ORIGINAL RESEARCH

Mapping Knowledge Landscapes and Evolving Trends of Clinical Hypnotherapy Practice: A Bibliometrics-Based Visualization Analysis

Fei-Yi Zhao[1-3],*, Li Li[4],*, Peijie Xu[5],*, Gerard A Kennedy [ID][2],*, Zhen Zheng[2], Yan-Mei Wang[3], Wen-Jing Zhang[3], Li-Ping Yue[1], Yuen-Shan Ho[6], Qiang-Qiang Fu [ID][7], Russell Conduit [ID][2]

[1]Department of Nursing, School of International Medical Technology, Shanghai Sanda University, Shanghai, 201209, People's Republic of China; [2]School of Health and Biomedical Sciences, RMIT University, Bundoora, VIC, 3083, Australia; [3]Shanghai Municipal Hospital of Traditional Chinese Medicine, Shanghai University of Traditional Chinese Medicine, Shanghai, 200071, People's Republic of China; [4]Shanghai Changning Center for Disease Control and Prevention, Shanghai, 200335, People's Republic of China; [5]School of Computing Technologies, RMIT University, Melbourne, VIC, 3000, Australia; [6]School of Nursing, Faculty of Health and Social Sciences, The Hong Kong Polytechnic University, Hong Kong SAR, People's Republic of China; [7]Yangpu Hospital, School of Medicine, Tongji University, Shanghai, 200090, People's Republic of China

*These authors contributed equally to this work

Correspondence: Yuen-Shan Ho, School of Nursing, Faculty of Health and Social Sciences, The Hong Kong Polytechnic University, Hong Kong SAR, People's Republic of China, Tel +852 2766 6410, Fax +852 2364 9663, Email janice.ys.ho@polyu.edu.hk; Qiang-Qiang Fu, Yangpu Hospital, School of Medicine, Tongji University, Shanghai, 200090, People's Republic of China, Tel + 86 021-6569 0520, Fax +86 021-6569 6249, Email qiangqiang.fu@tongji.edu.cn

Background and Aims: Increasing interest in hypnotherapy's application for a wide range of health conditions has spurred a rise in global research and publications. This study aims to visualize development patterns and current research hotspots in clinical hypnotherapy practice using scientometric methods, and to predict future research directions based on the keyword trending topics analysis.

Methods: Data on hypnotherapy applications and mechanisms in clinical settings between 1994 and 2023 were gathered from Scopus, Web of Science, and PubMed, followed by analysis and visualization using the VOSviewer, *Bibliometrix* package in *R*, and CiteSpace.

Results: A total of 1,549 publications were examined, indicating a steady annual increase with an average growth rate of 8.5%, reaching a high of 134 publications in 2022. The United States was the primary research hub. Collectively, 1,464 distinct institutions involving 3,195 scholars contributed to this research theme. Collaboration was predominantly confined to the same country, institution, and/or research team. High-frequency keywords included "Pain", "Irritable Bowel Syndrome (IBS)", and "Anxiety". Systematic review and/or meta-analysis have emerged as favored research methods. fMRI and EEG were commonly used techniques for exploring the neuropsychological mechanisms underlying hypnotherapy. "Self-Hypnosis", "Virtual Reality", and "Meditation" were predicted as trending topics, indicating that patients' self-managed hypnosis practice, virtual reality hypnotherapy, and exploration of the variations in mechanisms between meditation and hypnotherapy might be emerging topics and/or future key research directions within the current field.

Conclusion: The use of hypnotherapy for diverse clinical issues, particularly pain, IBS, and comorbid anxiety, is garnering global attention. The evidence-based approach is widely used to assess the quality of clinical evidence for hypnotherapy. Researchers are keen on innovating traditional hetero-hypnosis, with a shift towards more cost-effective self-hypnosis and immersive virtual reality hypnotherapy. Promoting and reinforcing collaborative research efforts across countries, institutions, and teams is warranted.

Keywords: scientometrics, VOSviewer, Citespace, hypnosis, anxiety, pain, irritable bowel syndrome, complementary and alternative medicine

Background

The *American Psychological Association* defines hypnosis as "a state of consciousness involving focused attention and reduced peripheral awareness, characterized by an enhanced capacity for response to suggestion".[1] Hypnotherapy, the psychotherapeutic application of hypnosis,[1] employs techniques such as monotonous stimulation and relaxation to induce a hypnotic state.[2] This state, combined with the patient's imagination,[3] enhances psychotherapeutic engagement.[2] Under hypnosis, counselees typically exhibit a narrowed focus of attention, enhanced memory, perceptual distortions, hallucinations, and increased suggestibility or even blind obedience to the clinician's instructions.[2] This condition, where the patient's will can be influenced or manipulated by the therapist rather than being freely controlled, represents the primary ethical dilemma in hypnotherapy.[4] Consequently, 3.8% of respondents in a prior survey, influenced by religious beliefs, perceive hypnosis as leading to demonic possession.[5] Nonetheless, the majority of general public views hypnotherapy positively and considers its use in appropriate contexts.[5]

The contemporary practical application of hypnotherapy is distinguished by the innovative techniques and strategies formulated by Milton H. Erickson.[6] A significant body of research has examined the benefits of hypnotherapy for diverse somatic and mental illnesses.[2] This widespread interest may be attributed to general practitioners' enthusiasm in utilizing this technique.[1] Furthermore, hypnotherapy is among the few complementary and alternative medicine (CAM) therapies included in the clinical guidelines of *National Institute of Health & Care Excellence* (NICE), United Kingdom.[5] Evidence suggests that hypnotherapy may ameliorate pain,[7] obesity,[8] inflammatory bowel disease,[9] asthma,[10] sleep disturbance,[11] anxiety,[12] and depression.[13] It may also serve as an adjunctive therapy to conventional psychotherapies such as cognitive-behavioural treatment and family therapy.[14] However, not all favorable outcomes were supported by rigorous evidence-based studies.[2] Investigating the mechanisms underlying hypnotherapy is also appealing, as it advances our understanding of cerebral functions and the responses influenced by hypnosis, including delusions, hallucinations, and amnesia.[15] One perspective posits that the mechanisms of hypnotherapy may be associated with unconscious restructuring and reframing of dysfunctional cognitions contributing to the disorder.[2]

Despite the underutilization of hypnotherapy in clinical settings at present, interest in it is growing.[16] This trend is evidenced by the increase in the United States cancer center websites offering hypnotherapy information, from 30% in 2009 to 60% in 2016.[16] The WHO also stated on its official website (https://www.who.int/) that CAM should be appropriately integrated with national health system to improve healthcare availability. A recent scoping review found that healthcare professionals globally held a positive view of hypnotherapy, consistent across countries.[16] This growing interest led to an increase in research and evidence,[15] some of which underscored the benefits of hypnotherapy in cancer management. For instance, a two-year follow-up study demonstrated that its integration with palliative care significantly reduced the use of analgesics and opioids among advanced cancer patients.[17] Additionally, hypnotherapy has been shown to facilitate the discontinuation of Benzodiazepines in individuals with insomnia.[1] These findings regarding the adjunctive role of hypnotherapy in substituting and reducing prescription medications carry substantial clinical significance for patients who are intolerant or resistant to pharmacological treatments, as well as for frail elderly individuals undergoing polypharmacy. Identifying the dynamic evolution of disciplinary development and future work directions from a vast array of publications poses a considerable challenge.[18] Therefore, researchers and stakeholders rely on scientometrics, a tool leveraging mathematical, statistical, and other techniques, to examine distribution patterns, quantitative relationships, and evolving trends within a body of literatures.[19]

We are aware that a hypnosis-related bibliometric study exists.[3] However, this study included only 54 papers,[3] which is undoubtedly too few for such research type and may lead to biased results due to incomplete analysis. This limitation likely arises from using "hypnosis" as the sole search term, excluding synonyms. Additionally, the study only covered literature from January 2002 to June 2013,[3] leaving emerging trends in hypnotherapy from July 2013 onward unexplored. These potential knowledge gaps prompted us to conduct the current scientometric analysis to contextualize international scientific output in clinical hypnotherapy and support clinical decision-making.

