Evolution of Chatbots in Nursing Education: A Narrative Review

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Abstract

Background: Nursing education plays a critical role in global healthcare, integrating technological advancements to enhance patient-centered care. While recent studies explore the impact of emerging technologies like virtual reality and smart glasses, challenges persist, including a scarcity of nursing expertise, resource disparities, and the aftermath of the global COVID-19 pandemic.

Objective: Our objective is to conduct an analysis and synthesis of the current literature on chatbots in nursing education, aiming to illuminate valuable perspectives on the evolving role of chatbots and contribute insights that inform future research directions.

Methods: By conducting a comprehensive literature review combining MeSH term "Education, Nursing" and relevant keywords including chatbots and conversational agents, across three databases (PubMed, Web of Science, and Embase), we examined the present situation of nursing education and the potential of chatbots as an innovative solution.

Results: A total of 40 articles met eligibility criteria, with a notable increase in publications observed in 2023 (n=20,50%). Taiwan province made substantial contributions (n=8, 20%), followed by the United States (n=6, 15%) and Korea (n=4, 10%). Study types varied, with reviews (n=8, 20%) and editorials (n=7, 18%) being predominant, showcasing the richness of research in this domain.

Conclusions: Integrating chatbots into nursing education holds transformative potential, addressing existing challenges and reshaping learning experiences. Chatbot technology enhances inclusivity and personalization, elevating the competence of future healthcare professionals. Clinical Trial: null

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Abstract

Background: The integration of chatbots in nursing education is a rapidly evolving area with potential transformative impacts. This narrative review aims to synthesize and analyze the existing literature on chatbots in nursing education.

Objective: To comprehensively examine the temporal trends, international distribution, study types, and implications of chatbots in nursing education.

Methods: A comprehensive search was conducted across three databases (PubMed, Web of Science, and Embase) following the PRISMA flow diagram.

Results: A total of 40 articles met eligibility criteria, with a notable increase in publications observed in 2023 (n=20,50%). Temporal analysis revealed a notable surge in publications from 2021 to 2023, emphasizing the growing scholarly interest. Geographically, Taiwan province made substantial contributions (n=8, 20%), followed by the United States (n=6, 15%) and Korea (n=4, 10%). Study types varied, with reviews (n=8, 20%) and editorials (n=7, 18%) being predominant, showcasing the richness of research in this domain.

Conclusion: Integrating chatbots into nursing education presents a promising yet relatively unexplored avenue. The review highlights the urgent need for original research, emphasizing the importance of ethical considerations.

Keywords: Nursing education, chatbots, artificial intelligence, narrative review

Introduction

Nursing education, crucial for positive patient-professional relationships [1,2] and continuous professional development [3], holds a pivotal position in global healthcare systems [4], driving progress [5] and integrating technological advancements to enhance patient-centered care [6,7]. A study on oncology nursing provides compelling evidence for nurses, addressing challenges and advocating for specialized education and safety measures in the escalating global cancer burden. [8] A recent meta-

analysis, employing 12 studies with 821 participants, evaluating the role of virtual reality (VR) in nursing education revealed substantial enhancements in knowledge but identified no distinguishable disparities in skills, satisfaction, confidence, and performance time, underscoring the imperative for additional investigations in these domains. [9] Another study explored the usability and feasibility of extended reality smart glasses in core nursing skill training for undergraduate students, uncovering positive effects on engagement, learning satisfaction, and competency improvement, highlighting the potential of smart glasses as an impactful educational strategy in nursing training. [10] However, nursing education encounters obstacles such as a worldwide scarcity of nursing expertise [11], uneven distribution of resources [12], potential disparities between theoretical and practical aspects [9], restricted interdisciplinary collaboration [13], insufficient opportunities for professional development [14], and the ramifications of the global COVID-19 pandemic [15].

In the swiftly evolving landscape of artificial intelligence (AI) and smartphone proliferation, the integration of large language models such as ChatGPT into chatbots is emerging as a trend, with chatbots progressively showcasing the potential to revolutionize mental health [16], behavior [17], and knowledge [18] within the dynamic advancing deep learning. Recent studies on education have accentuated chatbots to deliver personalized learning experiences [19,20] by tailoring content delivery to the unique needs of individual students, thereby augmenting comprehension and retention. Concurrently, chatbots provide an easily accessible platform for continuous learning [21], affording students the opportunity to retrieve information at their convenience and cultivating a culture of self-directed learning. Moreover, the interactive attributes of chatbots facilitate real-time feedback, permitting the prompt rectification of misconceptions and fostering a more profound grasp of intricate healthcare concepts. [22] The adaptability of chatbots caters to diverse learning styles, ensuring inclusivity in education [23]. Despite these advantages, few studies investigate the integration, development, and feasibility of chatbots within nursing education.

