Hamburg University of Applied Sciences

Faculty of Life Sciences

Maternal Mental Health And The Role of Artificial Intelligence-Based Conversational Agents: A Scoping Review

Master Thesis

Master of Public Health

Submitted By

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Abstract

Background: The physical and psychological changes, as well as events associated with the perinatal period, can have a very distressing impact on maternal mental health. About 20% of women experience a mental health problem during the perinatal period, and this remains a global public health problem. Due to the limitations of traditional in-person care, attention has recently shifted to digital methods for more innovative approaches to addressing mental health-related issues. Growing research interest is now towards the use of AI-based conversational agents within the digital mental health field. This thesis thus aimed to highlight how AI-based conversational agents developed for the perinatal context support maternal mental health during the perinatal period.

Methods: This scoping review was conducted, guided by the framework of Arksey and O'Malley, the JBI scoping review recommendations, and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR). A search was performed across seven electronic databases (MEDLINE, CINAHL, ACM Digital Library, Cochrane Central, IEEE Xplore, Scopus, and ScienceDirect), as well as an additional search in Google Scholar. Primary studies of different study designs published between 2014 and 2024 in English were included during the search.

Results: A total of six studies were included in this review, and data was extracted. The studies were mostly conducted in HICs (n = 4). The mental health condition that was most addressed was depression and depressive symptoms (n = 5). Narrative synthesis presented the basic shared functionalities of AI-based conversational agents used in the perinatal mental health context, with other unique features being specific to their intervention target. Thematic analysis identified five themes as facilitators and four themes as barriers. Digital benefits stood as the dominant facilitator, while Technological challenges were the dominant barrier to engagement with these agents among perinatal women.

Conclusion: Interaction with AI-based conversational agents during the perinatal period has a positive impact on maternal mental health. Continued engagement with these agents and with the features of their associated platforms also provides support in other aspects of maternal well-being. To increase the generalisability of findings, and enhance engagement among perinatal women, future studies should prioritise higher methodological designs and the use of more advanced-level NLP techniques in developing these conversational agents.

Keywords: Maternal mental health, Artificial Intelligence, Conversational agents, Chatbots, Scoping review

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List of Acronyms and Abbreviations

AI	Artificial Intelligence
BA	Behavioural Activation
CAs	Conversational Agents
CBT	Cognitive Behavioural Therapy
HICs	High Income Countries
JBI	Joanna Briggs Institute
LICs	Low-Income Countries
LMICs	Low and Middle-Income Countries
MeSH	Medical Subject Headings
NLP	Natural Language Processing
PHQ-9	Patient Health Questionnaire
PICO	Population, Intervention, Comparison, Outcome
PRISMA-ScR	Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews
RCT	Randomised Controlled Trial
SCT	Social Cognitive Theory
SDGs	Sustainable Development Goals
UX	User Experience
WHO	World Health Organisation

1. Introduction

Maternal mental health issues are a major public health problem globally (Dadi et al., 2020; Kathree et al., 2014; Roddy Mitchell et al., 2023). They now require more innovative intervention strategies in addressing them. Problems associated with maternal mental health affect 10% of pregnant women and 13% of post-partum mothers, with higher prevalence rates, 15.6% and 19.8%, occurring in developing countries (WHO, 2019). Although there have been efforts to mitigate the mental health challenges associated with the pre- and post-partum period through traditional in-person care and various interventions, challenges such as accessibility and associated stigma on mental health issues still pose a barrier. This has resulted in the need to prioritise real-time support through digital health interventions. Significant technological advancements in digital health have now led to the integration of Artificial Intelligence (AI) in the mental health space (D'Alfonso, 2020) and its application as AI-based conversational agents for specific causes and populations (Greer et al., 2019; Oh et al., 2021). However, little is known about their application for the pregnant and postpartum population and their role in supporting them. This thesis explores current information on the role of artificial intelligence-based conversational agents in supporting maternal mental health during the perinatal period. This study focuses on maternal mental health within the perinatal period, as this is the time with the most significant impact on maternal mental health. The following sections of this chapter provide background information on the study, aim and significance.

1.1 Mental Health In The Perinatal Period

Mental health during the perinatal period refers to the maternal mental health problems associated with this time, and how they impact not only the woman but also have broader implications for the family and society at large.

The heightened state of physical, emotional and social vulnerability during the pregnancy period until the first year after birth, also known as the perinatal period, increases the woman's susceptibility to poor mental health and well-being. Almost 1 in 5 women will experience a mental health condition during pregnancy or in the year after birth (World Health Organisation, 2022). The most recurring expressions of mental health-related problems in pregnant and post-partum women are depression and anxiety. Experiences of depression range from mild to moderate to severe, and anxiety and its related disorders are reported as: generalised anxiety disorder, social anxiety disorder, posttraumatic stress disorder, obsessive-compulsive disorder,

panic disorder, and adjustment disorder (Awini et al., 2023; Banti et al., 2011; Roddy Mitchell et al., 2023). Aside from depression and anxiety, mental health-related problems in the perinatal period also express as intrusive thoughts and mania, substance use disorder, eating disorder, bipolar disorder, low mood, poor self-care, increased likelihood for smoking and alcohol usage, sleep disturbances, suicidal ideation and self-harm (Healey et al., 2013; Howard et al., 2014; Legazpi et al., 2022). World Health Organisation (2022) states that 20% of women who have perinatal mental health conditions will also have suicidal thoughts and engage in acts of self-harm. Self-harm has been reported to be a major risk factor for suicide within the perinatal period and a leading cause of maternal mortality (Johannsen et al., 2020). Other life-threatening conditions reportedly associated with mental health-related problems in the perinatal period are pre-eclampsia, diabetes and an increased risk of cardiovascular and autoimmune diseases (Bränn et al., 2024).

Despite the positive anticipation of motherhood, the mental health challenges associated with the perinatal period significantly impact not only the woman but also the mother-infant relationship, the mental health of the father (Staneva et al., 2015; Nath et al., 2019; Wee et al., 2011) and further has economic implications for society. For example, the high cost burden in the United Kingdom, particularly to health and social care, was estimated to be £75,728 and £34,840 per woman lifetime for perinatal depression and anxiety, respectively, with an aggregate cost of £6.6 billion for the country (Bauer et al., 2016).

Long-term adverse effects have also been reported as an increased risk of death in women with post-partum depression compared to those who did not have it, and also an increased risk of cancer-specific mortality after perinatal depression as far as 18 years post-diagnosis (Hagatulah et al., 2024). Adverse consequences of maternal mental health-related problems during the perinatal period, persisting in the long term, are not only specific to the mother but also extend to the child well into childhood and adolescence and are usually expressed as emotional and behavioural problems (Korhonen et al., 2012; Leis et al., 2014). These adverse outcomes underscore the need for adequate support during the perinatal period, particularly in the early stages of pregnancy.

1.1.1 Social Support and Health Interventions

Social support during the perinatal period is crucial for optimum maternal well-being and health-related quality of life (Webster et al., 2011). Significant associations between depression,

anxiety and self-harm in pregnant and post-partum women who received low social support have been reported (Bedaso et al., 2021). Social support comprises two dimensions: structural and functional support. Structural support is received either formally from health professionals and services, or informally from family, friends or partners (Leahy-Warren et al., 2011; Sufredini et al., 2022). The functional dimension is categorised according to House's theory of social support into four types: emotional, informational, instrumental and appraisal support (House, 1981; Langford et al., 1997; Sufredini et al., 2022).
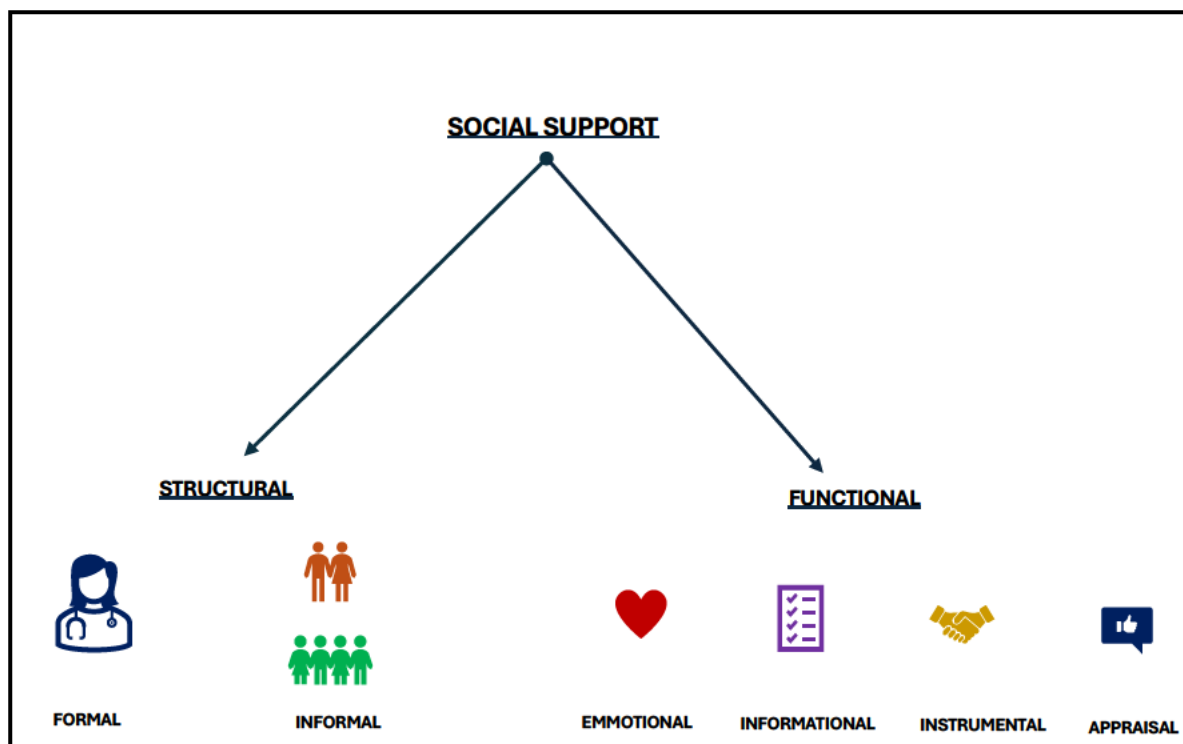
Figure 1: Dimensions of Social Support. Own Figure based on information from Leahy-Warren et al., 2011, Sufredini et al., 2022 and House, 1981.

