LA, *glove anaesthesia*, *switchbox*) or indirect in IH (metaphor); post-hypnotic suggestions for comfort with H in the next LP
			SH training structure and content ≈ attention C [pre-LP; for 45 minutes]		- Step 1: induction and intensification ⊂ imagery and ideomotor techniques then reverse counting from 5 to 1 (eyes open at 3 and alertness at 1), discussion on acquired knowledge of de-induction and fast emergency de-induction - Step 2: discussing the most helpful induction techniques, discarding rest, asking children to detail chosen techniques for induction, analgesic suggestions to feel-good and go easy and naturally to H with therapist adding details if child wording was broad then pause, reassurance, and discussion of problems if any	
			SH [intra; x3]		Step 3 ≈ step 2 with silent recall and experience of induction and suggestions, nodding when finished, then pause and discussion to clarify problems if any	
Liossi, 2006 [99]	Haematology - oncology	- Attention [5 days pre; for 40 minutes] - EMLA [60 minutes pre; for 45 minutes x 2] - SC + EMLA by hospital - Medical and nursing staff [pre; for 60 minutes]	SH training by trained therapist [5 days pre 1st LP; for 40 minutes x 1]	- Asking about children (likes, dislikes, fears, hopes, experiences) - Clarifying ideas and misviews of H [in 1 week of H]	References to well-being, strengths, competence, and comfort	Analgesic suggestions after several minutes of H ⊂ numbness, LA, *glove anaesthesia*, and *switchbox*; post-hypnotic suggestion for comfort with repeated H in LP upon therapist cue to relax and be ready for LP and H
			SH with therapist present [intra; for 45 minutes x2]		Child SH upon cue from parents; medical and nursing staff requested to offer info if needed and briefly encourage children to be calm	

Liossi, 2009 [100]	Haematology-oncology	- Attention C by therapist [pre for 15 minutes and intra] - SC/EMLA on arrival to clinic [60 minutes pre-procedure]	SH training by therapist [pre; for 15 minutes x 1] SH [intra]	[Advice to practice safe place imagery several times a day and return to office in 1 - 2 weeks pre-procedure, discharging sufficiently comfortable children with home SH tape (4/5 listened to the tape for ↑ pain control at home and found it helpful)]	References to well-being and abilities Child SH upon cue from parents	Analgesic suggestions after several minutes of H start (numbness, topical/local/*glove anaesthesia*, and *switchbox*); post-hypnotic suggestion for procedural comfort with repeated H, parent cues, and LA as cues for relaxation, calm, and readiness for LP
Lobe [101]	NR	GA (epidural catheter) by anaesthetist [intra]	SH training and taped SH [pre and intra]		Standard induction for relaxation and safe place imagery to shift attention from procedure to safe place	Post-hypnotic suggestion for eyes closure, breathwork, and safe place imagery on cues by clinician/family; instructing children that they can emerge from H whenever wished or needed [de-induction, testing and reinforcing post-hypnotic suggestion]
Manworren, 2015 [78]	Surgery	Thoracic epidural analgesia or CILA [to 3rd POD]; IV PCA and IV NSAID [post-op] then oral opioids and NSAIDs [4th POD; for 96 - 120 hours]	SH training and practice [1 - 20 days pre; for 60 - 80 minutes ⊂ 30 - 40 minutes H]	Discussing child interests, SH goals, and sensory experience ⊂ prior pain; explaining H as SH ⊂ child control; depicting H provider as teacher and coach, rather than hypnotist [post-H consent, reflection and recommending H	Breathwork; suggestion for relaxation and control; favourite place imagery [⊂ *soothing* phrases and language]	Anchoring: teaching cue for relaxation and pleasant feeling; suggestions for ↑ worthiness feelings and perceived ability to ↓ pain and anxiety. Teaching self-therapeutic suggestions and reviewing time distortion suggestions for ↑ comfort. Children may interact with the hypnotist verbally or via ideomotor signals. Teaching posthypnotic suggestion (e.g., op cues as reminders for breathwork, favourite place imagery, comfort as

