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THE CHATBOT APPLIED TO HEALTH. A BIBLIOMETRIC REVIEW

José Eduardo Cortés Torres¹: Manuela Beltrán University. Colombia.

jose.cortes@docentes.umb.edu.co

Carol Estefanía Saldaña Moreno: Manuela Beltrán University. Colombia.

carolsaldana.em@academia.umb.edu.co

Juan Sebastián Mendoza Moncada: Manuela Beltrán University. Colombia.

juanmendoza.sm@academia.umb.edu.co

Jesús David Perdomo Pineda: Manuela Beltrán University. Colombia.

jesusperdomo.dp@academia.umb.edu.co

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ABSTRACT

Introduction: The use of chatbots in healthcare is an emerging area of growing interest, and a comprehensive characterization of the state of knowledge regarding their applications in this field was needed. **Methodology:** A qualitative bibliometric review of 50 indexed articles published between 2018 and 2023 was conducted, sourced from specialized databases. The articles were classified based on objectives, methodologies, conclusions, and areas of application. **Results:** Most of the studies focused on mental health, particularly in supporting and treating disorders, as well as in medical education. Descriptive, experimental, and quantitative designs predominated, with a strong focus on rigorously evaluating the effectiveness of chatbots. **Discussion:** Chatbots

¹ Corresponding author. **José Eduardo Cortés Torres:** Doctoral candidate in Education (César Vallejo University), holder of a Master's degree in Mother Tongue Pedagogy, and Bachelor's degree in Basic Education with an Emphasis in Humanities and Spanish Language.

have shown benefits in areas such as mental health, medical education, and other specific applications. However, there is a need for further high-quality research to assess their effectiveness in healthcare contexts before widespread implementation. **Conclusions:** While initial results are promising, there is a need to deepen the scientific foundation of chatbot applications in healthcare, to better characterize their scope and limitations, which will help guide future studies on this emerging technology.

Keywords: Chatbot, Health, treatment, medical education, technology.

1. INTRODUCTION

The rapid evolution of artificial intelligence is causing profound transformations in various areas of contemporary society. One of the fields in which great potential for the application of these emerging technologies can be foreseen is the provision of health services. In particular, in recent years there has been growing interest in studying the implementation of chatbots or intelligent conversational agents for purposes related to healthcare.

Although there are some preliminary studies in this area, up to now there has been no comprehensive characterization of the state of knowledge regarding the development and application of chatbots in the field of health. In response to this need, the present research aims to systematically map the main thematic focuses, trends, methodological designs, and conclusions obtained in the studies conducted on this topic in recent years.

The growing development of applications based on artificial intelligence is transforming many areas of society Ortega (2023). One of the fields in which great potential for improvement through these emerging technologies is envisioned is the provision of health services. In recent years there has been marked interest in studying the implementation of chatbots or conversational agents for various purposes in healthcare contexts. Although there are already some preliminary studies in this regard, up to the present there has been no comprehensive characterization of the state of knowledge in this novel field of study.

There thus arises the need to systematically map the principal thematic focuses and trends in research devoted to the development of chatbot applications in health Arias et al. (2022). Likewise, and as affirmed by Gamarra et al. (2022), it is essential to analyze in greater depth the methodological designs employed and the conclusions obtained in the studies conducted up to the present, in order to determine the robustness of the evidence and to adequately support future applications.

To address this gap, a qualitative bibliometric review of 50 indexed scientific articles published between 2018 and 2023 was carried out, extracted from the main biomedical and multidisciplinary databases. Through thematic and content analysis, the studies examined were classified in relation to their objectives, methodologies used, principal findings, and areas of application studied. In this way, comprehensive results were obtained regarding the current state and the prospects of this growing field of study.

The findings make it possible to determine the areas and specific applications of chatbots in health that are currently receiving the greatest research attention. Likewise, they make it possible to assess the robustness of the evidence obtained up to the present regarding the real potential and

effectiveness of the use of chatbots in healthcare contexts (Auqui, 2021; Camelo et al., 2019; Palacios et al., 2019). On this basis, future lines of research can be guided, and the foundations can be laid for a rigorously grounded clinical application when deemed appropriate.

In summary, the present study will make it possible to obtain a comprehensive view of the state of progress, thematic trends, main conclusions, and pending challenges in the research devoted to the study and implementation of chatbots in the broad field of health. The results will serve to guide new research efforts and practical applications, optimizing resources and efforts on the basis of existing knowledge.