Our aim is to meticulously investigate and amalgamate the existing literature pertaining to the integration of chatbots in nursing education reviewing selected articles. By scrutinizing studies sourced from three prominent databases (PubMed, Embase, Web of Science), we accentuate insightful perspectives on the evolving role of chatbots in nursing education. Approaching this investigation with the perspective of a reviewer, we seek to contribute a nuanced and well-supported analysis of the existing literature on this topic.

Methods

Search strategy

We devised pertinent search queries concerning nursing education and chatbots, with the designated search terms detailed in the supplementary materials (pp 3-4). A thorough investigation encompassing three databases—PubMed, Embase, and Web of Science—was carried out from their individual inception dates until November 16, 2023.

Eligibility criteria for study inclusion

The eligibility criteria were devised in accordance with the PICOS framework [24] (population, intervention, comparison, outcome, and study type). The study inclusion criteria were meticulously outlined to ensure the accuracy and relevance of the selected research. The specified population comprised nurses or nursing students, including managers and clinical nurses, with a deliberate exclusion of doctors and other professional personnel. Intervention criteria encompassed any chatbot intervention, including chatbot apps, messaging, and online website interventions, while excluding interventions not specifically focused on chatbots or lacking communication with them. Comparator conditions involved conventional education methods, such as face-to-face or drug interventions,

excluding the integration of chatbot interventions. Exclusion criteria also considered comparators that included chatbot interventions at comparable rates but with differing frequencies. The outcomes of interest include results relevant to nursing education, covering levels of medical knowledge, nurses' engagement with chatbots, and the improvement of practical skills. Study design inclusion criteria accepted any design. Detail seen in the supplementary materials (p5).

Selection process and outcomes of interest

The search findings were imported into Covidence (Veritas Health Innovation, Melbourne, Australia) adhering to established protocols. The screening process involved two stages. Initially, titles and abstracts were screened, followed by a thorough review of full-text articles. Regarding duplicated papers, they were indeed removed using Covidence prior to the screening stages to ensure the integrity of the selection process. Three authors (SZ, XL, and WW) independently and in duplicate executed all screening stages and data extraction, resolving any discrepancies through consultation with the senior author (FZ). To ensure precision and uniformity in data, we formulated a comprehensive data extraction form (SZ and WW) that underwent subsequent refinement (SZ and FZ) in alignment with guidelines from the Cochrane Handbook for Systematic Reviews of Interventions. [25] Before full extraction, the form underwent a pilot test on a subset of included studies. Extracted details from all included studies (SZ, XL, and WW) employed elements such as publication details (study ID, title, year), author particulars (lead author contact information), study specifics (country, study type, objectives), and conclusions.

Study design and statistical analysis

This is a narrative review. After screening process, we successfully gathered comprehensive data, encompassing publication details (study ID, title, year), author particulars (contact information for the lead author), study specifics (country, study type, objectives), and conclusions. Subsequently, we categorized this data based on the respective year, country, and study type. To provide a visual representation of the trends observed, we conducted percentage calculations for each category. These percentages are then visually depicted using a bar chart to illustrate trends over time and a pie chart to convey the distribution of studies across various categories.

Results

In total, 38,412 distinct records were identified. Subsequently, an eligibility assessment was conducted on 77 full texts, with 3 articles not retrieved, as depicted in Figure 1. Out of these, 37 were subsequently excluded, resulting in the inclusion of 40 articles that met the eligibility criteria for synthesis. [26-65]

Between 2010 and 2020, the yearly average saw one article published every 3-4 years, culminating in a total of three articles, contributing to 12% of the overall publications. However, a noticeable upswing occurred in 2021, witnessing two articles, making up 7%. In 2022, the count increased to three articles, constituting 11%. The most notable surge transpired in 2023, with the publication of 20 articles, accounting for a substantial 71% of the total publications.