Methods

Data Acquisition and Search Strategy

This study was conducted adhere to a bibliometric analysis guideline published in 2021.[20] To achieve thorough data retrieval, we gathered data from three repositories: Web of Science (WoS), PubMed and Scopus. We developed the search strategy (Appendix 1) in an iterative manner, beginning with search terms from the aforementioned bibliometric study[3] and supplemented by terms used in existing systematic reviews on hypnotherapy. The search targeted title and keywords, considering only English-language publications from 1994 to 2023, and was executed on June 10, 2024. Only "Article" and "Review" were included to highlight original contributions and cardinal research findings. News and corrigenda were filtered out due to their lack of academic value. Conference abstracts and study protocols were disregarded, as they typically lack the necessary information for bibliometric analysis of CAM literature.[21] Proceedings are also commonly excluded in bibliometric studies because of their generally lower scientific impact and robustness.[22]

We also collected Journal Citation Reports (JCR) quartiles and impact factor (*IF*) of journals from the WoS, along with the *h*-index of scholars. The JCR quartile and *IF* are established metrics reflecting a journal's status and prestige in its field.[23] The *h*-index quantifies a researcher's cumulative scholarly impact and performance, and can predict his/her future achievements.[24]

Bibliometrics and Visualization Analysis Tool and Process

Documents retrieved from three databases underwent initial data cleaning and deduplication using the `mergeDbSources` function from *Bibliometrix* package 4.1.2 in *R* Studio 4.3.0. Additionally, we used the `distinct` function from the *Tidyverse* package in *R* to remove duplicates based on three parameters: title, journal, and author. The results were then cross-checked with the duplicates removed by the `mergeDbSources` function to ensure consistency. Two research assistants (YM-W and WJ-Z) then independently assessed the results of data cleaning and further excluded irrelevant documents. Following a consensus, a third researcher (PJ-X) imported finalized records into *Bibliometrix* package, VOSviewer 1.6.20, and CiteSpace 6.3.R3 for bibliometric analyses and visualization. The software extracted data on countries/regions, affiliations, authors, journals, keywords, and key indicators of research performance, including the number of publications (*Np*), number of citations (*Nc*), and *h*-index. *Np* measures research productivity and activity level;[25] *Nc* measures influence, popularity, and attention within the scientific community;[26] and the *h*-index combines productivity and impact by establishing a benchmark that connects *Np* and *Nc*.[18] It is important to note that, since the data were automatically extracted by the software, potential biases may exist. Missing parameters were manually retrieved and supplemented by research assistants to minimize any bias.

Bibliometrix package is an open-source tool implemented in *R* for conducting thorough science mapping analyses. It provides a structured approach for bibliometric evaluations and benefits from *R*'s flexibility and ease of integration with other statistical packages.[27] VOSviewer, a Java-based application, generates and analyzes network maps[28] where nodes represent entities such as regions, institutions, authors, or terms, with their size reflecting frequency. Node connections signify relationships like co-authorship or co-occurrence, and colors denote clusters or time periods.[29] CiteSpace employs techniques such as cluster analysis, timeline/time zone views and keywords citation bursts to visually present knowledge domains and development trends.[30] It captures keywords with strong citation bursts and examines their temporal co-occurrence to reveal co-evolutionary trends and predict research frontiers.[18] As such, CiteSpace complements VOSviewer in our analysis.

Results

We identified 6,901 records from the databases, of which 1,549 papers were deemed eligible (Appendix 2). The total *Nc* for these papers was 19,440, with an average *Nc* per paper of 12.6. Among the included papers, "Articles" constituted the predominant publication type (83.9%, 1,300/1,549). Additionally, the flowchart in Appendix 2 provided a detailed presentation of each scientometric analysis involved in this study, specifying the software used for each analysis. Excluded literatures, aside from duplicates, mainly comprised studies on hypnotic drugs and anesthesia-induced

hypnosis,[31] hypnosis in the judicial/criminal Investigation field,[32] and history and different schools of hypnosis,[33] as indicated by the term "hypnosis" in the title and keywords but irrelevant to the current research topic.

Annual Publications and Trends

Despite fluctuations in the number of hypnotherapy publications, there was an overall upward tendency over the past three decades. The average annual growth rate (AAGR) of publication was 8.5% (Figure 1A), nearly 2.1 times greater than the growth of overall scientific publication (4.1%).[34] While the reasons for this increase were yet to be determined, it was likely partly attributed to the expanding interest in and use of CAM modalities.[35] Among the 1,549 included papers, the first was published in 1994. Annual publications remained below 50 until 2006, after which they began increasing rapidly, indicating a period of accelerated development. After 2021, annual publications surpassed 100, with 2022 reaching a peak of 134, marking the most productive three-year span in the past three decades. The periods 1994–2003 (10.9%) and 2014–2023 (13.7%) exhibited higher AAGRs compared to the 30-year average of 8.5%, while 2004–2013 had a notably lower AAGR of 2.8% (see Appendix 3 for AAGR calculation). Scopus and WoS have indexed the majority of hypnotherapy publications, whereas PubMed has indexed fewer, particularly in the last three years despite the surge in publications (Figure 1B). The curve-fitting formula ($y = 44.199e^{0.1342x}$, $R^2 = 0.93$) indicated that the volume of literatures in this field is expected to continue growing steadily (Figure 1A).

Contributions of Countries/Regions

A total of 57 countries/regions have published research on hypnotherapy over the past 30 years (Figure 2A). Among these, 17 have a total link strength with other countries/regions equal to or greater than three, qualifying them for country/region co-authorship analysis. The United States was a central hub, collaborating closely with Australia, Italy, the United Kingdom, and Canada. Switzerland and Germany also maintained strong research partnerships. Despite relatively low research outputs, Sweden and the Netherlands have also launched at least three bands of varying colors, indicating ongoing collaborations with multiple countries/regions at different research capacities and potentially influencing research in these countries/regions (Figure 2B). However, the volume of collaborative research was significantly lower than the number of independent studies within each country (Figure 2C).

The top ten high-output countries are led by the United States with 477 papers (30.8% of the total), followed by the United Kingdom (138 papers, 8.9%) and France (92 papers, 5.9%). These countries also led in international collaboration. Germany, despite fewer publications than Australia, Italy, and Canada, had higher research collaboration with other countries/regions (Figure 2C; Appendix 4).

The powerful research impact of the United States was also reflected in its status as the most cited country/region, with its papers cited a total of 6,244 times. Belgium, though with fewer publications than Italy, Canada, Australia, Germany, France, and Iran, exceeds these countries in total citations (Appendix 4).

Contributions of Institutions

Collectively, 1,464 distinct institutions were involved in publishing hypnotherapy papers, with 827 serving as corresponding author affiliations. Of these, 13 institutions published at least 10 papers, predominantly located in the United States, the United Kingdom, and Australia, consistent with the country/region contributions. These institutions significantly enhanced national influence. The State University of New York (SUNY) led with 22 papers as the corresponding author affiliation, followed by the University of Washington and Baylor University, each with 20 papers. Notably, while the top three institutions by publication count were all from the United States, the highest average citation counts per paper were recorded by Imperial College London (46.8) and Universitaire de Liège (43.8), both exceeding those of other institutions (Figure 3A; Appendix 5).