2. OBJECTIVES

This document presents, through a qualitative bibliometric study, the analysis of publications indexed between 2018 and 2023. The objective is to characterize the scientific publications that consider the implementation of chatbots in the field of health. The database analyzed contains 50 articles indexed in Scopus, ScienceDirect, Scielo, PubMed, and Web of Science. Therefore, the parameters analyzed were based on: Database, Year, Objective, Main conclusions and key ideas of the text, thematic area, topic, university, country, method, and language.

3. METHODOLOGY

The present research is framed within a qualitative methodological approach of a descriptive type. This approach was chosen in order to characterize in depth the current state of scientific publications concerning the implementation of chatbots in the field of health. The descriptive design is appropriate when the primary objective is to specify the properties, characteristics, and trends of a given phenomenon or process (Hernández et al., 2017). In this particular case, the aim was to describe comprehensively the predominant thematic dimensions, the methodological approaches applied, and the main conclusions obtained in the recent scientific literature on the use of chatbots in health contexts.

Likewise, it was decided to employ a qualitative strategy since it allows a holistic, contextualized, and open approach to the phenomenon in question, incorporating the complexity inherent to social processes and their multiple dimensions (Vasilachis, 2006). Given the diversity of disciplines and perspectives involved in this emerging field, it was considered appropriate to adopt a qualitative approach that would facilitate capturing the richness of the data.

The collected documentary corpus was subjected to thematic and content analysis procedures, with the aim of classifying the studies examined according to their objectives, methodologies employed, main findings, and areas of application of the chatbots studied. In this way, it was possible to comprehensively characterize the current state of knowledge and the prospects for progress in this growing field of study. The publications reviewed mark a temporal advance in works and projects carried out to improve chatbots, on the continents of America, Asia, and Europe, published in Spanish, English, and Russian. Use is made of Boolean operators, which are:

Table 1. *PVO search variables*

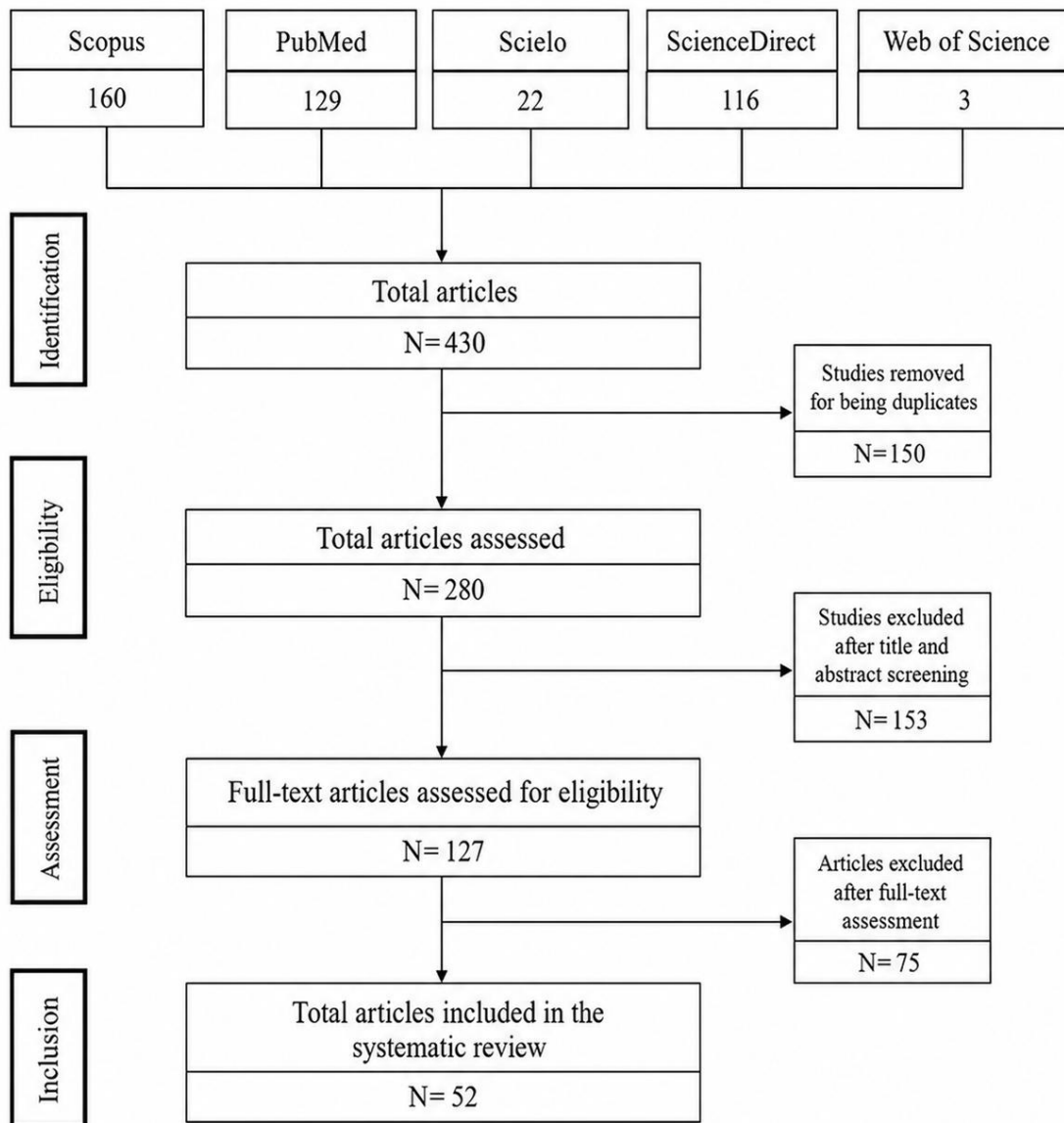
Variable (P)	AND	Variable (V)
Chatbot	X	Disease treatment
Chatbot	X	Mental health
Chatbot	X	Rehabilitation
Chatbot	X	Mental Disorders
Chatbot	X	Healthcare System
Chatbot	X	образование