In providing social support to mitigate the effects of health-related challenges, one means by which social support is expressed is through interventions. Interventions exhibit the functional dimension of social support and can either be emotional, instrumental, or informational, thus leading to better psychological and overall health (Hogan et al., 2002). Thus, studies in recent years have explored both pharmacotherapeutic (Hantsoo et al., 2014; Meltzer-Brody et al., 2018) and non-pharmacological forms of intervention (Ladyman et al., 2020; Swanson et al., 2018; Teychenne et al., 2021) to mitigate mental health-related problems in the perinatal period and provide support for pregnant and postpartum women.

Although studies have reported positive associations between these interventions and fewer depressive and anxiety symptoms, improved physical health, better sleep quality and mood, there are still limitations to their impact. Conflicting evidence on the benefits of pharmacotherapy as well as the unavailability and inaccessibility of non-pharmacological interventions by care systems, particularly in low- and middle-income countries, limit intervention efforts to mitigate maternal mental health-related conditions (Almeida et al., 2016; Palmsten et al., 2013; Sambrook Smith et al., 2019; Roddy Mitchell et al., 2023). These drawbacks, as well as increased recognition of the critical role of mental health in maternal and child well-being, resulted in the prioritisation of perinatal mental health services worldwide.

1.2 Maternal Mental Health Services

In 2022, the WHO launched a guide for integrating perinatal mental health in maternal and child health services (World Health Organisation, 2022), offering high-quality information to aid mental health services in identifying perinatal mental health symptoms and appropriately responding. The global prioritisation efforts, therefore, led to progress in maternal mental health services both in HICs and LMICs.

High-income countries (HICs) integrated mental health support into maternal healthcare systems, with evidence-based interventions like routine depression screening and digital mental health services being implemented to support mothers during the perinatal period. While in low- and middle-income countries (LMICs), task-shifting approaches and community-based interventions have demonstrated potential for improving mental health outcomes despite resource limitations (Oladeji et al., 2024; Wilson et al., 2024).

Despite the progress, significant challenges in accessing perinatal mental health services remain. In HICs, even in nations with strong healthcare systems, financial costs remain a barrier for uninsured people or those whose insurance does not cover mental health adequately. Other persisting barriers include geographic inaccessibility, systemic inequities faced by racial and ethnic minority populations and language barriers (Wilson et al., 2024). In LMICs, the situation is more challenging. Limited availability of mental health professionals, inadequate training for primary healthcare providers, and the absence of integrated mental health services in maternity care facilities create a significant gap in care (Baron et al., 2016). Resource constraints also limit the availability of adequate infrastructure. Socioeconomic factors, including poverty and

transportation barriers, further exacerbate access issues, while cultural misconceptions about mental illness and gender dynamics inhibit help-seeking behaviours.

Another dominant challenge in both HICS and LMICs is the issue of stigma. In HICs, the stigma around mental illness continues to discourage mothers from seeking support, particularly in cultures where maternal self-sacrifice is idealised and emotional vulnerability is stigmatised (Iturralde et al., 2021). In LICs, misinformation and cultural beliefs about mental illness frequently contribute to stigma, further marginalising affected women. These existing limitations in mental health services and the prevailing socio-cultural barriers, therefore, require a different approach to addressing maternal mental health-related conditions.

1.3 Digital Mental Health Interventions

The global surge in mental health crises in recent years and existing barriers to accessing psychological help in most healthcare services have led to the consideration of technological innovations and solutions to address the magnitude of the crises. With the eruption of digital technology systems, research groups have now been driven to focus on how technology might be used to provide self-guided psychological interventions to individuals with mental health issues. Digital technologies, therefore, offered the potential to increase service efficiency and costs, treatment access, collaborative decision-making, and the availability of reliable data to help clinicians make treatment decisions (Bucci et al., 2019). These platforms also enable people to self-monitor and self-manage in ways that face-to-face and paper-based evaluation approaches did not previously allow.

Digital mental health interventions have recently become popular as they have become a way to address accessibility to traditional in-person care (Anthes, 2016; Schueller et al., 2019). The utilisation of telehealth and mobile mental health services became pertinent during the COVID-19 pandemic and its resultant effect on mental health globally. Increased rates of psychological distress and mental health-related problems reported by countries necessitated the need to support the mental health of people in real-time (Strudwick et al., 2021; Andino et al., 2024).

Some digital solutions primarily provide psychoeducation regarding challenges, offering individuals accessible, structured, and interactive information that helps them cope with difficult situations (Ben-Zeev et al., 2013, 2014). For instance, people who have utilised mobile mental health apps were reportedly attracted to the '24/7' availability of support via mobile

technology (Carpenter-Song et al., 2020), further reiterating the importance of support, particularly informational, instrumental and appraisal dimensions of support.

Before delving further into the current advancements in digital mental health interventions, it is essential to highlight the importance of understanding key frameworks that can explain how individuals interact with, sustain their use of, and perceive the benefits and support received through health interventions. One fundamental way this can be understood is in the conceptual use of behavioural theories.

1.3.1 Health Behaviour Theories and Digital Mental Health Interventions

Interaction with digital mental health interventions can also be shaped by the dynamic interplay between individual cognitive factors and the social environments in which users engage with these technologies. Different theories of behaviour have been established over time, and although prominent ones like the Health Belief Model, Theory of Planned Behaviour and the Transtheoretical Model have been used to explain how individuals perceive health risks, assess the advantages of intervention and make decisions about preventive or therapeutic action, the theory that offers a sound conceptual basis for explaining the behavioural dynamics influencing the interaction with digital mental health interventions is one of the theories at the interpersonal level of influence, Social Cognitive Theory.

Developed by Bandura (1986), the Social Cognitive Theory explains a dynamic, ongoing process in which personal factors, environmental factors, and human behaviour exert influence upon each other (Ganz & Rimer, 2005). This theory includes constructs that, viewed in the context of digital mental health interventions, provide an important conceptual framework for design and application. The following paragraph explains the constructs of the SCT in the context of digital health interventions.

One core construct central to SCT is self-efficacy. It refers to an individual's belief in their ability to execute behaviours necessary to produce specific outcomes (Bandura, 1977). Digital mental health interventions that include goal setting, personalised feedback, or interactive skills training activities aim to increase users' self-efficacy, thus promoting continued use and evoking behavioural change. Outcome expectations, another core construct, refer to beliefs about the anticipated effects of a behaviour. Digital mental health applications typically focus on expected benefits, such as stress reduction or improved mood, through psychoeducational content and

supportive statements, which would therefore drive positive outcome expectancies that facilitate engagement and use. Observational learning, another construct, is the acquisition of behaviours through observing models, and is also exhibited in digital mental health interventions through simulated dialogues and reinforcement tools like motivational messages and symptom reduction feedback, offering users the opportunity to learn adaptive behaviours. Reinforcement mechanisms, like progress tracking and automated supportive messages, are often integrated to encourage repeated engagement and reinforce positive behaviour (Baumel et al., 2019).

Lastly, the construct of Reciprocal Determinism, which describes the interactions between behaviour, personal factors, and environmental factors, and their simultaneous influence on each other, guides the adaptive design of digital interventions based on real-time user feedback, helping to modify the content to support behavioural persistence. Therefore, social cognitive theory, as a conceptual basis for digital mental health interventions, provides a valuable explanation of the benefits of these interventions in improving emotional and mental health, facilitating sustainable behavioural change and providing meaningful support. Having established the benefit of this theory as a conceptual guide for understanding how users engage with these interventions and the resulting psychological outcomes, the current landscape and advancements in technology that reveal the study gap necessitating this study are discussed in the subsequent sections of this chapter.

1.4 Application of AI-Based Conversational Agents in Mental Health

Artificial Intelligence (AI) generally refers to a set of systems and computing methods that enable machines to perform tasks typically requiring human intelligence, such as learning, reasoning, and problem-solving (Wang & Preininger, 2019). A key branch of AI, known as Natural Language Processing (NLP), applies Machine Learning and deep learning techniques to understand and generate human language-driven capabilities such as speech recognition, automated translations, and intelligent chatbots. One prominent utilisation of AI within the digital mental health space is through the use of conversational agents, usually referred to as "chatbots". Chatbots evolved in the mid-2000s from the earlier models into more dynamic models and began to be integrated into web services and e-commerce platforms. This then paved the way for modern intelligent assistants, which are a sort of personal virtual assistants of intelligent voice, also known as Voicebot and were incorporated into mobile devices,

computers and smart speakers like Apple's Siri, Google's Google Assistant, Microsoft's Cortana and Amazon's Alexa (Adamopoulou & Moussiades, 2020; Mariciuc, 2022). Now, with the use of deep learning and NLP for more advanced conversational tasks, chatbots have become more dynamic, contextually aware and human-like conversational agents.

AI-based conversational agents have been explored in behavioural health, reproductive health education, and for specific populations (Oh et al., 2021; Maeda et al., 2020; Greer et al., 2019). They are now being applied as digital mental health interventions in the digital mental health space and have emerged as innovative tools that can deliver scalable, accessible, and personalised mental health interventions. AI-based conversational agents integrated into digital mental health interventions have been explored for conditions like anxiety, depression and substance use (D'Alfonso, 2020; Ahmed et al., 2021; Wibhowo & Sanjaya, 2021). They are typically task-oriented and function in content delivery and symptom management. They also offer psychoeducation, cognitive-behavioural therapy (CBT), and emotional support in a 24/7 format, thus addressing barriers to mental health care.