Table 1: Overview of Extracted Studies

Study ID	Title	Country	Study design	Year
Abdulai 2023	Will ChatGPT undermine ethical values in nursing education, research, and practice?	Canada	Commentary	2023

Ahmed 2023	The Impact of ChatGPT on the Nursing Profession: Revolutionizing Patient Care and Education	Iraq	Letter to editor	2023
Archibald 2023	ChatGTP: What is it and how can nursing and health science education use it?	Canada	Editorial	2023
Berse 2023	The Role and Potential Contributions of the Artificial Intelligence Language Model ChatGPT	Turkey	Letter to editor	2023
Castonguay 2023	Revolutionizing nursing education through Ai integration: A reflection on the disruptive impact of ChatGPT	Canada	Commentary	2023
Chang 2022	Promoting students' learning achievement and self-efficacy: A mobile chatbot approach for nursing training	Taiwan	Empirical article	2022
Chang 2022	Chatbot-facilitated Nursing Education: Incorporating a Knowledge-Based Chatbot System into a Nursing Training Program	Taiwan	Experimental design	2022
ChanMMK 2023	Critical Reflection on Using ChatGPT in Student Learning: Benefits or Potential Risks?	China	Commentary	2023
Chen 2022	Applying the Smartphone-Based Chatbot in Clinical Nursing Education	Taiwan	Teaching Tip	2022
Chen 2023	Need assessment for history-taking instruction program using chatbot for nursing students: A qualitative study using focus group interviews	China	Phenomenological study	2023
Cheng 2021	Transformation in Nursing Education: Development and Implementation of Diverse Innovative Teaching	Taiwan	Commentary	2021
Choi EPH 2023	Chatting or cheating? The impacts of ChatGPT and other artificial intelligence language models on nurse education	Hong Kong	Review	2023
Chuang 2021	The Design and Application of a Chatbot in Clinical Nursing Education	Taiwan	Review	2021
Daniel 2022	Answering Hospital Caregivers' Questions at Any Time: Proof-of-Concept Study of an Artificial Intelligence–Based Chatbot in a French Hospital	France	Proof-of-concept study	2022
Da Silva 2023	Is ChatGPT a valid author?	Japan	Letter to editor	2023
Dave 2023	ChatGPT in medicine: an overview of its applications, advantages, limitations, future prospects, and ethical	Ukraine	Mini review	20

	considerations			23
DeGagne 2023	The State of Artificial Intelligence in Nursing Education: Past, Present, and Future Directions	United States	Editorial	2023
Friedman 2014	Let me introduce you to your first virtual patient	United States	Descriptive qualitative study	2014
Han 2022	Analysis of the effect of an artificial intelligence chatbot educational program on non-face-to-face classes: a quasi-experimental study	Korea	Quasi-experimental study	2022
Hsu 2023	Personalized Medical Terminology Learning Game: Guess the Term	Taiwan	Experimental study	2023
Hsu 2023	Mastering medical terminology with ChatGPT and Termbot	Taiwan	RCT	2023
Hwang 2022	How artificial intelligence (AI) supports nursing education: profiling the roles, applications, and trends of AI in nursing education research (1993â€“2020)	Taiwan	Systematic review	2022
Irwin 2023	What is ChatGPT and what do we do with it? Implications of the age of AI for nursing and midwifery practice and education: An editorial	Australia	Editorial	2023
Johnson 2023	When to err is inhuman: An examination of the influence of artificial intelligence-driven nursing care on patient safety	United States	Review	2023
Jung 2023	Challenges for future directions for artificial intelligence integrated nursing simulation education	Korea	Editorial	2023
Kang 2023	Awareness of using chatbots and factors influencing usage intention among nursing students in South Korea: a descriptive study	Korea	Quasi-experimental study	2023
Krüger 2023	ChatGPT: curse or blessing in nursing care?	Germany	Review	2023
Liu 2023	The application of Chat Generative Pre-trained Transformer in nursing education	China	Review	2023
Mascitti 2010	Modular e-course with virtual coach tool support	Italy	Experimentation methodology	2010
Miao 2023	Impact of ChatGPT on Interdisciplinary Nursing Education and Research	United States	Editorial	2023