Source: Own elaboration.

More publications were analyzed and, taking into account the inclusion criteria in the database, related to the variables and search descriptors associated with chatbot technology today, more focused on the health factor, in order to find relevant articles. At the beginning of the search, 430 articles were found in general. After identifying the articles by means of a complete review of the articles and, by topic, carrying out an analysis of which articles were repeated, 280 articles could be identified. Of these, 153 more were eliminated after evaluating in greater detail the topic and the title of the articles, in order to analyze their importance in the field, obtaining 127 articles. Finally, 75 articles were eliminated in the full-text review, leaving the 52 most relevant and most important articles for the research.

Subsequently, the PRISMA diagram was used, which incorporates several novel conceptual and methodological aspects related to the methodology of systematic reviews. This diagram helps to prevent the risk of bias in systematic reviews and ensures greater transparency through its four main phases. In this way, the diagram contributes to obtaining qualitative conclusions, thanks to review parameters, Urrútia et al. (2010). Finally, Boolean operators were used in the search in databases on the topic of chatbots, following the review of the PRISMA diagram.

Figure 1. PRISMA diagram for the inclusion and exclusion of articles



Source: Adapted from Page et al. (2021)

4. DISCUSSION

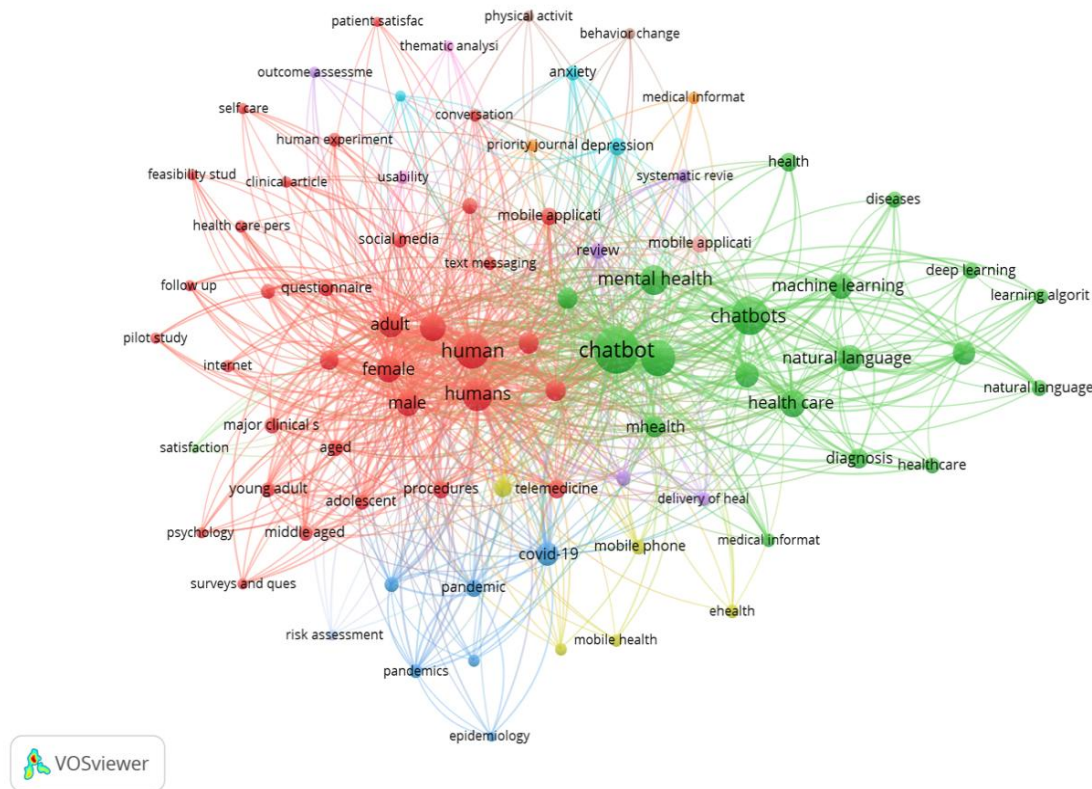
The visual content of Figure 1 describes the frequency and use of the keywords indicated in Phase 1 of the methodological design. One of the most frequently used keywords in the study of writing circle processes is identified in the red-colored cluster with (34) items, which have a direct relationship with the words: human ($n = 246$), article ($n = 134$), female ($n = 124$), communication ($n = 73$), allowing the inference of a focus on studies of academic and scientific communication in humans, with an emphasis on gender differences. In cluster 2, identified in green with (19) items, the words ChatBot ($n = 753$), artificial intelligence ($n = 244$), mental