Mental health-related apps with conversational agents or chatbot features have become increasingly popular and are available on both the iOS and Android app stores, with some apps on the Android store achieving at least 1 million downloads (Martinengo et al., 2022). Users and research participants who have engaged with mental health AI-based conversational agents have found them trustworthy and especially useful in supporting mental health management. Users have also described the personality of conversational agents as "coach-like", characterised by being encouraging, nurturing and motivating (Car et al., 2020).

1.5 Justification

Despite the increasing application of AI-based conversational agents in the field of mental health, little is known about their usage in the context of maternal mental health. The perinatal period is a life-changing period for pregnant and postpartum women, and the limited research focusing specifically on the use of AI-based conversational agents as digital interventions for maternal mental health necessitates a comprehensive synthesis of current evidence to justify their role in supporting the perinatal population. As AI-based conversational agents are accessible and can go beyond the reach of the limited availability of mental health care providers, being able to provide timely information, care, and support for mental health-related

conditions to women during the perinatal period, it is crucial to explore them as an intervention option.

Hence, in line with this existing gap and also to promote digital interventions that support maternal mental health and prevent mental health-related conditions and disorders for pregnant and postpartum women, this study seeks to explore the role of AI-based conversational agents as digital mental health interventions in supporting maternal mental health within the perinatal period. Recent reviews have been carried out on digital mental health interventions for perinatal mental health and other AI-related interventions (Hanach et al., 2021; Kwok et al., 2024), but to the best of the researcher's knowledge, no review has focused on the role that AI-based conversational agents play in maternal mental health support during the perinatal period.

By exploring this topic, this study aims to present an evidence-based opportunity to address the public health crisis of maternal mental health, thereby informing future research, clinical application, and policy development. Furthermore, this goal aligns with the World Health Organisation's Mental Health Action Plan, which emphasises the need to integrate digital tools into mental health care delivery to improve accessibility and outcomes globally (World Health Organisation, 2021).

1.5.1 Contribution to the Sustainable Development Goals

This study makes a significant contribution to achieving the United Nations' Sustainable Development Goals. (SDG), particularly to SDG 3 (Good Health and Well-being) and its related targets. Its other noteworthy contributions are to SDG 5 (Gender Equality) and SDG 10 (Reduced Inequalities). Investigating the role of AI-based conversational agents (CAs) as a digital mental health intervention for maternal mental health is crucial in addressing critical targets within these goals, some of which are highlighted in the following paragraphs.

Figure 2: SDGs supported by the utilisation of AI-based Conversational Agents. SDG icons from United Nations. (n.d). THE 17 GOALS | Sustainable Development [Infographic]. https://sdgs.un.org/goals

SDG 3 (Good Health and Well-being): Target 3.1 of this goal aims to reduce the global maternal mortality ratio to less than 70 per 100,000 live births by 2030. Target 3.4 aims to reduce premature mortality from non-communicable diseases by one-third through prevention and treatment, and to promote mental health and well-being. Maternal mental health conditions are a leading cause of preventable maternal deaths in the perinatal period (Gimbel et al., 2024) and a major contributor to non-communicable disease burdens in women (Howard et al., 2014). By exploring the potential of AI conversational agents to enhance support and access to mental health care for women during the perinatal period, this study addresses the need for scalable, evidence-based interventions that can help reduce the prevalence of these conditions, thereby promoting mental health and well-being and contributing to the goal.

SDG 5 (Gender Equality): Target 5.6 of this goal aims to ensure universal access to sexual and reproductive health and reproductive rights. Maternal mental health is an important aspect of reproductive health. Women experience unique mental health challenges compounded by social stigma and cultural barriers during the perinatal period, which hinders access to traditional therapeutic resources (Slomian et al., 2019). The anonymity and nonjudgmental ease of interacting with AI conversational agents create a safe space for perinatal women, thereby addressing these barriers and contributing to this goal.

SDG 10 (Reduced Inequalities): Target 10.3 of this goal aims to ensure equal opportunity and reduce inequalities of outcomes. Access to mental health support and care remains unequal, particularly for those in marginalised communities and rural areas. AI-based conversational agents have the potential to address these disparities, as they offer a cost-effective and culturally adaptable digital mental health intervention for a diverse audience, thereby contributing to the promotion of equal opportunities and the reduction of inequalities. By exploring the role of AI-based conversational agents as a digital mental health intervention for maternal mental health, this study makes a significant contribution to this goal.

Following the identified study gap and the presented justification for this study, the main research question, sub-research questions and study objectives are provided in the following chapter.

2. Research Question and Objectives

Based on the established background, the following main research question was developed for this study:

How do Artificial Intelligence-based conversational agents support maternal mental health during the perinatal period, and what features and contextual factors influence their acceptance and engagement among perinatal women?

Sub-Research Questions:

1. What key features and functionalities of AI-based conversational agents have been adopted in maternal mental health?
2. How does the interaction with AI-based conversational agents impact maternal mental health?
3. What facilitators and barriers influence the acceptance and use of AI-based conversational agents among perinatal women?

Specific Objectives:

1. To outline and describe the primary features and functionalities of AI-based conversational agents that have been explored in maternal mental health.
2. To explore the reported impact of the interaction with AI-based conversational agents on the mental health of perinatal women.
3. To identify the facilitators and challenges to the acceptance and engagement with AI-based conversational agents among perinatal women.

2.1 Approach And Structure

To synthesise current knowledge and present the accurate scope of available evidence on the use of AI-based conversational agents as digital mental health interventions to support maternal mental health, this study will utilise a scoping review approach. Because the application of AI in mental health is a rapidly emerging research area, and because scoping reviews offer a comprehensive overview of existing literature and the current state of knowledge in evolving

fields, a scoping review is the appropriate method for this study. Furthermore, scoping reviews have the potential to enhance healthcare practice, policy, and research (Colquhoun et al., 2014).

Following the introductory chapter and research questions in chapters 1 and 2, respectively, a methodology section guided by the framework for scoping reviews proposed by (Arksey & O'Malley, 2005) is described in chapter 3. The Inclusion and exclusion criteria, search strategy, data extraction and synthesis are presented in detail. The results and findings of this study are presented in chapter 4. This is followed by a discussion of the study's results and findings, in accordance with the research aim, in chapter 5. It also includes implications for practice and recommendations for future research. Finally, the conclusion of this thesis work is presented in chapter 6.

3. Methodology

3.1 Study Design

This study is conducted using the methodological approach of a scoping review. A scoping review identifies all available evidence to assess and understand the extent and nature of research activity in a topic of interest. It is particularly useful in rapidly mapping evidence in developing areas while preserving rigorous search and study selection methods, and can therefore act as a precursor to full systematic reviews (Munn et al., 2018).

The conduct of this scoping review is guided by the framework for scoping reviews proposed by (Arksey & O'Malley, 2005) and expanded on by (Levac et al., 2010), which includes the following: i) identifying the research question; ii) identifying relevant studies; iii) selecting relevant studies; iv) charting the data; and v) collating, summarising, and reporting results. In addition, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) (Tricco et al., 2018), is also used to guide the reporting.

3.2 Eligibility Criteria

The development of the specific inclusion criteria for a scoping review is guided and directed by the scoping review's research question (The Joanna Briggs Institute, 2015). Thus, in line with the developed research question, the eligibility criteria for relevant studies were determined using the PICO (*Population*, *Intervention*, *Comparison*, *Outcome*) tool. Two additional constructs were added to the framework, *Publication* and *Study Design,* which served as filters during the search process to obtain a more defined search result within the confines of the research aim. Table 1 summarises the inclusion and exclusion criteria based on this format. Although the PCC framework (P - *Population,* C - *Concept* and C – *Context*) is widely used in scoping reviews, the PICO framework, developed by Richardson et al. (1995), was used in this study since it provides a more structured and precise approach to identifying and selecting relevant studies, with a defined population, intervention and outcome as opposed to the PCC, which is broader. Moreover, the Intervention and Outcomes fall within the *"Concept"* of the study's aim. The study's *"Context"* is focused on studies within the perinatal period. However, the setting was left "open" to accommodate a broader context and better understand the knowledge available within the global context.

PICO	Inclusion Criteria	Exclusion Criteria
Population	Pregnant, Prenatal and Post-partum women and adolescents (up to 12 months after delivery)	Non-pregnant or non-post-partum women and children
Intervention	Usage/ interaction with mobile application or web-based Artificial intelligence-based conversational agents ("Chatbots")	Other digital interventions without the application of AI conversational agents.
Comparator	Not relevant	
Outcome	Any reported mental health-related impact or measures after usage/interaction with conversational agent	No reported mental health-related impact or measures
Publication	Studies published between 2014 and 2024 in full-text journals with title, abstract and full text in English	Unpublished studies and studies in other languages
Study Design	Quantitative studies, Qualitative studies, Clinical studies, Mixed-methods studies, Case studies	Reviews and Meta-Analyses

Table 1: PICO Framework (Richardson et al., 1995) with the addition of Publication and Study Design. Own Table

3.2.1 Population

The population for this review consisted of pregnant, perinatal, and postpartum women. Pregnant women at any stage of pregnancy and post-partum women up to 12 months after delivery are included. As the focus is on supporting maternal mental health within the perinatal period, the chosen population is in line with this. In this context, gender was not used as an inclusion or exclusion criterion, as the population of interest was in line with the study title and aim, "maternal mental health," which in this use case refers specifically to women. There was flexibility in the age of participants included, and adolescents were also included, as this group is also susceptible to maternal mental health problems. The socioeconomic status or employment status of the population is not included as an inclusion or exclusion criterion because maternal mental health applies to all women regardless of socioeconomic or employment status. This study excludes studies carried out on non-pregnant, non-postpartum

women, women in preconception care and children as they have no connection to the research aim and questions and will therefore not be relevant to include.