In the co-author's institutions network, 861 links were identified among the top 100 most productive institutions (Figure 3B).
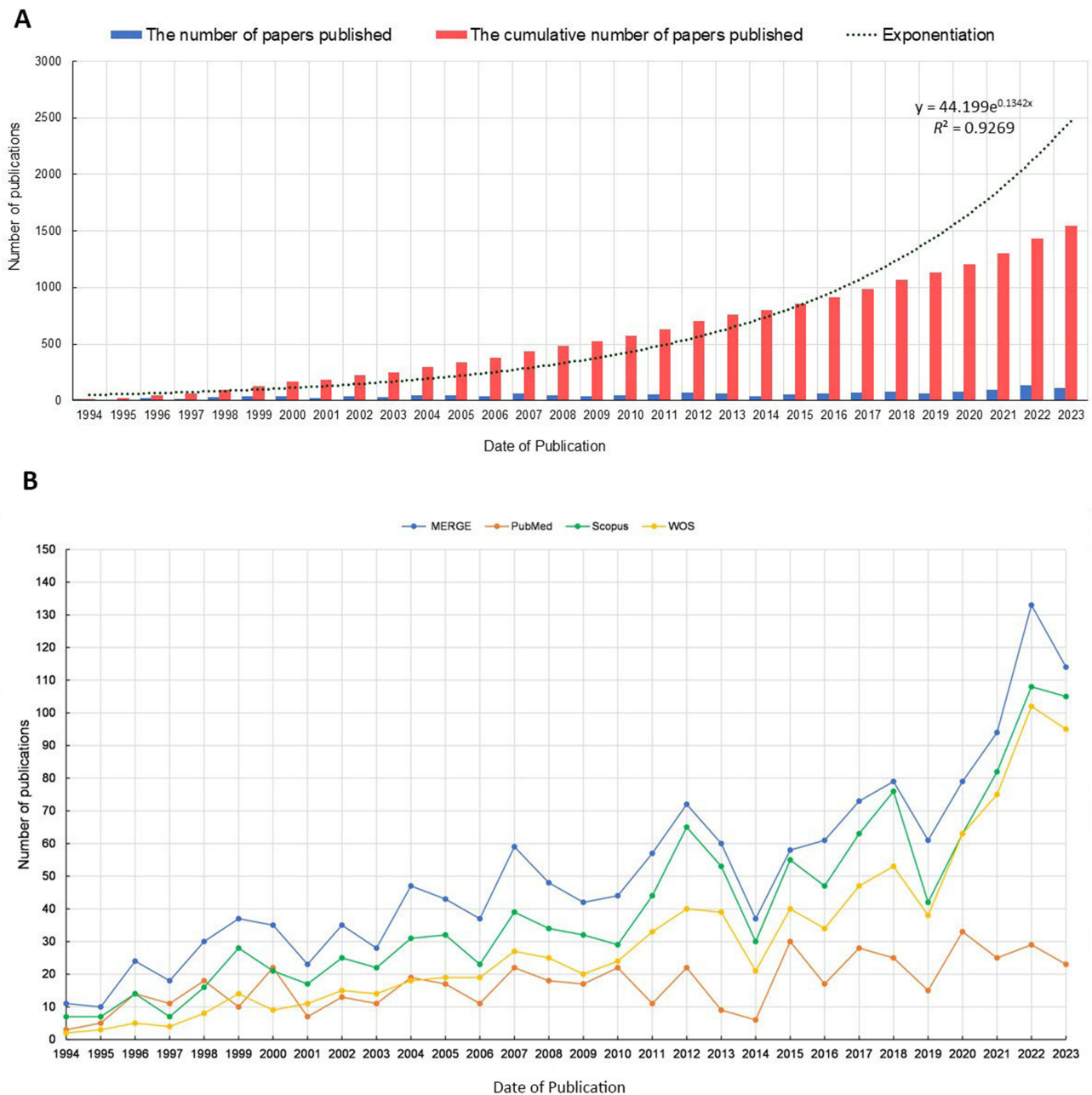
Figure 1 Global Trends of Annual Publications Regarding Hypnotherapy from 1994 to 2023. (**A**) Publication growth trend with fitting curve. (**B**) Indexing of subject-related publications in the three databases.

Contributions of Authors

A total of 3,195 authors contributed to research on clinical practice of hypnotherapy, with 33 authors publishing at least 10 papers. The top 10 most prolific authors collectively authored 214 papers, representing 13.8% of all publications (Table 1). Analysis of their profiles revealed that most work in psychology field, holding positions as professors or clinical psychologists at universities/medical centers. The remaining authors were from the medical field: Mark P. Jensen, Marie-Elisabeth Faymonville and David R. Patterson focused on pain management; Ran D. Anbar developed pediatric hypnosis and counseling methods; and Marie-Elisabeth Faymonville also explored hypnotherapy combined with local anesthesia as an alternative to general anesthesia.
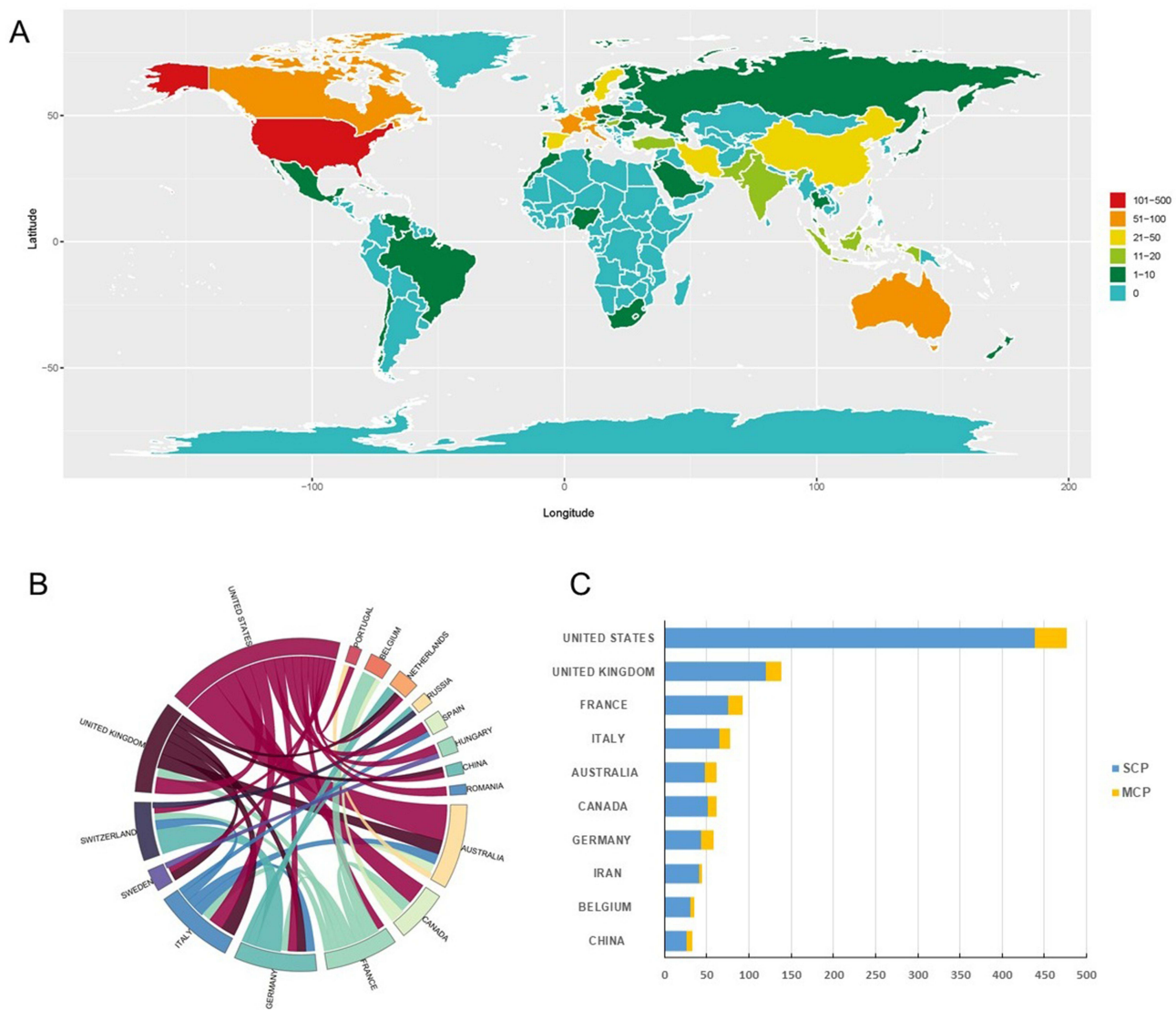
Figure 2 Contribution of Countries/Regions to the Research Regarding Hypnotherapy. (**A**) World map displaying the global distribution of the current research theme. Different countries are indicated by different colors based on the number of papers published. (**B**) Distribution and international cooperation of countries/regions involved in the current research field. The thickness of the line reflects the frequency of the cooperation; the thicker the line, the closer the cooperation. (**C**) The total number of publications counts and average citation per item of the top 10 most productive countries that contributed research within the current focused field.
Abbreviations: *SCP*, single country publications; *MCP*, multiple country publications.