health (n = 170), natural language (119), make it possible to deduce that it indicates research on the use of chatbots and AI in the context of mental health.

In cluster 3, colored blue with (27) items, the leading keyword is coronavirus (n = 101), in relation to the words: pandemic (n = 88), COVID-19 (n = 99), public health (n = 25), epidemiology (n = 19), thus pointing to studies on the impacts of the pandemic in various areas of health. In cluster 4, colored yellow with (2) items, the words digital health study (n = 54), health (n = 28), mobile health (35), Telehealth (24) are mentioned, therefore suggesting an interest in the study of emerging technologies for the provision of health services.

In summary, transdisciplinary research is observed among communication, AI, public health, and digital health, with a contemporary emphasis on the impacts of the pandemic. This reflects an integrative approach to technology for the study of complex problems in health and communication.

Figure 2. *Co-occurrences of keywords*



Source: Own elaboration

4.1 Classification of the thematic area and topic identified in the articles consulted

As it deals with the chatbot and its application in different areas, more specifically in the field of health, thematic areas can be identified such as mental health, COVID-19, the treatment of

mental disorders, rehabilitation, and education; and topics such as the implementation of the chatbot in education, in health, in rehabilitation processes, in mental health, and in accompaniment and support for different disorders and syndromes. Thus, it can be stated that 55% correspond to “Mental Health Chatbot,” 18% to the theme of “Rehabilitation Chatbot,” 14% to the area of “Education and Learning Chatbot,” 5% correspond to “Diagnostic Chatbot,” and finally 8% to “COVID-19 Chatbot.”

Table 2. *Classification by thematic area*

Thematic area	Number of Articles	%
ChatBot COVID-19	10	20
Diagnostic Chatbot	1	2
Education and Learning Chatbot	32	64
Rehabilitation Chatbot	1	2
Mental Health Chatbot	6	12
Total	50	100

Source: Own elaboration.

Now, it is necessary to emphasize that the topic plays a very important role in the research, since topics serve as parameters for identifying the publications analyzed. Therefore, 26.92% can be identified as the topic of Chatbot for support and follow-up in mental health, 23.07% as Chatbot for the treatment of disorders, 21.15% as Educational Chatbot, 17.30% as Rehabilitation Chatbot, and 11.53% as Chatbot for treating diseases.