			practice for ↓ parasympathetic arousal; discussing what child learned, enjoyed and disliked; post-op coaching for 20 - 80 minutes x 1/day for 1 - 6 POD: focus on child needs for comfort, anxiety control, or other post-op symptoms, reviewing SH and answering questions]		needed/wanted) [de-induction: teaching eyes opening and shifting focus back to the room after achieving what is needed, suggestions for feeling refreshed, energetic, and proud of what is achieved]
Manworren, 2018 [83] Tertiary care	Thoracic epidural analgesia or CILA [intra-op to 3rd POD] + IV PCA and NSAID + oral opioid + NSAIDs [post-op]	Live SH training [pre; for 60 - 80 minutes] and taped SH [pre]	[Post-procedure discussion by integrative medicine physician for 20 - 60 minutes: discussing child interests, SH goals, and sensory experience ⊂ prior pain; explaining H as SH and child control in H; describing H provider as teacher and coach, rather than *hypnotist*]	Induction [intensification]	Therapeutic and post-hypnotic suggestions [de-induction and shift of awareness in 2nd 1/2 of SH training] + SH training tape to facilitate SH home practice
Oberoi [79]	LA w/o hypnotic induction by H provider	H by paediatric dentist certified in integrated clinical H [intra (during LA)]		Eye fixation then closure, relaxation, and absorption in inner experience	Suggestions to relax the body; arm levitation to test HS with eyes closed, during alveolar nerve block [de-induction by count to 5]

					(e.g., imagery) reverse counting, breathwork	
Olmsted [102]	Oncology research and treatment	NonH techniques (e.g., distraction, deep breathing,) to ↓ fear by H provider [intra]	H by paediatric psychologist and paediatrician [intra; in 1 - 3 BMA or LP or BMA+LP)		To ↑ involvement in motivating and pleasant image ⊂ exciting or funny story gradually made more vivid with images, surprises and questions invoking imagination; breathwork and H ⊂ imagery and fantasy	
Ramírez-Carrasco [80]	Dentistry	Standard conventional behavioural management techniques	Taped H on headphones ⊂ classic directive teaching of relaxation + breathing [intra, during LA]	[post-H: dentist verified child alertness and cooperation]	Standard 3 minutes PMR induction [for 5 minutes to ↑ focused attention and absorption]	Suggestions for ≠ pain perception; safe and special imagery for mouth numbness and relaxation; requesting ideomotor signal for mouth numbness
Rienhoff [75]	Dentistry	Nil	H [pre/intra + GA; x 3] by a dentist and 2 treatment assistants trained in behavioural management and H with >10 years of experience with children and sedation	- Taking child anamnesis and treatment info - Asking parents about child development, prior therapies, and pain history - Asking children and parents about children's preferences (e.g., favourite toys, hobbies) and creating contact with children [at session end, asking children about well-being, informing parents on behaviour then discharging child after being checked by	- Hypnotic story alternatively by dentist and assistant ⊂ confusing technique before dental treatment. - During dental treatment: additional techniques from behavioural management, such as tell-show-do and H ⊂ double-induction techniques as required by children; constant physical contact with children by at least the practitioner or assistant's hand (2nd assistant present in the room)	

				a dentist; if not, child stayed in the recovery room for treatment in pattern ≈ 1st session]		
Sabherwal [85]	Outpatient setting	- PMR - SC: c*ommunication and rapport building* [pre]	H by post-graduate trained in H and psychiatry under a psychiatrist		Eye-fixation, focused breathwork, reverse counting; touching children's forehead and suggesting *sleep*	Suggestions to relax the body, safe happy place imagery [counting from 1 to 5 then shifting to restful conscious awareness]
Schnee [107]	1 of 2  Gastro-enterology	- Medical SC by a registered nurse [pre; for 15 minutes] - Counselling by a registered nurse or counselling psychology master's student trained in counselling by a PhD student	Treatment package/H training by clinical psychology PhD student with 1 year of training in paediatric psychology [pre; for 45 minutes]	Brief sensory and procedure info + education: explaining, modelling procedure ⊂ relaxation, normalising anticipated sensory experience in terms of other children's reporting	(i) H training ⊂ breathwork, PMR, suggestions, and imagery for relaxation while checking muscle tone. Asking children about enjoyable and relaxing activities while keeping them focused on imagining participation in related activities and experiences (e.g., sounds, smells, colours) with suggestions for ↑ relaxation, self-control, and self-help abilities (ii) Parent skills training: after observing child training, asking parents to do ≈ child coaching ⊂ breathing, relaxation, and imagery; emphasising ↑ parent involvement at procedure stress points (iii) Practice: parents and child role-played exercises as the therapist pretended to be a nurse/physician performing procedures at ≠ stress points and giving modifying experience	