3.2.2 Intervention

Studies are included if the intervention or concept of interest focuses on AI-based conversational agents and chatbots, and their applicability within the context of maternal mental health or perinatal mental health. It did not matter if it was a standalone conversational agent in a mobile or web-based form or if it was integrated into a mobile or web-based mental health application. The determining factor was the usage or interaction with the conversational agent or chatbot feature of the mobile application. Studies involving other digital interventions for mental health within the perinatal period without the use of AI-based conversational agents or chatbots as part of their features were excluded from this review. Studies with machine learning models, AI screening tools for mental health or depression risk and cognitive behavioural apps without chatbot features are excluded.

This study aimed to explore and map out currently available information; hence, there was no need to compare the usage of AI-based conversational agents with other AI and digital mental health interventions. The comparator section in the tool is, therefore, not relevant.

3.2.3 Outcome

Studies exploring the usage of a conversational agent or a mobile application with a chatbot feature and its outcome on any targeted maternal mental health-related issue were included. Studies addressing support for the study population and reporting any mental health-related impact or measures, whether via quantitative or qualitative reports, after participants' usage or interaction with a conversational agent or chatbot feature, were included in this review. Studies that explored conversational agents or an application-based chatbot feature for supporting the study population within the perinatal period but reported no mental health-related impact, whether by quantitative or qualitative measures, were excluded.

3.2.4 Publication

Due to the emerging nature of this research topic and in line with charting out the most current information, this study included only articles published between 2014 and 2024. The selection period was until 2024, as this is when the search for articles was conducted. Selection was limited to studies with titles, abstracts, and full-text in English and published in full-text journals. Unpublished studies, studies published but not within the indicated time frame, and studies not published in English were excluded.

3.2.5 Study Design

Since this review aimed to investigate current evidence on a relatively emerging topic area, minimal restrictions were made to the study designs used in the included articles. Inclusion criteria allowed for the inclusion of quantitative, qualitative, mixed-methods, case studies, pilot studies and clinical studies. This is also in line with the JBI scoping review recommendations (The Joanna Briggs Institute, 2015). Although scoping reviews allow for a broad inclusion of evidence sources and study designs, including secondary studies, and despite offering the most substantial degree of evidence, secondary studies (reviews and meta-analyses) were excluded from this review as this review sought to explore the real state of available evidence and not a secondary account of available information.

Finally, there were no restrictions on the geographical location where the included studies were carried out or the classification by income level of the countries of publication, as the setting was based on available evidence within the global context.

3.3 Information Sources

The literature search was carried out between the 28th of October 2024 and the 6th of November 2024, on the following databases:

- MEDLINE (Medical Literature Analysis and Retrieval System Online) via PubMed
- CINAHL (Cumulative Index to Nursing and Allied Health Literature) via Ebsco
- ACM (Association for Computing Machinery) Digital Library
- Cochrane Central Register of Controlled Trials
- IEEE Xplore

- Scopus
- ScienceDirect

The listed databases are those important for health-related and medical articles. The ACM Digital Library and IEEE Xplore databases are computing, engineering and technology-related databases that were necessary to include in the systematic search due to the topic of research and research questions.

A complementary search was also conducted on Google Scholar on the 7th of November 2024, using an adjusted search string to provide a wider selection of articles. Following the first and second stages of screening, a brief additional search was conducted on the ProQuest database to explore the possibility of grey literature as well as the reference lists of relevant review articles.

3.4 Search Strategy

Search terms were developed under word categories related to the research aim, which include *'maternal health'*, *'mental health'*, *'digital mental health intervention'* and *'artificial intelligence'*. Specific keywords, synonyms and related words for each category were then developed as search terms to be included in the search string. (See Appendix 1). The search strings were a combination of MESH (Medical Subject Headings) terms and free-text words for each category, and the database searches were conducted using this format. However, the search on Google Scholar was conducted using an adjusted search string according to its peculiarity. MESH terms were initially searched for on the MEDLINE database before being included as search terms. This also applied to the Cochrane Central database.

The search terms were applied within the Title or Abstract search field for the databases using the 'OR' and 'AND' Boolean operators. Where necessary, the double quotation mark ("") and truncation symbol (*) were also included in the search string to indicate a phrase and a wild card (substituting for 0 or more characters in a term), respectively. These were applied to the advanced search fields and adjusted according to the requirements and peculiarities of the different databases while still maintaining the relevant keywords. These peculiarities can be seen across the search histories of the databases used. Table 2 presents a summary of the search format used on PubMed, utilising search term categories related to the research aim. The full search history for all databases is provided in Appendix 2.

The limitations applied to all the searches were within the confines of the publication period, language, and species, and the justification for this is based on the eligibility criteria explained in Chapter 3.2.

No	Search String	Filters
#1	(Maternal health) AND (Mental health)	
#2	(Mental health) AND (Digital interventions)	
#3	(Artificial intelligence)	
#4	(#2) AND (#3)	
#5	((#1) AND (#2)) AND (#4)	Humans, 2014 - 2024, English
	Note: Each listed term represents a category of search terms with relevant keywords and MESH terms. (See Appendix 1)	

Table 2: Summary of the Search format applied to PubMed. Own Table.

3.5 Screening and Selection Process

Following the input of the search strings and filters on each database, and guided by the eligibility criteria, screening and selection were done through the following steps:

- Screening of identified citations by title and relevance
- Retrieval of records and screening of retrieved records by title and abstract
- Saving records to the reference manager and removing duplicates
- First full-text reading and exclusion of ineligible papers based on eligibility criteria
- Second full-text reading and confirmation of eligible papers for review based on inclusion criteria
- Review of included articles

The reference manager used for the screening and selection process was Zotero. The researcher conducted the screening and selection of articles. The flow chart, according to the PRISMA-ScR checklist (Tricco et al., 2018), summarising the screening and selection process is shown in Figure 3 below. Full details of the number of records retrieved, studies excluded, and reasons for exclusion are provided in the results section (Section 4.1).

Identification

Records identified from databases
(n = 6,058)

PubMed (n = 19)
Cochrane (n = 22)
Scopus (n = 63)
CINAHL (n = 26)
ACM Digital Library (n = 314)
IEEE Xplore (n = 1,523)
Sci Direct (n = 2,621)
Google Scholar (n = 1,470)

Records removed by relevance and title (n = 5,665)

Screening

Records retrieved (n = 393)

Duplicate records removed (n = 53)

Records screened by title and abstract (n = 340)

Records excluded (n = 267)

Exclusion criteria:
Full text unavailable (n = 12)
Wrong publication (n = 17)
Not primary study (n = 90)
Wrong intervention (n = 81)
Wrong population (n = 13)
Proposed intervention study (n = 38)
Not relevant to research topic (n = 16)

Records included for full-text reading (n = 73)

Additional records from reference screening (n = 2)

Records screened by full-text reading (n = 75)

Records excluded (n = 69)

Exclusion criteria:
Digital intervention without CA (n = 27)
Non-MH-related outcomes/MH outcomes not clearly defined (n = 9)
Full text unavailable (n = 5)
No participant interaction with CA (n = 6)
Study/Intervention not related to CA (n = 7)
Proposed study/intervention/study protocol (n = 8)
Not primary study/review/duplicate (n = 5)
Study partially reported (n = 2)

Included

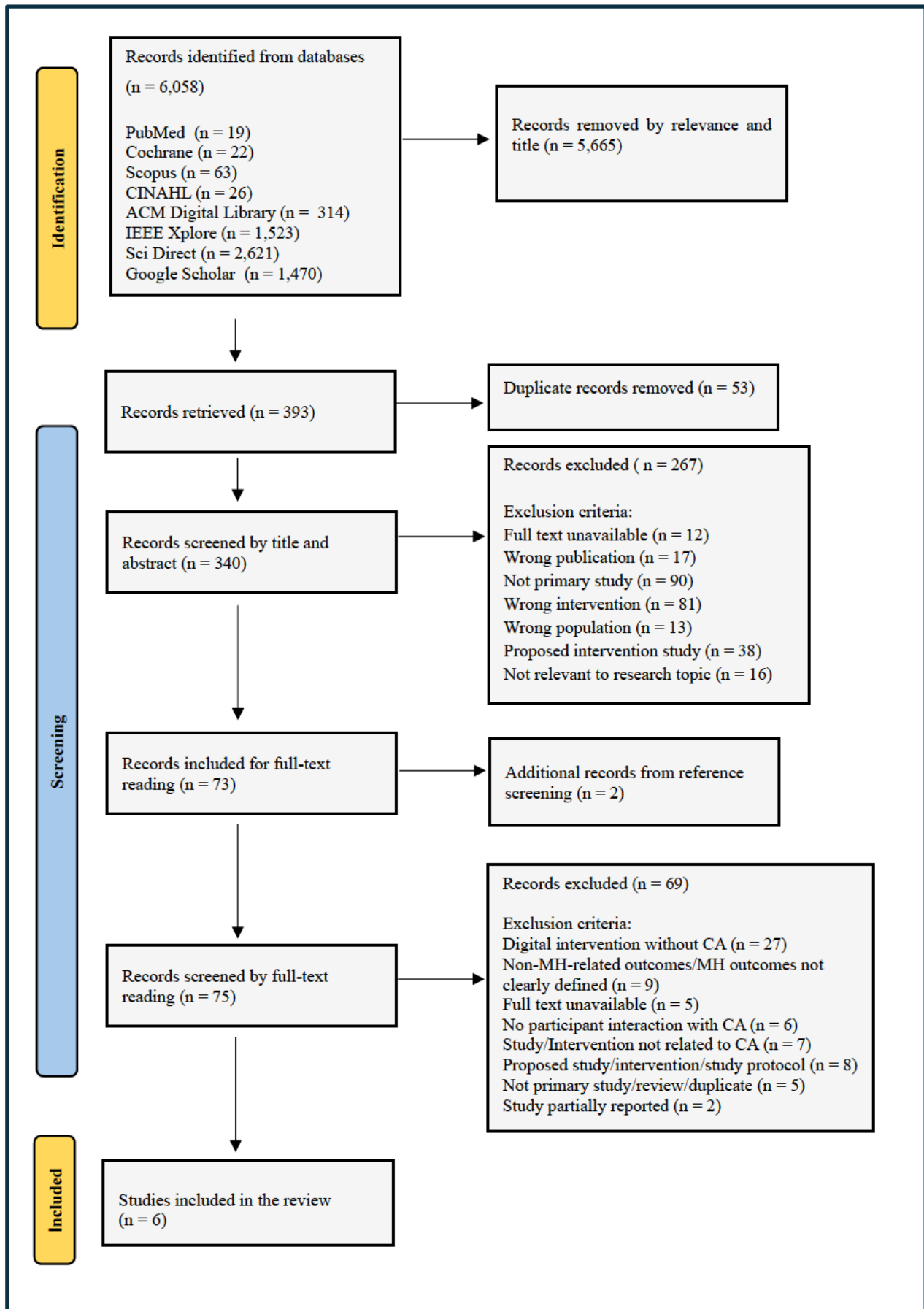Studies included in the review
(n = 6)

Figure 3: Flow diagram for study selection process based on PRISMA 2020 Statement (Page et al., 2021)

MH – Mental health, CA – Conversational agent.