O'Connor 2023	Open artificial intelligence platforms in nursing education: Tools for academic progress or abuse?	UK	Editorial	2023
Scerri 2023	Using chatbots like ChatGPT to support nursing practice	Malta	Editorial	2023
Seney 2023	Using ChatGPT to Teach Enhanced Clinical Judgment in Nursing Education	United States	Teaching Tip	2023
Sharma 2023	A holistic approach to remote patient monitoring, fueled by ChatGPT and Metaverse technology: The future of nursing education	India	Review	2023
Shorey 2019	A virtual counseling application using artificial intelligence for communication skills training in nursing education: Development study	Singapore	Development Study	2019
Shorey 2023	Evaluation of a Theory-Based Virtual Counseling Application in Nursing Education	Singapore	Quasi-experimental study	2023
Sun 2023	The ChatGPT Storm and What Faculty Can Do	United States	Review	2023
Tam 2023	Nursing education in the age of artificial intelligence powered Chatbots (AI-Chatbots): Are we ready yet?	Singapore	Review	2023
Uslu 2023	The Effects of Manikin-Based and Standardized-Patient Simulation on Clinical Outcomes: A Randomized Prospective Study.	Turkey	RCT	2023
Ye 2021	Development of a Chatbot Program for Follow-Up Management of Workers' General Health Examinations in Korea: A Pilot Study	Korea	Communication	2021

Taiwan province contributes 20% of the total articles with a count of 8 [31,32,34,35,37,42-44]. Following closely is the United States, contributing 15% of the articles with a count of 6 [39,40,46,52,55,59]. Korea secures the third position, representing 10% of the articles with a count of 4 [41,47,48,63]. Canada [26,28,30], Mainland [33,50,64], and Singapore [57,58,60] share the same contribution percentage of 8%, each contributing 3 articles. Turkey [29,62] contributes 2 articles, making up 5% of the total. Other countries such as Australia [45], France [38], Germany [49], Hong Kong [36], India [56], Iraq [27], Italy [51], Japan [61], Malta [54], the UK [53], and Ukraine [65] each contribute 1 article, constituting 3% each.

In our review, the predominant study type is the review, constituting 20% of the total articles and contributing 8 articles [36,46,49,50,56,59,60]. Reviews exemplify a meticulous synthesis of existing literature, providing comprehensive insights and analyses on specific topics. Editorials, comprising 18% with 7 articles [28,39,45,47,52-54], serve as platforms for commentary, opinions, or perspectives on current issues and developments in the field. Commentaries contribute 10%, with 4 articles [26,30,35,64] offering critical reflections, analyses, or perspectives on specific subjects. Letters to the editor, making up 8% with 3 articles [27,29,61], provide readers with a platform to express opinions, raise concerns, or offer feedback on published content. Quasi-experimental studies contribute 8%, represented by 3 articles [41,48,58]

employing experimental methods without random assignment. Contributing 5%, teaching tips offer valuable insights into effective educational strategies, encompassing 2 articles [34,55]. Randomized Controlled Trials (RCTs), considered gold standards in experimental design, contribute 5%, represented by 2 articles [42,62]. Experimental design, symbolizing systematic investigation, is embodied in 1 article [31], contributing 3%. Empirical articles, grounded in observations and experiences, constitute 3%, with 1 contribution [32]. Phenomenological studies, delving into lived experiences and perceptions, contribute 3%, represented by 1 article [33]. Proof-of-concept studies, showcasing the feasibility of an idea or approach, contribute 3%, with 1 article [38]. Mini reviews, furnishing concise overviews, contribute 3%, represented by 1 article [65]. Descriptive qualitative studies, concentrating on detailed exploration, account for 3%, with 1 article [40]. Experimental studies, engaging in controlled testing, contribute 3%, represented by 1 article [43]. Systematic reviews, characterized by methodical literature synthesis, contribute 3%, represented by 1 article [44]. Articles centering on experimentation methodology contribute 3%, represented by 1 article [51]. Development studies, exploring the creation of new methodologies or tools, contribute 3%, represented by 1 article [57]. Lastly, articles classified as communications, conveying crucial information or updates, contribute 3%, with 1 article [63].

Discussion

In this work, we developed comprehensively examine the temporal trends, international distribution, study types, and implications of chatbots in nursing education to map the challenges and issues to address in the future. Our analysis highlights significant findings, including a marked increase in research publications in 2023, reflecting growing interest in this field. Contributions from Taiwan, the United States, and Korea illustrate the global scope of chatbot integration in nursing education. The diverse study types reviewed, ranging from reviews and editorials to quasi-experimental studies, indicate the extensive research exploring chatbots' role in enhancing personalized instruction, patient-care simulations, and critical thinking. Despite these advancements, challenges such as the need for rigorous original research, funding, ethical considerations, and resource distribution disparities remain. Furthermore, addressing these issues through international collaboration and targeted research will be crucial for fully realizing the potential of chatbots in nursing education.