Table 3. *Classification of the research topic*

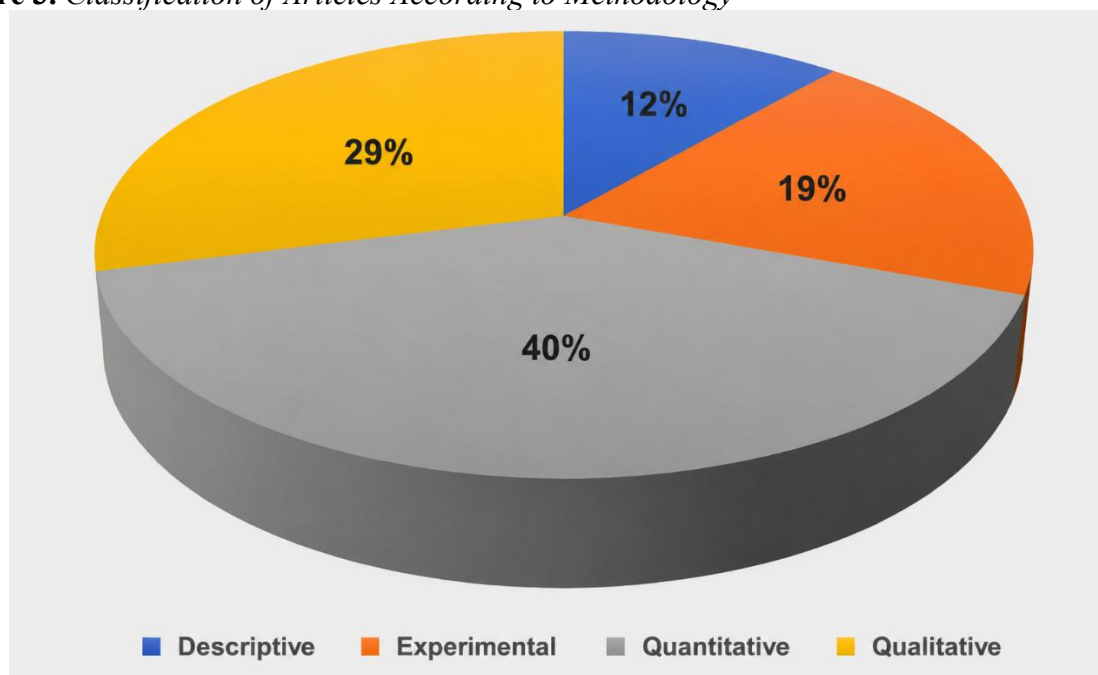
Tema investigativo	Numero de artículos	%
Rehabilitation Chatbot	9	17.30%
ChatBot educational	11	21.15%
ChatBot for support and follow-up in mental health	14	26.92%
ChatBot for the treatment of disorders	12	23.07%
ChatBot for treating diseases.	6	11.53%
Total, general	52	100%

Source: Own elaboration.

4.2 Methodological Classification of the Consulted Articles

Continuing with the classification of the articles, they were organized according to the type of publication, as indicated by its methodology; thus, 40.38% corresponded to the descriptive method, 28.84% to the experimental method, 19.23% were quantitative, and 11.53% were qualitative.

Figure 3. *Classification of Articles According to Methodology*



Source: Own elaboration.

The bibliometric review is based on the 50 articles selected from the database compiled through the standards of the PRISMA diagram, all of which were published between 2018 and 2023. These articles, drawn from databases such as Scopus, ScienceDirect, SciELO, PubMed, and Web of Science, will be presented below. Table 4 highlights their authors, main research objectives, and conclusions. All the articles are related and contribute to or provide information on projects conducted with chatbots focused on the fields of health, academia, or therapy, considering the chatbot as the central factor of study.

The bibliometric review conducted makes it possible to identify various areas and applications in which chatbots are being implemented within the health context. A clear emphasis is placed on the use of these conversational agents to provide support and follow-up in mental health, as well as for the treatment of different types of disorders. In this regard, studies such as those by Guerrero et al. (2019), Abd-Alrazaq et al. (2019), and Koulouri et al. (2022) specifically analyze the potential of chatbots in interventions aimed at improving resilience, the mental health of university students, and, more generally, as a tool for psychological support..

Another area of marked interest is medical education and training with chatbots. This includes studies such as those by Castillo and Soto (2020), Vásquez (2021), Viñas (2022), and López García de Albizu (2019), whose chatbots seek to improve education on the prevention of infectious diseases, learning about the human oral system, the performance of PCR tests, and awareness of influenza, respectively. In all cases, promising results are found regarding the pedagogical and motivational potential of these conversational technologies applied to health training.

The digital era has marked a significant change in the way we approach health and healthcare. In this context, chatbots have emerged as innovative tools that offer transformative potential in

various aspects of health, from medical care to the promotion of mental health. The bibliometric analysis conducted reveals a wide range of chatbot applications in different areas, highlighting their ability to provide personalized support, continuous follow-up, and efficient communication. Through this overview, we will explore how chatbots are currently being used to improve people's quality of life, facilitate access to medical information, and contribute to the advancement of modern healthcare. Based on the above, a detailed analysis of each of the identified topics is presented below, highlighting the objectives and main contributions of the studies.