Interestingly, despite Mark P. Jensen being the latest to publish on hypnotherapy, he led in output with 32 papers among the top 10 authors. These papers outlined the findings of Jensen and his team on hypnotherapy for pain relief. They reported that: (1) hypnotic analgesia consistently led to greater reductions in various pain outcomes for both chronic and acute pain, compared to no treatment or standard care; (2) hypnotherapy often outperformed non-hypnotic interventions (eg, education, supportive therapy) in reducing pain-related outcomes.[36] Based on neuroimaging studies, they also concluded that the analgesic effects of hypnotherapy might be mediated by modulating activity in cortical and subcortical regions linked to analgesic response.[15] Despite ranking only fourth and fifth in publication volume, John H. Gruzelier and Marie-Elisabeth Faymonville were the most influential scholars in the field, with their papers being cited an average of 45.3 and 40.8 times, respectively. This may be because Marie-Elisabeth Faymonville was the first scholar to publish in this research area, while John H. Gruzelier's work has garnered more attention than other scholars, with the highest *h*-index of 15. Gruzelier concentrated on exploring the psychophysiological evidence for hypnotherapy
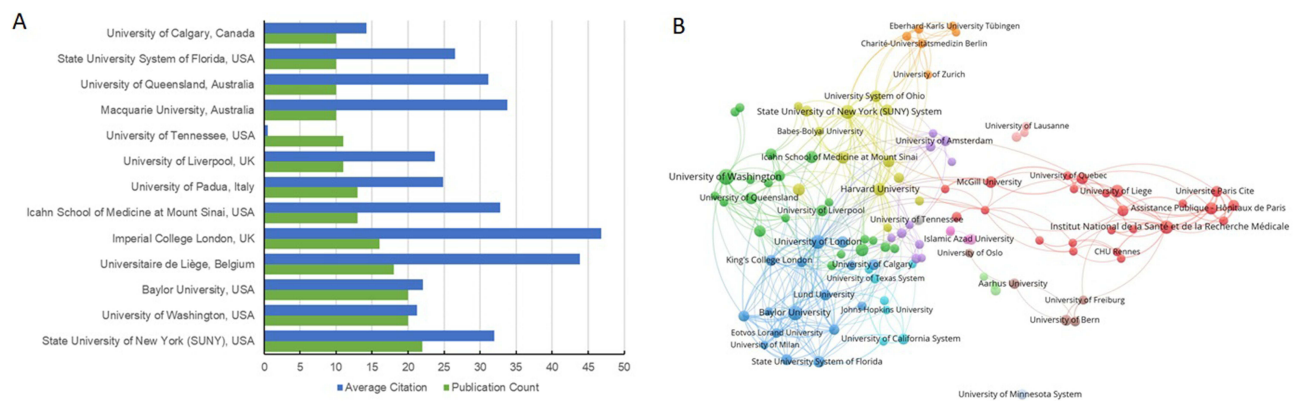
Figure 3 Contribution of Institutions on Research Regarding Hypnotherapy. (**A**) The total number of publications counts and average citation per item for institutions that contributed a minimum of 10 papers in the current research field. (**B**) Mapping of the co-authorship analysis among the top 100 most productive institutions in the current research field. Each node represents an institution, and the node size indicates the number of publications. The connection between the nodes represents a co-authorship relationship, and the thickness of the lines indicates strength (weights on the total link strength).

and hypnotic susceptibility. His team identified neurophysiological changes in frontal and lateral brain functions during hypnosis that distinguish highly susceptible individuals from those with low susceptibility. These findings led to the development of a working model and neuropsychological framework for hypnosis induction.[37] He also recommended acknowledging and disclosing adverse effects of hypnotherapy to improve treatment safety through better safeguards and practitioner education.[38] The top five most prolific authors predominantly from the United States, the United Kingdom, and Belgium, indicating that these three countries have more outstanding researchers dedicated to exploring hypnotherapy (Table 1).

According to *Price's Law, m* = 0.749 $\sqrt[n]{max}$ (where *m* represents the author's minimum number of papers published, $\sqrt[n]{max}$ represents the author's highest number of papers published),[18] the core author group (publications ≥ 3) were determined. This criterion resulted in 219 core authors being mapped and divided into nine clusters (Figure 4). Authors within the same cluster, such as Devin B. Terhune and Philip D. Shenefelt, exhibited active collaboration. Connections between nodes from different clusters were also noted, exemplified by the collaboration between Devin B. Terhune and Zephanie Tyack.

Journal Analysis

A total of 622 academic journals published hypnotherapy studies. The top 10 most productive journals produced 624 papers, representing 40.3% of all publications (Appendix 6). The *American Journal of Clinical Hypnosis* led with 243 papers and the highest citation rate (*Nc* = 2,224), followed by the *International Journal of Clinical and Experimental Hypnosis* (176 papers) and *Contemporary Hypnosis and Integrative Therapy* (102 papers). Half of the top ten active journals specialized in hypnosis, although three have ceased publication: the *Australian Journal of Clinical and Experimental Hypnosis* and *Sleep and Hypnosis* ended in 2017 and 2020, respectively, while *Contemporary Hypnosis* transitioned to *Contemporary Hypnosis and Integrative Therapy* in 2011 and ceased in 2021. The remaining journals cover complementary medicine, psychology, cognitive science, or pain. Although the published papers were related to hypnotherapy, variations across academic disciplines appeared to shape the journals' preferences. Specifically, *Complementary Therapies in Medicine*, a CAM journal, primarily published studies on the clinical applications of hypnotherapy, such as treating insomnia[1] and habit cough.[39] In contrast, *Consciousness and Cognition*, a journal in psychology and cognitive science, focused on the theoretical frameworks, principles,[40] and cognitive mechanisms[41] of hypnosis. According to the latest JCR data (2023–2024), excluding the ceased journals, the other leading journals range from *Q3* to *Q1*, with *Pain* having the highest *IF* (*IF* = 5.9).

The *International Journal of Clinical and Experimental Hypnosis*, publishing on hypnotherapy since 1995, reached a peak of 28 papers in 2022, despite its reduced dominance in this field compared to *Contemporary Hypnosis and*

Table 1 The Top 10 Authors with the Highest Productivity

Rank	Author	Primary Research Fields	Affiliation	Country	PSY	Np	Nc	*h*-index	*g*-index	*m*-index
1	Mark P. Jensen	- Pain Management - Psychology Rehabilitation	University of Washington	USA	2007	32	353	12	18	0.667
2	Gary R. Elkins	- Mind-Body Medicine	Baylor University	USA	1998	27	412	10	20	0.37
3	Steven Jay Lynn	- Consciousness, Cognition, and Psychopathology	Binghamton University, SUNY	USA	1997	23	288	9	16	0.321
4	John H. Gruzelier	- EEG-neurofeedback and applications	Imperial College London	UK	1997	20	906	15	20	0.536
5	Marie-Elisabeth Faymonville	- Anesthesia and Intensive Care - Pain Management	Centre Hospitalier Universitaire (CHU) de Liège	Belgium	1995	20	815	13	20	0.433
6	Antonio Capafons Bonet	- Personality, Evaluation and Psychological Treatment	University of Valencia	Spain	1998	20	207	8	14	0.296
7	Guy H. Montgomery	- Behavioral Oncology - Psycho-oncology	Icahn School of Medicine at Mount Sinai	USA	2005	19	512	11	19	0.55
8	Irving Kirsch	- Placebo Studies	Harvard Medical School	USA	1997	18	386	9	18	0.321
9	Ran D. Anbar	- Pediatric Pulmonology - General Pediatrics	SUNY Upstate Medical University	USA	2000	18	236	8	15	0.32
10	David R. Patterson	- Pain management - Psychology - Physical Medicine and Rehabilitation	University of Washington	USA	1998	17	214	10	14	0.37