AI language models such as chatbots have caused a revolution in nursing education through the provision of personalized and interactive learning activities. Chatbots are implemented in nursing education for personalized instruction, for patients-care simulation, and for critical thinking enhancement. Chatbots in healthcare are used for teleconsultation to improve communication skills, support clinical judgement, and enable remote patient monitoring. Chatbots are key component in addressing global shortages of knowledge and resources in nursing training. They bridge the theoretical and practical aspects, thereby illustrating the potential of this technology to revolutionize learning processes and change the face of healthcare services and education.

This study aims to shed light on the evolution of chatbots in nursing education through data analysis of temporal trends. The PRISMA flow diagram leads you through a systematic search procedure which lets us guarantee a transparent and strict methodology. Indeed, publishing in 2023 grew up to 71% which might be due to either increased scholarly interest or intensified effort. This study tries to delve into the technological education aspect of healthcare, which is a rapidly expanding area. Consequently, it will provide a comprehensive reflection of the dynamic and developing educational sector.

This gives a new approach about how artificial intelligence and mobile communication can be applied in nursing education and how can both of them influence the former. Chatbots and AI integration can be seen as a technical invention with thrilling effects on the mental health, behavior and knowledge of deep learning. The analysis stresses the sole benefits of chatbots in education, that

they provide the chatbots with the capacity of individualized learning [27,31,32,39,43,44,47,48,50,51,53,56,60]. The talk focuses on the problems in nursing education that involves the shortage of global knowledge, condition differences, and lack of relationship between theory and practice [29,35,45,49,58], and illustrates the ways chatbots can cope with these issues.

A detailed study of the worldwide distribution and categorization of chatbot research on nursing education is carried out with reference to international contexts highlighting major contributions. The participation of United States and Korea, Taiwan province reaches 20% of all articles as the largest share. This regional perspective highlights the universal nature of adding chatbots to nursing education. As research methodology analysis reveals, reviews cover 20% of the whole, providing exhaustive summaries of present literature. A diverse range of designs that includes commentaries, quasi-experimental studies, teaching ideas, and trials on randomized controlled subjects explains the extensive and varied research on chatbots in nursing education.

In spite of the huge benefits, there are some barriers that nursing education will face as they try to incorporate chatbots. Original research like randomized controlled trials (RCTs) or cohort studies is the most important part of confirming the efficiency of conversational bots. For funding research about advanced techniques and application of rigorous process they need high levels both of staff and finance. The integrity and the security problems of chatbots with the wrong advice are highlighted demonstrating the need for correcting the technical problems in order to ensure ethical and secure operations. Funding should be set aside to close resource distribution disparities [39,40,47,57-59] so that students from disadvantaged backgrounds can also have an opportunity to have access to technologically advanced educational resources. Collaboration among those in the academic, technical and healthcare disciplines is indispensable as an effort to develop supportive surroundings for the application of chatbots to nursing education globally.

It demonstrates the substantial changes that chatbots bring into nursing education to make nursing practice more enjoyable. This integration aims at resolving several issues, including lack of competitiveness from a global perspective, and economic disparity, in essence to get an integrated and dynamic learning environment. Analyzing the small components of chatbots and conducting research on the feasibility, pros, and cons is a necessity to aim for the future of education [44]. Lack of original research forces us to rely more on the already existing qualitive studies such as comments, editorials. Amongst all, great attention should be given to privacy and ethics when integrating current technologies into the healthcare education system.

There are some limitations. Firstly, the study only provides a description of the changes over time in articles related to chatbots in nursing education, as well as the distribution of regions and types of articles. Due to lack of original studies, it does not show the characteristics of papers included in the final analysis. Secondly, there is uncertainty about whether the specific research topics related to chatbots in nursing education are consistent between countries. Thirdly, there is a lack of in-depth quantities exploration and discussion regarding the specific application directions of chatbots in nursing education, preventing the formulation of more constructive recommendations.

Conclusion

Integrating chatbots into nursing education presents a promising yet relatively unexplored avenue. The review highlights the urgent need for original research, emphasizing the importance of ethical considerations. This exploration contributes to the evolving landscape of technology in healthcare education, bridging gaps and fostering a learner-centric approach aligned with contemporary healthcare demands.