Rehabilitation Chatbot

The cited studies cover a broad spectrum of chatbot applications in the field of health and healthcare. For example, Zobenco and Vacileev (2020) analyze the use of chatbots in dentistry to improve care and awareness among patients with congenital facial anomalies. In contrast, Bacilio (2021) evaluates the usability of a chatbot in patients with COVID-19 and its possible adverse reactions. In addition, Pino (2021) seeks to make science accessible to people with visual impairments through a chatbot that enables conversations in natural language.

In another area, Morone et al. (2021) focus on robot-assisted rehabilitation for people with neurological disabilities, highlighting the need to investigate and standardize the effectiveness of this technology. On the other hand, Calvaresi et al. (2019) and Segrelles-Calvo et al. (2021) focus their studies on smoking cessation through chatbots, emphasizing their personalized support. Meanwhile, Seitz et al. (2022) investigate the use of conversational agents in healthcare, highlighting the importance of the trust generated among users..

Furthermore, proposals such as those of Ávila-Tomás et al. (2020) and Fadhil and Schiavo (2019) also address the development of high-quality chatbots to assist smokers. The usefulness of these studies lies in their potential to improve the quality of healthcare and accessibility to health services. Chatbots can provide personalized support, continuous follow-up, and efficient communication, which contributes to innovation and the improvement of patients' quality of life. In addition, their ability to save time and resources in the management of clinical cases, as well as their adaptability to address different health needs, makes them valuable tools in the field of health and healthcare.

Educational ChatBot

In the educational field, Zobenco and Vacileev (2020) analyze the use of chatbots in dentistry to improve care for patients with congenital facial anomalies, while Bacilio (2021) focuses on evaluating the usability of a chatbot in the follow-up of patients with COVID-19. For their part, Arias-Navarrete et al. (2020) seek to implement a chatbot to advise students and improve their personalized learning management, emphasizing the chatbot's adaptation to individual needs..

In addition, C.-Y. Huang et al. (2018) developed a system called "SWITCHes" that facilitates real-time communication with a health chatbot to support users' weight and physical activity monitoring. In the field of sexual education, Fernández-Saborío (2018) designed a user interface for a chatbot intended to educate adolescents about sexual health. Similarly, Guerra and Rojas (2020) investigated the effect of learning through a chatbot on the prevention and treatment of COVID-19, demonstrating a significant increase in users' knowledge and satisfaction.

These studies, together with those previously mentioned, have as their main objective the exploration and evaluation of the use of chatbots in educational and healthcare contexts. The value of this body of research lies in its capacity to provide information, support, feedback, and motivation in an efficient and personalized manner, thereby contributing to effective learning and the promotion of healthy behaviors. Furthermore, they facilitate access to information and interaction within educational and healthcare environments, offering new opportunities to enhance individuals' well-being and quality of life.

Chatbot for the support and monitoring of mental health.

The aforementioned studies primarily aim to develop, evaluate, and apply chatbots for the support and monitoring of mental health across diverse domains and populations. Noble et al. (2021) assess the effectiveness of the Intelligent Mental Health Information Resource Assistant in supporting healthcare workers and their families in Canadian provinces, highlighting its potential as an additional point of access to mental health services when needed.

Chung et al. (2021) develop a chatbot for obstetric care and perinatal mental health, focusing on improving its usability and encouraging sustained engagement through the periodic updating of its database. Cameron et al. (2018) outline the design and development of iHelpr, a chatbot for mental healthcare, emphasizing best practices in its design, development, and ethical considerations. Morales Quintero et al. (2021) focus on the development of a chatbot for the emotional self-management of young people, reflecting on the research process within this emerging field.

For their part, Romero et al. (2020) discuss the growing presence and potential of chatbots in psychology, emphasizing the need for further evidence regarding their effectiveness and efficiency. Cueva y Medina (2020) validate the use of a chatbot for the initial diagnosis of anxiety and depressive disorders, focusing on its utility as an accessible self-diagnostic tool. Espinosa Rodríguez et al. (2018) design a chatbot to administer an ADHD questionnaire, aiming to improve care and support for students with this disorder.

These studies demonstrate the potential of chatbots in the field of mental health, providing support, information, counseling, and personalized monitoring through accessible and efficient technological platforms. Chatbots can facilitate the early detection of disorders, offer self-help resources, and enhance communication between users and healthcare professionals, thereby contributing to the promotion of mental health and self-care within the population.