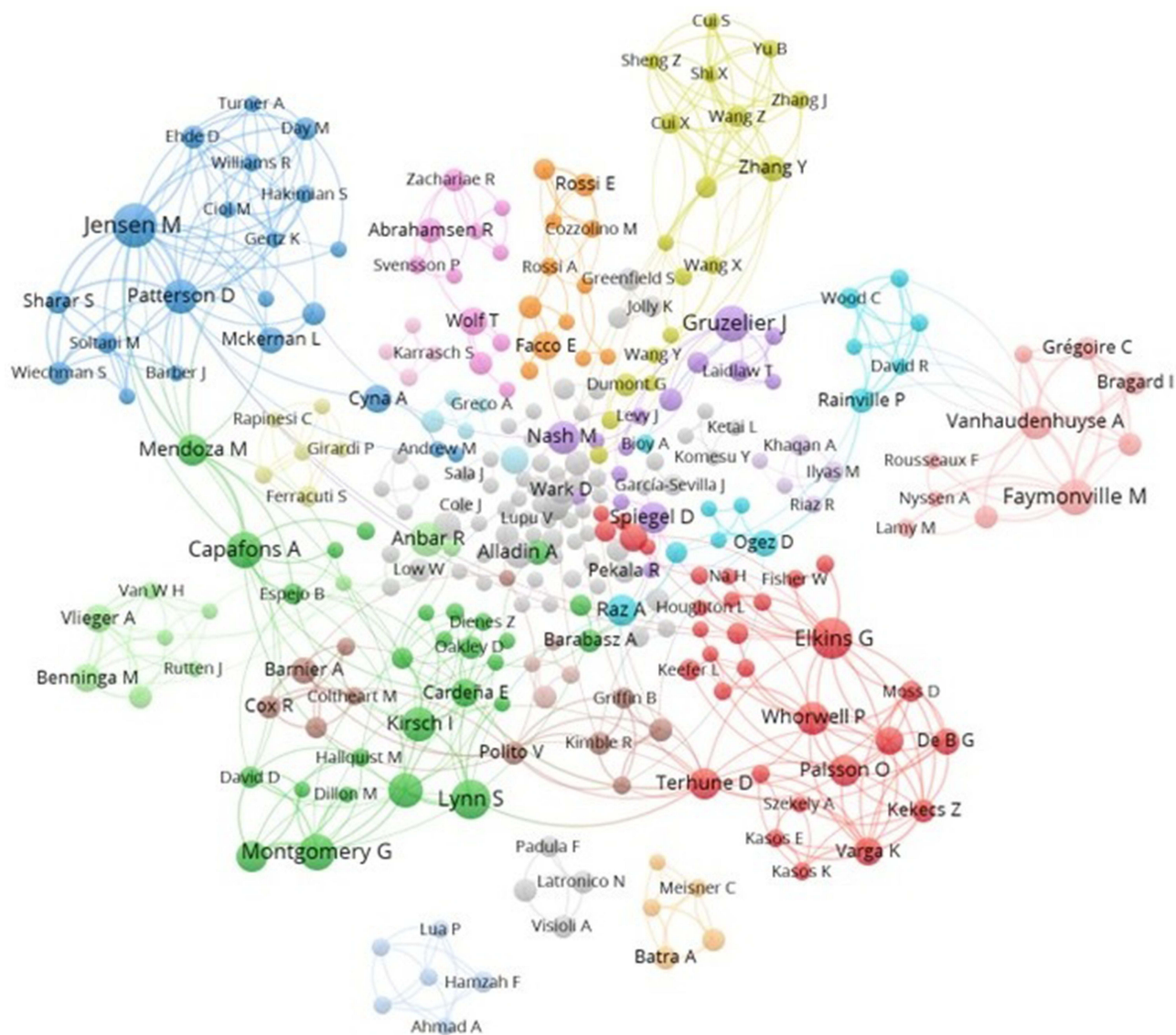**Abbreviations**: Np, number of publications; Nc, number of citations; PSY, publication start year.

Figure 4 Mapping of the Co-Authorship Analysis Among the Authors Who Have Published at Least Three Papers On Research Regarding Hypnotherapy. Each node represents an author, and the node size indicates the number of publications. The connections between the nodes represent co-authorship relationships, and the thickness of the lines indicates the strength of the relationships (weights on the total link strength).

Integrative Therapy and the *American Journal of Clinical Hypnosis* from 1998 to 2014. Although not a specialized hypnosis journal, *Pain* has published hypnotherapy research since 1994, with its papers averaging 55.1 citations, the highest among all journals (Figure 5A).

The dual-map overlay of the co-occurrence network for hypnotherapy identified five main citation paths. The citing matrix of journals primarily concentrated in two areas: (1) Medicine, Medical, and Clinical, and (2) Psychology, Education, and Health. Conversely, the most frequently cited publications originated from journals in the following areas: (1) Health, Nursing, and Medicine, (2) Psychology, Education, and Social Sciences, and (3) Molecular, Biology, and Genetics (Figure 5B). These findings highlighted the interdisciplinary nature of hypnotherapy. To advance research and foster innovation, establishing multidisciplinary teams that included hypnotherapists, clinical psychologists, neuroscientists, bioengineers, and medical imaging technicians was likely essential.
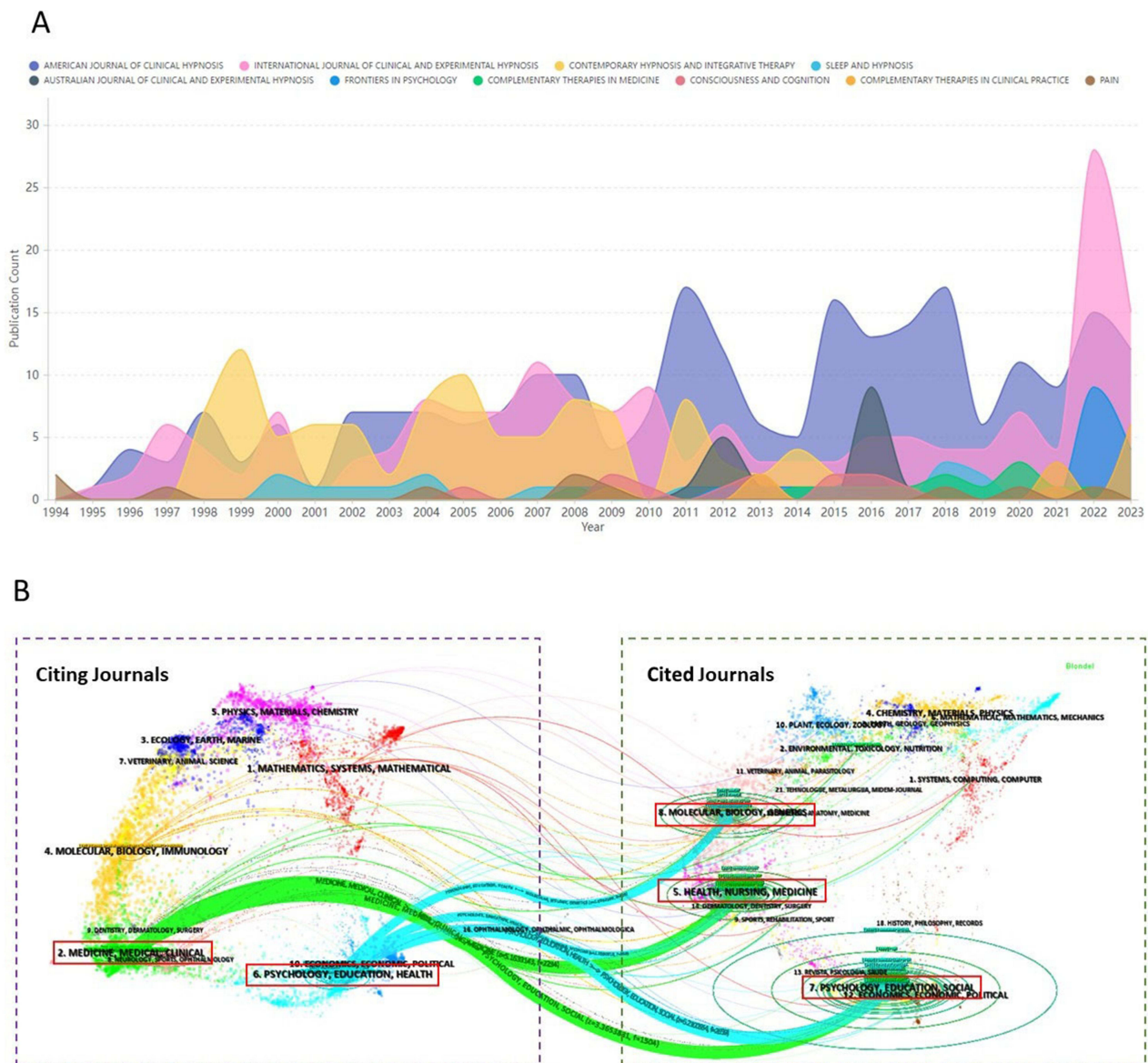
Figure 5 Contribution of Journals in the Research Field Regarding Hypnotherapy. (**A**) Growth trends in the publication quantity of the top 10 productive journals in the current research theme from 1994 to 2023. (**B**) Dual-map overlay of the journals on the current research theme. The labels represent different research subjects covered by the journals. The citing journals are on the left side (indicating the field's applications), while the other side of the map represents the cited journals (indicating the field's research foundations). Different colored lines correspond to the different paths of references, beginning with the citing map and ending at the cited map. The research subjects of the main citing and cited journals are shown in the red box.