3.6 Data Extraction

In line with the fourth step of the framework guide for the methodological process of this review, *charting the data* (i.e., extracting relevant data in accordance with the study objectives and research questions), two tables were created during the data charting process. The first table provides the study characteristics in detail, and the second table provides the technological characteristics of the chatbots and associated apps in the studies. The data extraction table with the study characteristics is presented in the results section (section 4.2), and the table of technological characteristics is provided in section 4.3.1. The following data were extracted from the selected studies:

- Study author, year and country in which the study was carried out
- Study participants, number of participants and demographic characteristics
- Study design and Setting
- Aim of the study
- Targeted condition
- Study intervention/Conversational Agent/Chatbot used
- Type of Conversational Agent/ Key Features
- Data collection method (Outcome measures)
- Theoretical Framework/Basis for Intervention
- Study duration/duration of interaction with conversational agent
- Main findings
- Technological characteristics of conversational agents, which include: Chatbot name, Key features, Response generation, Dialogue initiative, platform used and the modality of communication

The researcher independently reviewed the extracted data, double-checked for discrepancies and ran a repeat extraction process to avoid missing key information.

3.7 Quality and Risk of Bias Assessment

In presenting a narrative account of existing literature, there is no attempt to present a view regarding the 'weight' of evidence in relation to particular interventions or policies because a scoping review does not seek to assess the quality of evidence and hence cannot determine if certain studies yield reliable or broadly applicable results (Arksey & O'Malley, 2005).

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Moreover, a scoping review aims to present an overview of existing evidence through a preliminary assessment of the potential size and scope of available research literature, which usually includes studies with various study designs and therefore does not perform a formal quality assessment (Grant & Booth, 2009). Against this background, a critical appraisal of sources of evidence and risk of bias assessment across studies was not carried out in this review.

3.8 Data Synthesis

A narrative approach was used to synthesise the extracted data. An overview of the characteristics of the studies and participants was first presented, described and summarised in a table. Afterwards, results were synthesised in line with each of this review's sub-research questions. The features and functionalities of the conversational agents in the included studies were described, the reported impact on maternal mental health highlighted, and facilitators and barriers to the acceptance and use of conversational agents among perinatal women presented. A thematic synthesis approach was used to identify these facilitators and barriers. This aligns with the expanded scoping review framework by Levac et al. (2010). The steps proposed by Braun & Clarke (2006) were used as a guide in understanding and carrying out the thematic process, as they present an acceptable systematic guide for conducting thematic analysis. The researcher carefully reviewed the studies, examining the results and findings across them. Key statements were extracted and coded. Based on the assigned codes, themes were generated. Generated themes were further categorised into two categories to address the study's third sub-research question. The fit of the generated themes was checked against the extracted data and assigned codes, and was scrutinised for accuracy by the researcher. Microsoft Excel was used to manage this extraction and synthesis process.

4. Results

4.1 Study Selection

After implementing the search strategy, the systematic database searches yielded 6,058 records. Based on relevance and title, 5,665 citations were excluded. Records retrieved after exclusion by relevance were 393. The retrieved records were saved to the reference manager, and duplicates (n = 53) were removed. 340 records were then included for abstract screening. Following the exclusion criteria, 267 records were excluded. Most excluded records were either not primary studies (n = 90) or involved the wrong intervention (n = 81). The other reasons for exclusion were as a result of either the study being a proposed intervention (n = 38), the record not falling under the correct publication category (n = 17), the study not being relevant to the research topic (n = 16), the study having the wrong population (n = 13) or the full text not being available (n = 12). After this screening stage, 73 studies were included for the full-text reading.

After the first full-text reading, a quick search of the reference lists of relevant review articles was conducted, and two additional records were included, bringing the total number of articles screened by full text to 75. After this stage, 67 studies were excluded, and a second reading was done. Following a careful adherence to the inclusion criteria, two other studies were excluded. Six studies were finally included in the review. Most excluded studies at this stage applied digital interventions that did not include a conversational agent (n = 27) or did not report any mental health-related impact after participants' interaction with a chatbot or chatbot features (n=9). Other reasons for exclusion are outlined in the diagrammatic summary of the selection process, as depicted in the flow diagram in chapter 3 (section 3.5). A table listing the excluded full-text articles and their corresponding reasons is provided in Appendix 3.

4.2 Characteristics of Included Studies

This review includes six recent studies published in the English language between 2020 and 2024. Figure 4 illustrates a steady upward trajectory in the number of studies published, with the highest number of studies published in 2024 (50%), reflecting recent increased research attention toward this topic area. The included studies comprised randomised controlled trials (n = 3), quasi-experimental (n = 1), a multiple-case study (n = 1) and a mixed-methods quantitative and qualitative analysis (n = 1).
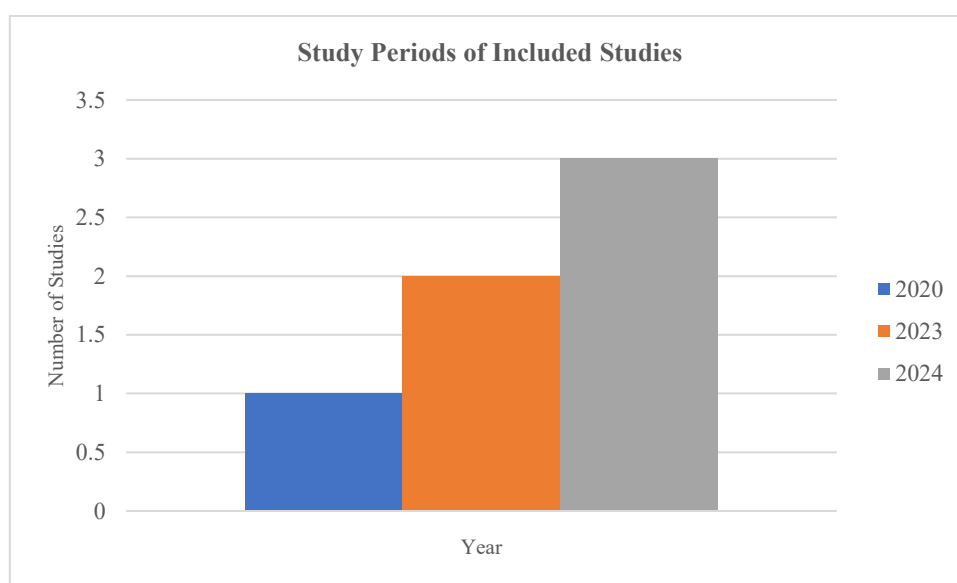
Figure 4: Study Periods of the Included Studies. Own Figure.

The majority of the included studies were conducted in HICs (Suharwardy et.al., 2023; Nguyen et.al., 2024 - *USA*, Mancinelli et.al., 2024 - *Italy* and Chua et.al., 2024 - *Singapore*) and limited studies were carried out in LMICs (Green et.al., 2020 - *Kenya*). This geographic distribution of studies is illustrated in Figure 5. One of the studies adopted an online global setting because it collected and analysed data from worldwide users of the developed app. The study also reports that majority of the data from its app users came from North America and Europe (Inkster et.al., 2023).
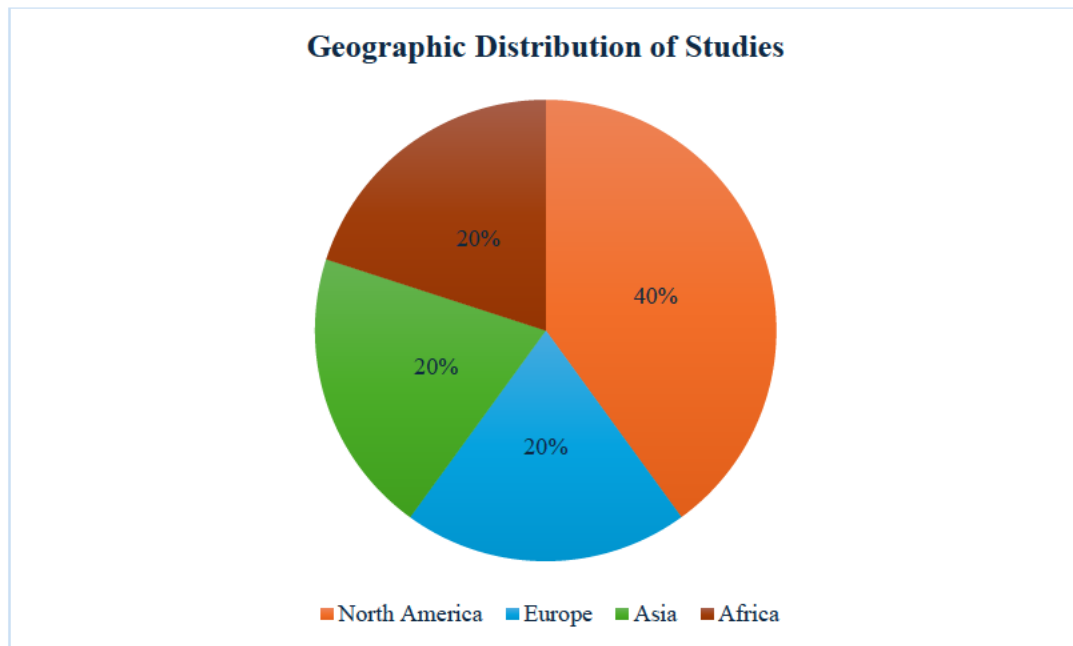
Figure 5: Geographic Distribution of the Included Studies. Own Figure.