Chatbot for the treatment of disorders.

These research proposals primarily aim to develop, evaluate, and apply chatbots for the treatment of mental disorders across different contexts and populations. DiPietro et al. (2019) focus on the integration of computer-assisted therapies to teach social skills, while Espinosa et al. (2018) seek to improve educational quality through a chatbot designed to identify ADHD symptoms in university students. For their part, Narynov et al. (2021) and Merino (2021) develop chatbots to address mental health needs and detect cognitive disorders through conversational dynamics.

The value of these studies lies in their capacity to provide support, early detection, and continuous monitoring in the treatment of mental disorders through accessible and efficient technological platforms. Mazera y González (2018) highlight how an application can offer

information and ongoing support for chronic conditions such as renal insufficiency, while Arrabales (2020) and Hernández y Barrera (2021) explore the use of chatbots for the detection and support of emotional disorders such as depression and anxiety.

The studies conducted by Lotero et al. (2022), Muñoz et al. (2021), Bermejo et al. (2020), Castro y Arias (2021), and Hernández y Barrera (2021) emphasize how these digital tools can enhance early detection, access to information, emotional support, and personalized treatment for a wide range of mental disorders. This can have a significant impact on the promotion of mental health, the prevention of disorders, and the improvement of the quality of life of affected individuals.

Chatbot for the treatment of diseases.

The aforementioned studies primarily aim to develop and evaluate chatbots for the treatment of general diseases across different contexts and populations. Valencia Mesías (2020) focus on the design of a mechatronic system to adapt robots within the hospital setting, particularly for the classification and transport of surgical materials. Álvarez et al. (2022) seek to create a tool for the assessment and management of pediatric oncological pain, while Arimov et al. (2021) employ telemedicine technologies to evaluate the effectiveness of a bot in asthma monitoring and patients' adherence to self-management tools.

The value of these studies lies in their capacity to improve healthcare delivery and disease management through technology. Martínez (2021) highlights the optimization of chatbots to provide accurate information on diseases such as melanoma and ALS, with access to a cloud-based database and the capability to operate with online servers. Viñas (2022) evaluates the usefulness of a chatbot as an assistant during cardiopulmonary resuscitation (CPR), which can be crucial for individuals without medical training.

Furthermore, Mazera y González (2018) emphasize the importance of understanding and sharing information about chronic diseases such as chronic kidney failure, providing access to personalized information for patients, families, and healthcare professionals. This significantly contributes to patient empowerment and to strengthening communication and knowledge within the medical field. In summary, these studies demonstrate how chatbot technology can serve as a valuable tool for improving healthcare delivery, disease management, and access to relevant information for patients, caregivers, and healthcare professionals.

In terms of the main conclusions, it was found that the application of chatbots in the healthcare domain is a highly active and continuously expanding field. Most studies focus on their implementation in mental health-related applications, followed by their use in educational and learning contexts. This suggests that chatbots have significant potential to support and monitor mental health conditions, as well as to contribute to the treatment of various disorders.

Furthermore, various thematic areas were identified in which chatbots are being applied, such as the care of patients with ASD, surgical navigation, the rehabilitation of individuals with neurological disabilities, and education in the healthcare domain. Each of these areas offers a unique approach to chatbot implementation, with specific benefits for both patients and healthcare professionals.

In summary, the bibliometric review conducted in this study highlights the growing importance of chatbots in the field of healthcare. The findings suggest that chatbots have significant potential to improve healthcare delivery and to provide support in both mental health and health education. However, the need for further research and evaluation of these systems is also acknowledged in order to ensure their effectiveness and relevance within the healthcare domain.

5. CONCLUSIONS

The present study aimed to characterize scientific publications on the implementation of chatbots in the field of healthcare. Although the qualitative bibliometric review of 50 articles indexed between 2018 and 2023 made it possible to satisfactorily achieve this objective, it is important to acknowledge certain limitations of the study. First, as a documentary analysis, the findings are limited to the literature published in the databases consulted during the established period, and therefore other relevant works not considered may exist. Likewise, while the qualitative approach employed allows for an in-depth understanding, it does not permit statistical generalizations. Nevertheless, the findings obtained establish a valuable precedent by providing a comprehensive characterization of the current state of research on chatbots in healthcare, identifying trends, predominant methodological approaches, and priority areas of application. This creates a positive opportunity for future research to further develop this line of inquiry, expanding its scope, incorporating additional perspectives, and exploring new dimensions related to this emerging technology in the healthcare domain.