Keyword Analysis of Trending Research Topic

A total of 3,367 keywords were identified from keyword co-occurrence analysis, with 172 keywords having a frequency greater than five, forming seven distinct clusters. The keywords clustered in the red region were primarily terms associated with hypnotherapy. Keywords in the purple cluster demonstrated the hypnotherapy-related disciplines and the commonly used experimental techniques in the hypnotherapy research. Systematic reviews, meta-analyses, and randomized controlled trials were speculated to be the commonly used research paradigms for exploring hypnotherapy, as these terms were gathered in the sky-blue cluster. Keywords clustered in the orange region described other psychological modalities (eg, cognitive-behavioral therapy, psychoanalysis, etc). Based on the previous experience of the psychologists in our team, these therapies are often used in conjunction with hypnotherapy in clinical practice or serve as positive
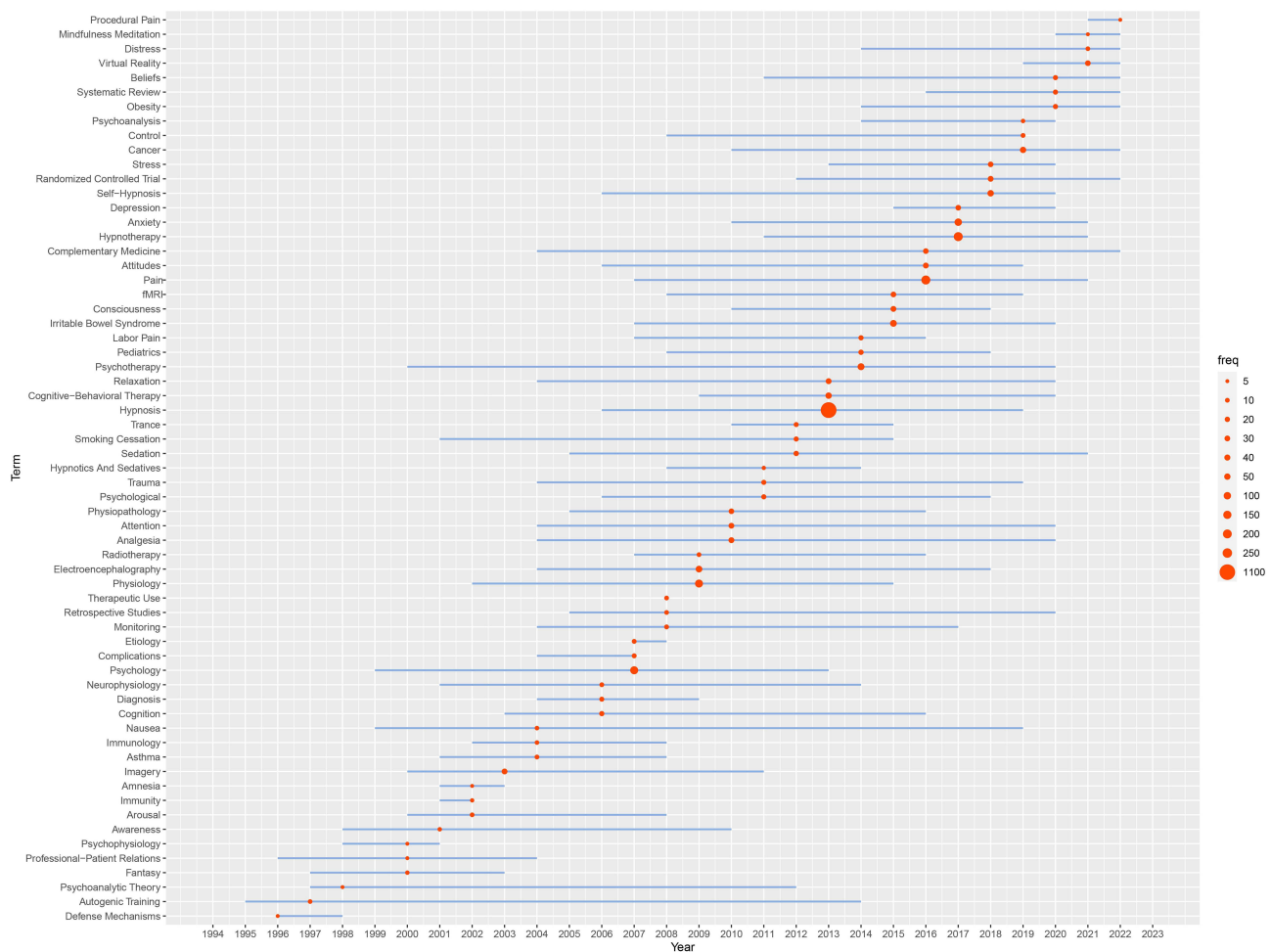
controls in hypnotherapy-related trials. Keywords in green cluster included the physiological/psychological terms related to hypnosis/hypnotherapy, such as consciousness/unconsciousness, arousal, and perception. Finally, keywords in the yellow and navy-blue clusters described the specific fields and diseases that might be suitable for intervention with hypnotherapy (Figure 6A).

Further analysis of the top 25 most frequently used keywords using the `KeywordGrowth` function in *R* revealed that pain, anxiety, and irritable bowel syndrome (IBS) appeared to be the most widely applied symptoms/diseases for hypnotherapy. The functional magnetic resonance imaging (fMRI) and electroencephalography (EEG) were the commonly used imaging and electrophysiological techniques, respectively, in clinical hypnotherapy trials. Hypnotic suggestibility and self-hypnosis were also high-frequency keyword in the current research theme (Figure 6B).

Figure 6 Mapping of Keywords In The Research Field Of Hypnotherapy. (**A**) Keyword co-occurrence analysis on the current research theme. (**B**) Keyword time zone on the current research theme over the years.

Figure 7 Trending Topics In Research Regarding Hypnotherapy Over The Years.

Keywords appearing at least five times over three decades were analyzed to predict future trends (Figure 7; Appendix 7). The key topics from 1994 to 2023 primarily included hypnotherapy and other psychotherapeutic procedure, research methods and tool, mechanism of action, disease and symptoms, and hypnotherapist-patient relationship. However, procedural pain, mindfulness meditation, systematic reviews, self-hypnosis and virtual reality (VR) were the most studied trending topics recently and might become the future research hotspots.

We noticed that earlier keywords in hypnotherapy research focused on hypnosis theories and physiological mechanisms, such as psychoanalytic theory, arousal, and awareness. In recent years, however, the focus has shifted to VR and systematic reviews. This trend can be attributed to the rapid development of modern information technology and evidence-based medicine.

Discussion
Summary of Findings

The knowledge map visually summarized 30 years of research on clinical hypnotherapy. The steady increase in relevant publications reflected widespread interest. The United States, the United Kingdom, France, and Belgium emerged as leading research countries, likely due to their larger number of institutions and prominent scholars in hypnotherapy, thus enhancing their national influence. The State University of New York had the highest publication output, hosting several key researchers in the field. Despite fewer publications, Imperial College London and Universitaire de Liège exhibited the strongest citation bursts, with their papers averaging 46.8 and 43.8 citations, respectively. John H. Gruzelier and

Marie-Elisabeth Faymonville from these institutions were among the most influential authors in hypnotherapy. Collaboration among authors was generally limited, often confined to single institutions or regions, with insufficient cross-team cooperation. Hypnotherapy research spans disciplines such as psychology, clinical medicine, education, social sciences, and molecular biology. Although hypnotherapy has diverse applications, research mainly focused on pain, IBS and anxiety. Self-hypnosis and the integration of VR into hypnotherapy were among the most recent trending research topics and may become promising research hotspots.