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Author Contributions

SZ: Conceptualization, Methodology, Data Curation, Formal Analysis, Writing—Original Draft Preparation, Writing—Review and Editing

XL: Methodology, Data Curation, Original Draft Preparation

WW: Methodology, Data Curation, Original Draft Preparation

FZ: Conceptualization, Methodology, Project Administration, Supervision

Declaration of Interests

All authors declare no competing interests.

Data Availability Statement

All data can be found in supplementary material.

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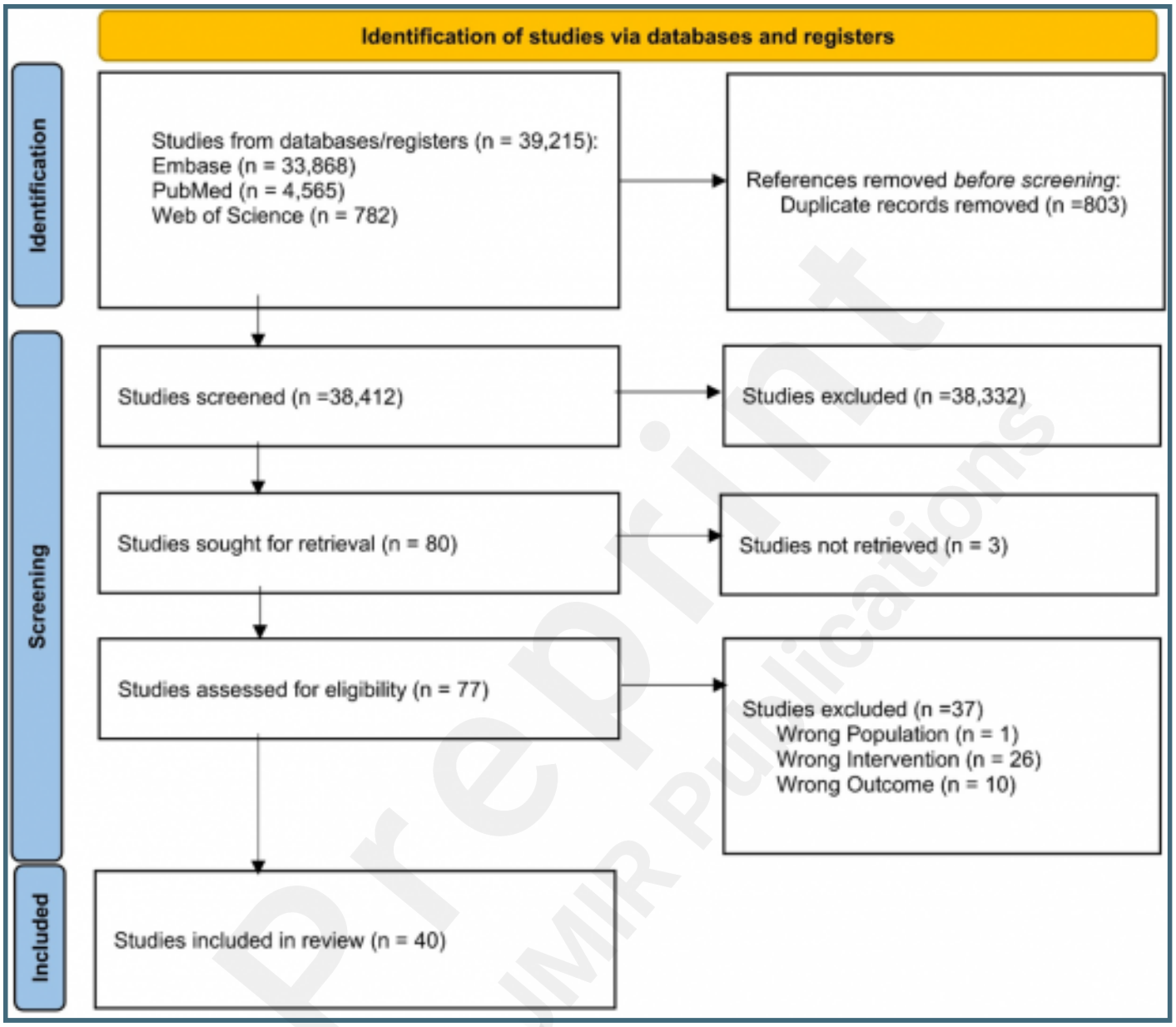
Supplementary Files

Figures

PRISMA flow diagram showing the study selection process.



Temporal fluctuations in articles from 2010 to 2023.