The keyword co-occurrence analyses conducted revealed the existence of four main axes or focal areas within the studies examined: research on academic and scientific communication among humans, with particular emphasis on exploring gender differences; applications of chatbots and artificial intelligence specifically within the context of mental health; studies addressing the impact of the COVID-19 pandemic across multiple dimensions of public health; and research on emerging digital technologies and platforms for the delivery of various healthcare services. These findings reflect a marked contemporary interest in analyzing, from an integrative perspective, the potential of technologies to address complex issues related to health and communication within this field.

With regard to the classification by thematic areas, it was found that the primary emphasis lies in the implementation of chatbots for various applications related to mental health, followed by their use in educational and learning contexts. Likewise, among the research topics addressed, particular prominence is given to the support and monitoring of mental health conditions and the treatment of different types of disorders through chatbots. Furthermore, in terms of the methodologies employed, studies with descriptive, experimental, and quantitative approaches predominate.

In summary, the bibliometric analysis carried out in this study leads to the conclusion that research on chatbots within the broad field of healthcare currently constitutes a highly active and rapidly expanding area, with promising benefits for both direct patient care and medical education. Nevertheless, further controlled studies are still required to more rigorously evaluate the actual effectiveness of these artificial intelligence applications before proceeding with large-scale implementation.

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Conceptualization: Cortés Torres, José, Saldaña Moreno, Carol and Mendoza Moncada, Juan. **Methodology:** Cortés Torres, José and Saldaña Moreno, Carol. **Software:** Perdomo Pineda, Jesús. **Validation:** Cortés Torres, José and Mendoza Moncada, Juan. **Formal analysis:** Cortés Torres, José and Saldaña Moreno, Carol. **Data curation:** Perdomo Pineda, Jesús. **Writing—original draft preparation:** Saldaña Moreno, Carol. **Writing—review and editing:** Mendoza Moncada, Juan. **Visualization:** Cortés Torres, José. **Supervision:** Cortés Torres, José. **Project administration:** Cortés Torres, José. **All authors have read and agreed to the published version of the manuscript:** Cortés Torres, José, Saldaña Moreno, Carol, Mendoza Moncada, Juan and Perdomo Pineda, Jesús.

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AUTHORS

José Eduardo Cortés Torres

Manuela Beltrán University.

PhD candidate in Education at César Vallejo University, holds a Master's degree in Mother Tongue Pedagogy and a Bachelor's degree in Basic Education with an emphasis in Humanities and Spanish Language (Francisco José de Caldas University distrital). He is a full-time faculty member at Manuela Beltrán University and a researcher in mother tongue education, as well as the developer of initiatives that integrate pedagogy, literature, and the humanities.

jose.cortes@docentes.umb.edu.co

Orcid ID: <https://orcid.org/0000-0002-7309-1949>

Google Scholar: <https://scholar.google.com/citations?user=r0ANwiMAAAAJ&hl=es>

Carol Estefanía Saldaña Moreno

Manuela Beltrán University.

Biomedical Engineering student at Manuela Beltrán University. Holds technical training in Basic Electronics and Multimedia Production, as well as coursework in Creativity and Innovation at the National University. She is a member of a university research seedbed in which a research project is being conducted alongside the development of a prototype.

carolsaldana.em@academia.umb.edu.co

Orcid ID: <https://orcid.org/0009-0005-0034-9805>

Juan Sebastián Mendoza Moncada

Manuela Beltrán University.

Software Engineering student at Manuela Beltrán University. Holds technical training in Software Programming, with knowledge of programming languages such as C#, Java, and Python, as well as web development using HTML, CSS, and JavaScript. Certified in Bosch Rexroth Industry 4.0 and in Brain–Computer Interfaces by P4H Bionics. Currently pursuing online studies in Sports Nutrition through Edutin Academy.

juanmendoza.sm@academia.umb.edu.co

Orcid ID: <https://orcid.org/0009-0002-1289-8244>

Jesús David Perdomo Pineda

Manuela Beltrán University.

Biomedical Engineering student at Manuela Beltrán University, with a well-developed set of technical and theoretical skills in software engineering and programming, particularly in languages such as Java and C++. Holds a certification in the Russian language issued by Kazan Federal University, Russia.

jesusperdomo.dp@academia.umb.edu.co

Orcid ID: <https://orcid.org/0009-0002-8017-8644>



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