Smith [103]	Outpatient haematology-oncology	Distraction by H provider	3-step H training for parent and child by 1 of 4 pre-intern PhD student who are experts with parents and children and can give distraction and H w/o extensive supervision [pre]	Asking about children's favourite induction place; video on distraction and H to cope with pain and fear [giving SH tapes to parents]	Teaching parents to help children develop imagery ⊂ story and coping suggestions, the arm-lowering item from SHCS - Child for distraction and H; H with coping suggestions practised by parents in role-play training with trainers to assure proper application	
			Taped SH [just pre/intra; daily for 1 week]		Practising the 3-step H tapes as model examples of strategies	
Tran [76]		None	H (+ GA) by 1 of 3 paediatric endoscopy nurses qualified to do H with a national certificate in distraction and hypnoanalgesia [pre]		Focused attention and sensory suggestions; nurse testing induction success with simple suggestions	Direct and indirect suggestions using imagination for dissociation of perception [return to ordinary senses at procedure's end]
Wall [104]	Orthopaedic + Oncology-haematology + Outpatient oncology research	Distraction by experimenter [pre in a week of 2nd procedure and intra; = durations]	H training by therapist [pre on 2nd procedure week; = duration]	Procedural info, HS test, answering questions, discussion, explaining H	Relaxation and imagery	Arm levitation suggestions and responses scoring on a 1 - 4 scale to test the presence/absence of H
			Taped H [pre-2nd procedure to site cleansing; x 1]	[Removing tapes and headphones]	≈ to H training for re-entering H	
			H by therapist		Relaxation and imagery	Arm levitation suggestions and responses scoring on a 1 - 4 scale
Zeltzer [105]	Oncology +	Attention C and support [pre and intra]	H/imagination-focused therapy [pre (post-baseline); for 15 - 30 minutes x1]	Introducing imagination; asking about child preferences; discussing pets, friends, and family;	Imaginative fantasy	Suggestions during and after fantasy for feeling *good* and re-experiencing enjoyable *fun* fantasies when wished
			H with a therapist [intra]	The therapist	Assisting imaginative fantasy with suggestions for security,	

		expressed wanting to be with children in the procedure and discussed H then went with children to the procedure room [pre-next procedure; 5 - 15 minutes]	feeling good, feeling hungry, wanting to socialise in the next few days

BMA: bone marrow aspiration; **CB**: cognitive behavioural; **CBT**: cognitive behavioural therapy; **CILA**: continuous infusion of local anaesthetic; **DH**: direct hypnosis; **EMLA**: Eutectic Mixture of Local Anaesthetics; **GA**: general anaesthesia; **H**: hypnosis; **HS**: hypnotic suggestibility; **IH**: indirect hypnosis; **Info**: information; **IV**: intravenous; **LA**: local anaesthesia; **LP**: lumbar puncture; **NR**: not reported; **Op**: operation; **PCA**: patient-controlled analgesia; **PMR**: progressive muscle relaxation; **POD**: post-operative day; **RT**: recreational therapy; **SC**: standard care; **SH**: self-hypnosis; **SHCS - Child**: Stanford Hypnotic Clinical Scale for children; **w/o**: without; ↓: decrease; ↑: increase; ⊂: including; ⊄: excluding; : hospital or medical centre; : regional hospital or medical centre; : metropolitan hospital or medical centre; : paediatric; : academic