The outcomes assessed in the included studies were the acceptability of the chatbots by the study population (n = 3) and effectiveness on the targeted condition (n = 2). The targeted condition that the included studies mostly addressed was depression, both prenatal and postpartum (n=5). Half of the studies adopted the theoretical framework of Cognitive Behavioural Therapy as the basis for the intervention (n = 3). Table 3 below presents a summary of the study characteristics of the included studies.

Characteristics	Number of Studies (n)
Study design	
Randomised Controlled Trial	3
Quasi-experimental	1
Multiple case study	1
Mixed Methods	1
Country	
Italy	1
Kenya	1
Singapore	1
United States of America	2
Global[1]	1
Year of Publication	
2020	1

2023	2
2024	3
Sample size	
< 50	3
50 -100	2
> 100	1
Setting	
Clinical	2
Educational	1
Community	1
Online	2
Targeted conditions[2]	
Perinatal depression	3
Postpartum depression	3
Stress	2
Anxiety	3
Psychological support	1
Maternal mental wellbeing	1
Measures[3]	
PHQ-9	6
EPDS-10	3
GAD-7	2
CSQ-8	1
PSS-10	2
UX	1
S-TAI-40	1

Note:

[1] Data from worldwide app users was collected and analysed

[2] Some studies addressed more than one condition as secondary outcomes

[3] Studies used different outcome measures

PHQ-9: Patient Health Questionnaire

EPDS-10: Edinburgh Postnatal Depression Scale

GAD-7: Generalised Anxiety Disorder Scale

PSS-10: Perceived Stress Scale

CSQ-8: Client Satisfaction Questionnaire

UX: User Experience

S-TAI-40: State-Trait Anxiety Inventory

Table 3: Summary of the Study Characteristics of Included Studies (n=6). Own Table.

The included articles provided data on 298 participants. Participants were recruited from either clinical (n = 2), community (n = 1), online (n = 2) or educational settings (n = 1). Participants varied in terms of their status as pregnant, perinatal, postpartum, or new mothers, and ranged in age from 18 to 34. Although studies mainly reported the mean age of participants, one study (Nguyen et.al., 2024) specified a minimum age of 14 years for recruiting participants. The minimum gestational period for pregnant participants was 12 weeks, and the maximum was 30 weeks. Post-partum participants were all no more than 6 months postpartum. In terms of the educational level and employment status of participants, three studies reported participants who were mainly educated to the level of a university degree or professional degree (Chua et.al., 2024 [56.9%]; Nguyen et.al., 2024 [60%]; Mancinelli et.al., 2024 [100%]) and two studies reported participants who were mainly employed (Suharwardy et.al., 2023 [80.9%]; Chua et.al., 2024 [87.9%]). In contrast, participants in one study were mainly unemployed (Green et.al., 2020 [78%]). All details of complete study characteristics are presented in the data extraction table below (see Table 4).

Author, Year, Country	Study participants, Number of participants (n), Age (in years), Mean age, Demographic Characteristics (%)	Study design, Setting	Study aim	Targeted condition	Intervention, Chatbot name	Theoretical Framework/Basis for Intervention	Study duration, Duration of use	Data collection method, Outcome measure	Main findings
Green et.al., 2020, Kenya	-Pregnant women, New mothers ≥ 20 weeks pregnant to ≤ 6 months postpartum - n= 41, ≥ 18 years, Mean age = 25.9 (± 4.8) years -Ethnicity: Kenyan (100%) -Level of Education: Secondary school (54%), College (27%), University (17%), Missing (2%) -Employment status: Employed (Not reported), Unemployed (78%)	-Prepilot study, single-case experimental design with repeated measures data collection and in-depth interviews. -Two public hospitals	To determine the feasibility, acceptability and response to the Healthy Moms intervention programme for perinatal depression and psychological support for pregnant women and new mothers in Kenya through an AI system.	-Perinatal depression -Psychological support	Healthy moms - Zuri	-World Health Organisation Mental Health Gap Action Programme (mhGAP) intervention guide -Cognitive Behavioural Therapy (CBT)	12 months, average of 7.7 days	-PHQ-9 for depression severity -Semi-structured interviews (n=15) -10-point mood rating (n=22)	-Estimated 7% improvement in mood ratings over average mood at baseline period (d =0.17)[+] -Improved self-care and self-love -Acquisition of new skills to better relate to the baby -Improved relations with others and better socialisation
Inkster et.al., 2023, Remote	-Data from Pregnant, perinatal & postpartum women -n =51 -Demographic characteristics not reported	-A mixed-methods quantitative and qualitative analysis of real-world anonymised data from app users. -Online setting (Data from worldwide app users)	To evaluate the effectiveness of an AI-enabled CA-based mental health and well-being app on reducing depressive symptoms for app users who reported maternal events.	-Maternal mental health and wellbeing -Depressive symptoms	Wysa app	-Cognitive Behavioural Therapy (CBT) -Acceptance and Commitment Therapy (ACT) -Dialectical Behaviour Therapy (DBT) -Motivational interviewing & positive behaviour support	8 months, 14 active days in 35 days (high engagement users)	-Patient Health Questionnaire 9 (PHQ-9) for self-reported depressive symptoms at baseline and follow-up -In-depth interviews (n=10)	-The highly engaged user group showed a significant depressive symptom reduction compared with the lower-engaged user group (p = .004). -Decrease in PHQ-9 score for the higher engagement group, indicating a shift in clinical improvement from "moderately severe" depression at baseline to the

						-Behavioural reinforcement, mindfulness, and guided micro actions.			"moderate depression" category at follow-up. -97% of app users expressed high or mid-satisfaction with sessions. -The top three stressors expressed by participants were relationships (100%), finance (60%) and loneliness (30%). -Participants did not ask about maternal health matters, but engaged more with the CA regarding their emotions and stressors.
Suharwardy et.al., 2023, USA	-Postpartum women -n=68, >18 years, Mean age= 34 years -Ethnicity: White (48.5%), Asian/Pacific Islander (39.7%), Black/African American (1.6%), Hispanic/Latinx (6%), Other (5.9%). -Education Level: not reported -Employment status: Employed (80.9%), Unemployed (including homemaker, student, retired) (19.1%).	-Single-centred, non-blinded, randomised controlled trial. -Academic centre	To assess the acceptability and preliminary efficacy of a mental health chatbot on mood management in a general postpartum population.	Postpartum depression	Woebot	-Cognitive Behavioural Therapy (CBT) -Interpersonal Psychotherapy (IPT)	5 months, 6 weeks	-Self-reported online survey -Edinburgh Postnatal Depression Scale (EPDS) for depression and anxiety -Patient Health Questionnaire (PHQ-9) for depression symptoms -Generalised Anxiety Disorder scale (GAD-7) for frequency and severity of anxious thoughts -Client Satisfaction Questionnaire (CSQ-8) for	-For the primary outcome, depression, there was a statistically significant difference between the 2 groups in mean change scores from baseline to 6-weeks for PHQ-9 (chatbot mean difference= −1.32 (SD=3.4); usual care mean difference= −0.13 (SD=3.01); *P*=.025) -Post-hoc analysis showed a significant between-group difference (*P*=.027): mean PHQ-9 scores decreased at 6 weeks in the chatbot group n=28; baseline=8.18 (SD=4.29) to 6-weeks=4.93 (SD=3.27) and were stable in the usual care

								satisfaction with the chatbot -Working Alliance Inventory Short - Revised version (WAI-SR) for therapeutic relationship with the chatbot.	group n=27; baseline=7.07 (SD=2.35) to 6-weeks=6.52 (SD=4.61) -64% of chatbot users had CSQ-8 satisfaction scores of 24 or higher, indicating high satisfaction with the tool. -Therapeutic relationship, measured by the WAI-SR, showed high scores in the bond subscale (mean = 3.3 [SD =1.6]), indicating the participants endorsed establishing an affective bond with the chatbot.
Nguyen et.al., 2024, USA	-Pregnant & postpartum women ≤ 6 months -n=15, ≥14 years, Mean age= 31.7 (± 4.7) -Ethnicity: Asian (7%), African American or Black (60%), Hispanic or Latino (33%), Multiracial (13%) -Education Level: High school (13%), associate degree (7%), bachelor's degree (20%), master's degree (20%), professional degree (40%) -Employment status not reported	-Randomised controlled pilot study -Online & Community-based	To examine the feasibility and acceptability of a health chatbot for new mothers of colour.	Maternal & child health information	Rosie	Not reported	3 months, Between daily use to once a week over the study period	-PHQ-9 depression scale -Emergency room visits for infants -Post-test survey with open-ended questions for qualitative feedback.	-A statistically significant decline in depression scores between the pretest and post-test periods, −3.66 (SD 4.55) for the treatment group (P=.008) compared to the control group −2.77 (SD 4.92) (P=.07) -Lower percentage of emergency room visits for infants in the control group (23%) compared to the treatment group (9%).