Strengths, Limitations and Comparison with Previous Scientometric Analysis

In contrast to the sole existing bibliometric study on this topic,[3] published in 2016, our study utilized a broader range of search terms ("hypnosis/hypnotherapy" and its synonyms vs "hypnosis" alone), covered more databases (WoS, PubMed and Scopus vs Scopus only), and spanned a longer time period (1994–2023 vs 2002–2013). Consequently, we included 1,549 publications compared to just 54 in the 2016 study,[3] providing a more comprehensive and detailed overview of the hypnotherapy research field. Our study also identified current research hotspots and predicted future trends through keyword co-occurrence analysis and keyword time zone views, offering new insights not available in that study.[3]

Some limitations should be noted. First, most data were automatically extracted and analyzed using bibliometric software employing machine learning and natural language processing, potentially introducing biases.[42] Second, France, Italy, Germany, and Iran were also prolific in hypnotherapy research (Figure 2C). We did not include papers from these countries published in their native languages, which could have further enriched the current findings. Lastly, continuous database updates may cause a lag in the scientometric analysis relative to the current research status.[43]

An unexpected observation was that neither "Ericksonian hypnosis" nor "Ericksonian hypnotherapy" appeared in the Keyword Time Zone or Trending Topics Diagrams. Given Milton H. Erickson's substantial contributions to hypnotherapy, including conversational hypnosis,[44] the development of Ericksonian hypnotherapy[44] and techniques such as arm levitation, illogic and irrelevance, future projections, and trance induction by touch alone,[45] along with the expansion of meaningful hypnotherapeutic responses to encompass resistance to suggestion,[44] we integrated "Ericksonian hypnosis/hypnotherapy" into retrieval strategy. Yet, the number of qualifying studies remained limited. A search in the WOS database yielded only 21 papers related to these two search terms (Appendix 8.1), of which only six were published in English and utilized these terms as keywords (Appendix 8.2). In PubMed and Scopus, the numbers were three and nine, respectively. Consequently, these terms did not emerge as high-frequency keywords in our visualizations. Nonetheless, this does not undermine the profound significance of Erickson and his theories in clinical hypnotherapy practice. Ericksonian hypnotherapy, characterized by an indirect and context-sensitive approach, offers multi-layered interventions.[46] Our study indicates that much of the hypnotherapy research has focused on pain, IBS, and anxiety. Ericksonian hypnotherapy has been effectively applied in these areas. For instance, Gonçalves et al analyzed chronic pain cases treated with Ericksonian hypnotherapy and found that it effectively highlights patient capabilities and addresses the social disarray caused by chronic pain, thereby constructing a context favoring habit-change and reorganizing habits in a more desirable configuration.[47] One randomized controlled trial reported that while both Ericksonian and traditional hypnotherapy significantly reduced IBS symptom severity for at least three months, only Ericksonian hypnotherapy lessened symptoms-related social hypervigilance.[46] Similarly, Ericksonian hypnotherapy has been effectively employed to treat various anxiety disorders, including generalized anxiety disorder, panic disorder, and agoraphobia.[48] The exploration of Ericksonian hypnotherapy may provide another treatment option for post-traumatic stress disorder (PTSD). Unlike traditional psychotherapies, which typically require direct confrontation and verbal processing of trauma, Ericksonian hypnotherapy enables patients to address their trauma indirectly through metaphors and storytelling, thereby minimizing the risk of re-traumatization.[49] Additionally, the structured use of metaphorical inductions may help elevate patients' thresholds of awareness regarding physiological arousal.[49]

Interpretation of the Findings

The rising number of publications indicates growing interest in the medical applications of hypnosis. Recent developments include the United Kingdom establishing national occupational standards for hypnotherapy;[50] the release of the "Hypnosis Efficacy Task Force's Guidelines" at the 2018–2019 annual meeting of the *International Society of Hypnosis*

by a working group consisting of scientist from Hungary, the United States, the United Kingdom, and Italy;[51] and the WHO's recommendation to integrate CAM into national health systems and routine data collection to bolster research and innovation.[52] Given these supportive policies, it is anticipated that research on this topic will remain prominent and publication numbers are likely to continue increasing. This is consistent with the trend predicted by the curve fitting.

Although the earliest known references to hypnosis trace back 6,000 years to Egyptian "Sleep Temples", modern hypnotherapy began in 18th-century Paris with Franz Anton Mesmer (1734–1815), who used it for pain management.[53,54] In the same era, James Braid (1795–1860) in the United Kingdom published "Neurypnology" (first book on hypnotherapy) in 1843, and John Elliotson (1791–1868) performed approximately 1,834 surgeries on patients under hypnosis.[53] These pioneering efforts sparked growing interest in hypnotherapy, leading to research expansion from France and the United Kingdom to Germany, Austria, and Switzerland.[53] Thus, France and the United Kingdom can be considered early leaders in clinical hypnotherapy discipline. Moreover, they remained research powerhouses in the field to this day—these two countries ranked second and third in hypnotherapy research outputs, respectively (Figure 2C), and were notable for their extensive international collaborations. For instance, the United Kingdom partnered with nine countries across various continents (Figure 2B). Such transcontinental collaboration also signifies that hypnotherapy research has garnered global interest. Nevertheless, the United States remained the foremost contributor to hypnotherapy research, with publication outputs approximately 3.5 times that of the United Kingdom and 5 times that of France (Figure 2C), and citation counts around 2.2 times and 10.4 times higher, respectively (Appendix 4). This dominance aligns with findings from bibliometrics conducted in other scientific fields,[55–57] likely due to substantial budget from the United States government for research and technology,[58] as exemplified by the growth of CAM research when supported by entities like the *US National Center for Complementary and Integrative Health* (NCCIH, previously called 'NCCAM').[59]

Although 3,195 scholars contributed to the current research topic, their collaborations were primarily within the same country and/or institution. This pattern of strong internal but limited external connections hinders the sharing of resources, ideas, and perspectives among researchers.[19] To produce more high-quality outcomes, cross-team (ie, cross-institutional and cross-regional) collaborations are necessary. Despite the predominance of Western authors in the co-authorship analysis, a notable cluster of Chinese scholars indicates growing interest and active participation from China. This trend aligns with the encouragement of integrating various medical forms in many Asian countries like China, Japan, and South Korea.[60] Traditional Chinese Medicine (TCM), classified as CAM along with hypnotherapy, exemplifies this integration in China.[61] Encouragingly, researchers are also exploring the combined effects of hypnotherapy and TCM techniques, such as herbal medicine and acupuncture, for treating conditions like endometriosis[62] and migraines.[63]

Among the top ten journals publishing on hypnotherapy, 70% specialized in hypnosis and CAM, aligning with the research focus and attracting relevant submissions.[18] However, all these journals have *IF* below 3.5, suggesting limited academic impact. CAM-related papers often face rejection from high-*IF* mainstream medical journals due to methodological and reporting flaws in CAM trials.[64] These flaws hinder the provision of robust evidence for clinical practice. Notably, "Systematic Review" appeared in both the co-occurrence network and trending topics, highlighting its importance and predicting its future significance in hypnotherapy research. This also reflects the scholars' recognition of the need for evidence-based critical evaluations of existing hypnotherapy evidence. Many countries, especially developing ones, have integrated evidence-based CAM practices into their healthcare systems, enabling mainstream providers to advise patients on the safe use of CAM.[65] As a result, the trend toward evidence-based hypnotherapy may increase its recognition within mainstream healthcare. Additionally, systematic reviews on hypnotherapy could directly provide valuable information for future comprehensive clinical practice guidelines (CPGs) considering the inclusion of hypnotherapy, as the development of CPGs heavily relies on systematic reviews to provide clear and reliable evidence.[66] Despite the challenges, we strongly recommend submitting crucial and original discoveries to psychology and mainstream medical journals to trigger more discourse on hypnotherapy within these fields. As demonstrated in Appendix 6, journals like *Consciousness and Cognition* and *Pain* published papers interpreting hypnotherapy from the perspectives of cognitive neuroscience and using hypnotherapy for pain management, respectively, to share with peers in neuropsychology and pain medicine who might otherwise seldom focus on hypnotherapy.