| Mancinelli et.al., 2024, Italy | -Pregnant women between the 12th and 30th week of gestation -n=5, >18 years, Mean age not reported -Ethnicity: Italian (100%) -Education Level: Bachelor's degree (20%), Master's degree (20%), Doctorate (60%) -Employment status: Employed (40%), Freelance (60%) | Multiple case study evaluation, Online | To qualitatively evaluate pregnant women's experience and perception of a chatbot prototype built to deploy a Behavioural Activation (BA) preventive support tool and intervention. | Behavioural activation for peripartum depression | Juno | -Obesity-Related Behavioural Intervention Trials (ORBIT) methodological framework -Behavioural Activation | 6 weeks, 10-14 days | -Self-report questionnaires -PHQ-9 for depression severity symptoms -The Edinburgh Postnatal Depression EPDS-10 for depression severity symptoms -Generalised Anxiety Disorder-7, GAD-7 for anxiety symptoms -Perceived Stress Scale-10 for stress symptoms -Semi-structured interviews -BA for Depression Scale-Short form -Environmental Reward Observation Scale -Mobile Application Rating Scale for the User Experience (UX) -User Engagement Scale-Short Form for User Engagement | -The trend of change at baseline and postintervention showed a reduction in stress symptoms and depression symptoms. -Few participants showed an increase in behavioural activation -High appreciation from participants for the provision of a 24/7 means to answer pregnancy-related questions. -High appreciation for esthetic and pregnancy-related content. -Modest to high perceived usability of the chat. |

Chua et.al., 2024, Singapore	-Parents (couples)* including Pregnant women & Mothers at > 24 gestational weeks -n= 118, > 21 years, Mean age = 32.6 (± 3.98) years -Ethnicity: Chinese (41.4%), Malay (34.5%), Indian (10.3%), Others (13.8%) -Education Level: Secondary school (5.2%), Polytechnic/Junior college (27.6%), University degree (56.9%), Postgraduate degree (10.3%) -Employment status: Employed (87.9%), Unemployed (12.1%)	-Single-centre, two-group parallel-armed randomised controlled trial with a pretest and repeated post-test -Antenatal clinics of a public tertiary hospital	To examine the effectiveness of the Parentbot - a Digital Healthcare Assistant in improving parenting self-efficacy (primary outcome), stress, depression, anxiety, social support, parent–child bonding, and parenting satisfaction (secondary outcomes) among parents during the perinatal period.	Parenting self-efficacy, stress, depression, and anxiety during the perinatal period	A Digital Healthcare Assistant - Parentbot	-Farao's non-linear, iterative, and user-centred framework for designing and re-designing mobile health applications -Bandura's self-efficacy theory -Mindful coping model -Self-determination theory -The concept of peer support -Psychoeducational and positive psychology principles	10 months, Gestational point of recruitment to 3 months postpartum	-Online self-report questionnaires -10-item Parenting Efficacy Scale -10-item Perceived Stress Scale -10-item Edinburgh Postnatal Depression Scale -40-item State–Trait Anxiety Inventory -8-item Perceived Social Support for Parenting scale -8-item Parent-Infant Bonding Questionnaire -11-item evaluation subscale for parenting satisfaction	-Statistically significant higher parenting self-efficacy scores at one month postpartum (p = 0.04) in the intervention group -Statistically lower mothers' state anxiety scores at three months postpartum in the intervention group (p = 0.01)
	* Data and study results were extracted for only the mothers' subgroup SD: Standard deviation + Cohen's *d* CA: Conversational agent								

Table 4: Data Extraction Table. Own Table.

4.3 Narrative Synthesis

The synthesis of the results of the included studies is organised based on response to each of the scoping review's sub-research questions. The following section presents the findings for each question.

4.3.1 What key features and functionalities of AI-based conversational agents have been adopted in maternal mental health?

Regarding this research question, a table of the technological characteristics of the conversational agents (chatbots) used in the included studies is used to extract the data and related information on functionalities and key features. (See Table 4).

Functionalities

The included studies utilised unique conversational agents (n = 6) as interventions for maternal mental health-related conditions and maternal health information. All chatbots had a **name**; the name adopted was either for the chatbot feature within an application or for the app itself. The names of the chatbots in the included studies were Zuri, Wysa, Woebot, Rosie, Juno and Parentbot. The **platform** on which chatbots are implemented can be either a stand-alone software, web-based, or multimodal. All chatbots in the included studies were mobile-based. The majority of the chatbots were implemented as a mobile software application (n = 4). The other chatbots were implemented via text messaging and Facebook (now Meta) (n = 1) and Telegram (n = 1). The **response generation** of a conversational agent, which is its method of processing inputs and generating responses, can either be rule-based or artificial intelligence-based. Three studies utilised a rule-based chatbot (Nguyen et al., 2024; Mancinelli et al., 2024; Chua et al., 2024), while the other three studies adopted an artificial intelligence-based chatbot (Green et al., 2020; Inkster et al., 2023; Suharwardy et al., 2023). The **dialogue initiative** refers to who leads the conversation, and this can either be by the user, the chatbot or both. The chatbot initiated the dialogue in three studies (Mancinelli et.al., 2024, Suharwardy et.al., 2023 and Inkster et.al., 2023), the user in two studies (Nguyen et.al., 2024 and Chua et.al., 2024), and both the user and the chatbot did it in one study (Green et.al., 2020). The **modality of communication** by the chatbots in the studies was: text-based (n = 1), text-based and visual (n = 4) and via text, visual and speech (n = 1). Aside from having these basic functionalities, all the chatbots in the included studies each had specific key features related to their intervention purpose. These are described in the following paragraphs.

Specific Features

In the study by Green et al. (2024), the chatbot *Zuri* was initially implemented via SMS and later also integrated with Facebook (now Meta). It sent out text notifications, performed automatic algorithm updates and automated sessions. It could recognise emotions, rate moods, engage active listening techniques such as restatement and reflection, and deliver modules on rapport-building (e.g., music, cooking, passions), as well as supportive interventions (e.g., mindfulness and relaxation). Its interaction with the user was unlimited, and it could detect user self-harm and send a crisis alert for in-person treatment.

Next is the *Wysa app* in the study by Inkster et al. (2023). It had an in-built chatbot with emotional intelligence features, ability to recommend evidence-based self-help tools and techniques such as Cognitive Behavioural Therapy (CBT), Acceptance and Commitment Therapy (ACT), Dialectical Behaviour Therapy (DBT), motivational interviewing, give positive behaviour support and reinforcement, mindfulness, and suggest guided micro actions that encourage users to build emotional resilience skills.

The intervention chatbot, *Woebot*, in the study by Suharwardy et al. (2023) was implemented via an application program that provided perinatal psychoeducational content and delivered psychotherapeutic techniques derived from Cognitive Behavioural Therapy (CBT) and Interpersonal Psychotherapy (IPT) for postpartum mood management. Users engaged in text-based conversations with the chatbot, and daily check-ins were performed on the app. Woebot tracked the users' moods and also displayed a mood graph of previously entered moods to aid mood management.

The next chatbot, *Rosie*, featured in the study by Nguyen et al. (2024), is a question-and-answer chatbot that provides information related to maternal and child health. It sent out push notifications and daily health tips and provided users with a library of maternal and child health-related video content.

Following that is the chatbot *Juno,* used in the study by Mancinelli et al. (2024), where users engaged with the chatbot through text messaging via Telegram. It provided users access to images and videos of intervention content. The chatbot could also schedule intervention content for users and send out reminders.

Lastly, the chatbot, *Parentbot*, in the study by Chua et al. (2024), was also a question-and-answer chatbot that incorporated gamification features and included an educational centre providing multimedia educational resources, including text, audio files, and videos.

Author, Year, Country	Intervention, Chatbot name	Key features	Platform	Response generation	Dialogue initiative	Modality of communication
Green et.al., 2020, Kenya	Healthy moms - Zuri	-SMS & Integration with Facebook (now Meta) -Text notifications -Emotion recognition -Automatic algorithm update & automated sessions -Mood ratings -Active listening techniques like restatement and reflection -Rapport-building modules (e.g., music, cooking, passions) -Supportive intervention (e.g., mindfulness and relaxation) -Unlimited interaction -User self-harm or crisis alert for in-person treatment	Mobile-based - via text messaging & Facebook (now Meta)	Artificial intelligence-based	User and chatbot	SMS, Text-based
Inkster et.al., 2023, Remote	Wysa app	-Emotional intelligence -Recommendation of evidence-based self-help tools and techniques such as Cognitive Behavioural Therapy (CBT), -Acceptance and Commitment Therapy (ACT)	Mobile application	Artificial intelligence-based	Chatbot	Text-based

		-Dialectical Behaviour Therapy (DBT) -Motivational interviewing & positive behaviour support -Behavioural reinforcement, mindfulness, and guided micro actions that encourage users to build emotional resilience skills.				
Suharwardy et.al., 2023, USA	Woebot	-Psychotherapeutic techniques derived from Cognitive Behavioural Therapy (CBT) and Interpersonal Psychotherapy (IPT) for postpartum mood management -Mood tracking & mood graph of previous moods -Text-based conversations -Daily check-ins -Perinatal psychoeducational content	Mobile application	Artificial intelligence-based	Chatbot	Text, Visual
Nguyen et.al., 2024, USA	Rosie	-Question & answer -Maternal & child health information -Video library -Push notifications -Daily health tips	Mobile application	Rule-based chatbot	User	Text, Visual
Mancinelli et.al., 2024, Italy	Juno	-Text messaging -Videos and images -Intervention content scheduling and reminders	Mobile-based - via Telegram	Rule-based chatbot	Chatbot	Text, Visual

Chua et.al., 2024, Singapore	A Digital Healthcare Assistant - Parentbot	-Education Centre containing multimedia educational resources (text, audio files, and videos) -Question & answer chatbot, Gamification features	Mobile application	Rule-based chatbot	User	Text, speech, and visual

Table 5: Overview of the Technological Characteristics of the Conversational Agents Across the Included Studies. Own Table.