Capturing emerging research hotspots aids countries, scholars and policymakers in better understanding the field and making informed decisions.[30] "Pain/Analgesia", "Irritable Bowel Syndrome", and "Anxiety", were displayed as disease-related hot topics in the keyword time zone. Trials regarding the application of hypnotherapy in pain management were the most numerous, likely due to Mesmer, one of the pioneers of modern hypnotherapy, who explored its use in pain treatment as early as the 18th century. Systematic reviews and/or meta-analyses have disclosed hypnotherapy's benefits in alleviating various types of pain, including disability-related pain,[67] pediatric functional abdominal pain,[68] labor pain,[69] musculoskeletal and neuropathic pain,[70] cancer pain,[71] pediatric procedural pain,[72] and acute dental and max-illofacial pain.[73] However, these reviews advised interpreting the results with caution due to the risk of bias across the included studies resulting in only low to moderate confidence in the quality of evidence. Among these types of pain, procedural pain was predicted to be a significant future research focus (Figure 7). In pain management protocols, in addition to clinician-provided hypnosis (hetero-hypnosis), patients are usually guided to perform self-hypnosis as a way to cope with pain and gaining greater self-control over it, with evidence suggesting greater and more lasting gains for patients actively engaged in self-hypnosis.[74] Such a patient self-management model is receiving global attention, particularly in the context of chronic disease care design and delivery. *International Frameworks for Chronic Care* emphasize key principles of self-reliance and empowerment, shifting patients from passive recipients to active partici-pants in health decisions.[75] This shift embodies the essence of patient-centered care.[75] The experience of hetero-hypnosis is not essential for inducing self-hypnosis.[76] Coincidentally, self-hypnosis was identified as a research hotspot by co-occurrence analysis and as a promising frontier direction by trending topics analysis. Similarly, both hetero-[77] and self-hypnosis[78] have been shown to improve gastrointestinal and extracolonic symptoms in IBS patients, although the quality of evidence still needs enhancement. Self-hypnosis is also highly cost-effective, widening access for IBS patients in primary care settings[78] and allowing patients to manage their symptoms without ongoing reliance on primary or secondary care.[79] Additionally, self-hypnosis enhances self-efficacy and boosts self-esteem.[76] A survey indicated a preference for self-hypnosis delivered via telehealth or smartphone apps with flexible scheduling among counselees.[80] This implies that primary care providers might consider referring patients with indications for hypnosis and a willingness to participate to optimal self-hypnosis intervention settings. Such app-based or other internet technology-based self- or hetero-hypnosis treatments were collectively referred to as "hypnosis teletherapy".[81] As an emerging model, it had the potential to improve treatment accessibility, particularly in underserved rural areas or among special populations, such as individuals with visual impairments or mobility limitations. This was supported by data showing a significant increase in the global utilization of hypnosis teletherapy during the COVID-19 pandemic.[82] Scholars even argued that, for individuals with disabilities, telehealth should no longer be viewed as a "complement" to in-person care, but rather as an "alternative" to traditional in-person healthcare in the post-COVID era.[83] Among hypnosis techniques, gut-directed hypnotherapy was the most studied for IBS.[68] Additionally, pain[71] and IBS[77] patients often experience anxiety symptoms, which improve with hypnotherapy, explaining why "Anxiety" was a hotspot in this research field.

Beyond outlining historical trends and current research status, scientometric analysis also provides clues for promising future research directions.[19] In addition to the aforementioned self-hypnosis and systematic reviews, VR and mindfulness meditation were identified as two other promising research priorities (Figure 7). In fact, Scholars are actively developing and optimizing virtual reality hypnotherapy (VRH), which uses 3D virtual technology to guide patients through hypnosis steps, creating an immersive and personalized therapeutic experience.[84] VRH may benefit counselees with lower hypnotic susceptibility more than traditional hypnotherapy,[85] as it replaces verbal cues with immersive stimuli,[84] aiding those with limited imaginative capacities to concentrate.[85] The better efficacy of VRH is also linked to the higher engagement level of patients in the immersive therapeutic environment.[86] The feasibility and efficacy of VRH have been preliminarily validated in the management of pain[85,87] and negative emotions, such as anxiety,[84] depression,[84] and fear.[87] Especially in pain management, VRH make hypnotic induction less effortful, which is crucial for patients with severe pain or on potent analgesics who have limited capacity for concentration and self-induced scenarios, thereby hindering traditional hypnosis. In these settings, computer-generated stimuli that capture and direct attention are particularly beneficial.[88] The analgesic effect of VRH may be linked to increased dissociation and modulation of cerebral pain processing mechanisms, primarily involving the frontal, central, and posterior regions.[89] Notably, like the aforementioned self-hypnosis, VRH was also

regarded as more cost-effective and accessible than traditional hypnotherapy.[90] This was attributed to the benefits of VR, including the capacity for repetition, immediate availability, and enhanced therapeutic input.[91] For instance, with the widespread availability of consumer VR headsets, VR-based delivery of certain traditional therapies held potential for improving pain management outside clinical settings.[92] Evidence regarding the efficacy and safety of VRH for chronic diseases beyond pain remained limited. Therefore, future research could focus on further validating its applicability in the management of other chronic conditions. It is not surprising that meditation was predicted as another "hot" topic in future research, given its historical and epistemological positioning as two sides of the same coin with hypnosis (Eastern philosophies vs Western mystical currents),[93] despite their shared phenomenological features.[94] Neurophysiologically, both practices show decreased default mode network (DMN) activity and increased central executive network-salience network connectivity. However, increased DMN-salience network connectivity is observed in meditation but not in hypnosis.[95] fMRI and EEG emerged as key terms in the co-occurrence analysis, underscoring their frequent application in clinical trials investigating the mechanisms of hypnotherapy. A systematic review has critically synthesized findings from various imaging techniques, revealing substantial evidence of functional changes in brain activity following hypnotherapy.[96] For instance, EEG data demonstrated a positive correlation between theta activity oscillations and hypnotic responses. Additionally, diminished activity during hypnosis was noted in the insula and anterior cingulate cortex. fMRI studies indicated reduced activity in specific regions (brainstem, left and right insula, right primary somatosensory cortex) during hypnosis relative to normal wakefulness, along with enhanced functional connectivity between the primary somatosensory cortex (S1) and the distant insular and prefrontal cortices.[96] Additionally, functional near infrared spectroscopy (fNIRS)[97] and positron emission tomography (PET)[98] have also been employed to investigate the emotional regulation networks activated, functional changes in brain activity, and other neural mechanisms under hypnosis. Advancements in electrophysiological and neuroimaging techniques, therefore, are expected to provide deeper insights into these phenomena in the future, especially regarding structural modifications in meditators or counselees predisposed to hypnosis and functional brain changes related to these practices.

Overall, the growing body of positive results led to increasing recognition of evidence-based hypnotherapy for treating a variety of medical conditions.[99] Advances in neuroimaging technologies, along with clinical measurements, also provided insights into how the therapy works.[100] Additionally, integrating multimodal data may enhance the predictive sensitivity and specificity of treatment responses, particularly in the context of mental disorders.[101] However, research on hypnotherapy's safety remained limited, and the practice was often clouded by myths and misuse, fueling ongoing controversy.[99] To facilitate the integration of hypnotherapy into healthcare, it was essential to conduct thorough evaluations of the evidence to weigh its risks and benefits.

Conclusions

Over the past thirty years, there has been increasing attention to using hypnotherapy for managing a range of clinical conditions, particularly pain, IBS, and comorbid anxiety. Reliable evidence is essential for expanding their use. Given evidence-based outcomes are preferred, research methods such as systematic review and/or meta-analysis were widely utilized. fMRI and EEG are frequently employed technologies for investigating the neuropsychological mechanisms that underpin hypnotherapy. Self-hypnosis, notable for its cost-effectiveness such as enhanced patient self-control and reduced reliance on primary/secondary care services, has emerged as a prominent research focus. Telemedicine and smartphone apps used for self-hypnosis are favored technological tools, with the potential to enhance treatment accessibility, particularly in underserved rural areas or among disabled populations. Another innovation in hypnotherapy is the integration of VR technology, which enhances immersion and engagement. The benefits of VR, including repetition, immediate availability, and increased therapeutic input, make VRH more cost-effective than traditional hypnotherapy. This approach primarily benefits clients with lower hypnotic susceptibility and limited self-induction capabilities. Exploring the shared and distinct neurophysiological mechanisms between hypnotherapy and meditation using electrophysiological and brain imaging techniques is also a topic of considerable scientific interest. Integrating these technologies with clinical outcomes is expected not only to yield deeper insights into the mechanisms of hypnotherapy but also to enhance the sensitivity of treatment response predictions. While France and the United Kingdom have been pioneers and remain active in hypnotherapy research, the United States leads globally this field.

Enhanced cross-country/regional collaborations are required to achieve higher quality research outputs. In addition to establishing global research platforms for data and resource sharing, hosting international conferences and facilitating researcher exchanges can stimulate intellectual exchange and expand collaboration opportunities.

Abbreviations

AAGR, Average Annual Growth Rate; CAM, Complementary and Alternative Medicine; DMN, Default Mode Network; EEG, Electroencephalography; fMRI, Functional Magnetic Resonance Imaging; fNIRS, Functional Near Infrared Spectroscopy; IF, Impact Factor; IBS, Irritable Bowel Syndrome; JCR, Journal Citation Reports; NICE, National Institute of Health & Care Excellence; Nc, Number of Citations; Np, Number of Publications; PET, Positron Emission Tomography; PTSD, Post-Traumatic Stress Disorder; S1, Primary Somatosensory Cortex; VR, Virtual Reality; VRH, Virtual Reality Hypnotherapy; WoS, Web of Science.

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