4.3.2 How does the interaction with AI-based conversational agents impact maternal mental health?

Regarding this research question, the reported impact on maternal mental health is based on the results and key findings from participants' interactions with AI-based conversational agents in the included studies. Four studies (Inkster et al., 2023; Mancinelli et al., 2024; Nguyen et al., 2024; Suharwardy et al., 2023) reported on changes in depression scores and depressive symptoms post-intervention. These studies showed both a significant reduction in depressive symptoms among participants who engaged more with the app and statistically significant decreases in PHQ-9 scores between baseline and post-test periods. (See Table 4)

Three studies, (Nguyen et al., 2024; Mancinelli et al., 2024 and Chua et al., 2024) reported improvements in the mood ratings of participants, reduction in stress symptoms and lower mothers' state anxiety scores post-intervention, respectively. Other wellbeing and care-related impacts on participants reported by Green et al., 2020; Mancinelli et al., 2024; Inkster et al., 2023 and Chua et al., 2024, were: improved self-care and self-love, development of new skills to better care for the new baby, emotional management, better social relations, an increase in behavioural activation and high parenting self-efficacy scores one-month post-intervention, respectively. Table 6 below gives a summary of the reported impact across the studies.

Condition	Impact	Study
Depression and Depressive Symptoms	Reduction in depressive symptoms and depression scores post-intervention	Inkster et al., 2023 Mancinelli et al., 2024 Nguyen et al., 2024 Suharwardy et al., 2023
Mood	Improvement in mood rate	Green et al., 2020
Stress symptoms	Reduction in stress symptoms	Mancinelli et al., 2024
State anxiety	Reduced state anxiety in mothers	Chua et al., 2024
Wellbeing related	- Improved self-care and self-love - Improved relationships and socialisation - Emotional management - Acquired skills for better infant care - Increased behavioural activation - Increased parenting self-efficacy	Green et al., 2020 Green et al., 2020 Inkster et al., 2023 Green et al., 2020 Mancinelli et al., 2024 Chua et al., 2024

Table 6: Summary of the Reported Impact of Interaction with AI-based Conversational Agents Across the Included Studies. Own Table.

4.3.3 What facilitators and barriers influence the acceptance and use of AI-based conversational agents among perinatal women?

For this research question, the facilitators and barriers to accepting and using chatbots and conversational agents, including their associated apps, were identified through a thematic synthesis approach. A thematic coding table, which includes the extracted supporting key statements from the review articles, is presented in Appendix 4.

From the thematic synthesis, nine themes were identified from the extracted data across the studies. These themes were then categorised as either facilitators or barriers. Five of the themes were categorised as facilitators, and four themes as barriers.

Facilitators

The five themes categorised as facilitators, as depicted in Figure 6, include: Psychological facilitators, Social and emotional needs, Informational facilitators, Socio-economic facilitators and Digital benefits.
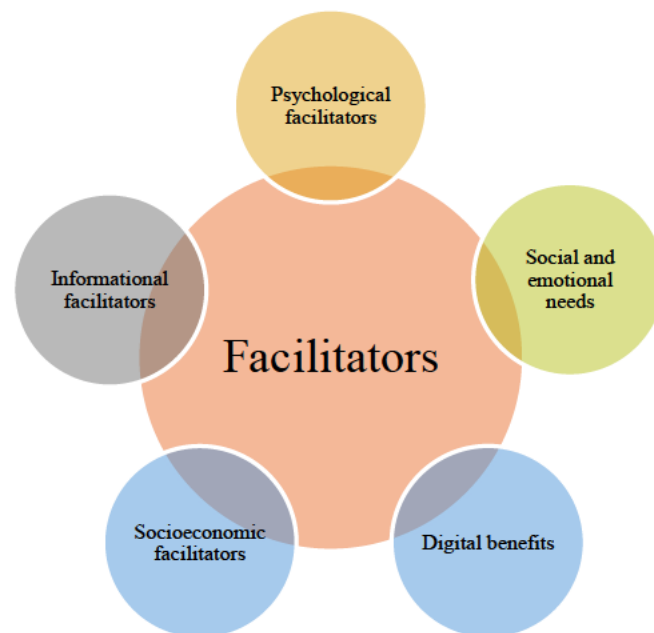
Figure 6: Diagrammatic Representation of Identified Facilitators to Acceptance and Use of AI-based Conversational Agents. Own Figure.

Psychological facilitators involved factors centred around mental wellbeing, self-image and self-efficacy. Green et.al, 2020 reported that participants who were ashamed of their bodies, did

not feel confident in their role as new mothers or were more stressed and anxious due to pregnancy, enrolled in the intervention and so showed more openness to use and engagement.

In the study by Chua et al. (2024), participants mostly used the education centre within the app, and over 1000 questions were directed to the chatbot. Participants sought information on newborn care and challenges associated with it. This knowledge and information-seeking behaviour among the participants, which facilitated their engagement and use of the app, were identified as informational facilitators.

Social and emotional needs were identified as facilitators in the studies by Inkster et al. (2023) and Green et al. (2020). They reported that participants appreciated their engagement with the chatbot and the app because they felt cared for, had a sense of connection with the chatbot, and also used the app to express their feelings, relax and manage their emotional states.

Green et al (2020) reported that participants who were married and had a higher level of education engaged more with the chatbot. The study also reports that most women who enrolled and engaged with the chatbot were experiencing stress resulting from financial problems, such as a lack of a stable source of income. These were therefore classified as the socioeconomic facilitators that influenced their acceptance of the intervention and engagement with the chatbot.

Digital benefits as facilitators were the dominant facilitators across the studies, as depicted in Figure 7. Acceptance and engagement were enhanced among participants due to the 24/7 availability of the apps, the ease of use, the ability to receive immediate feedback, the pleasing and engaging design, and the convenience of having a quick mental checkup. These benefits were reported in the studies by Mancinelli et al. (2024), Nguyen et al. (2024), Suharwardy et al. (2023), and Green et al (2020).
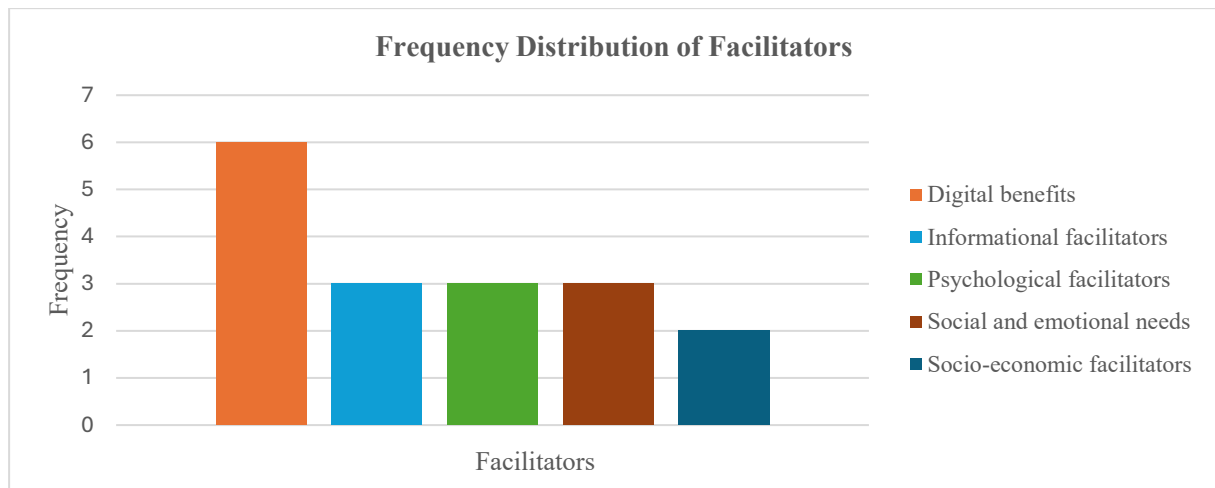
Figure 7: Frequency Distribution of the Facilitators to Acceptance and Engagement with AI-based Conversational Agents Thematically Identified across the Included Studies. Own Figure.

Barriers

The four themes categorised as barriers include: Financial constraints, Technological challenges, Time constraints and Language barriers.
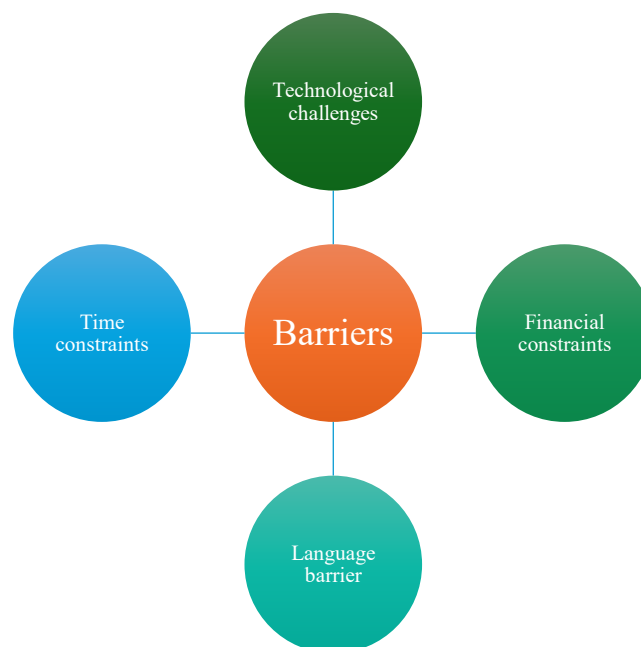
Figure 8: Diagrammatic Representation of Barriers to Acceptance and Use of AI-based Conversational Agents Identified Across the Included Studies. Own Figure.

In the study by Green et al. (2020), time constraints, language and financial constraints were identified as barriers to engagement with the intervention and chatbot. Participants with full-time employment outside the home and those distracted by caring for the new baby were less engaged in the intervention and chatbot. There was also less engagement via the Facebook integration due to financial constraints, as accessing the internet required higher internet connectivity costs. Intervention screening and conversations via the chatbot were only offered in English, which posed a barrier to acceptance by locals who were not very confident in the English language.

The technological challenges identified as barriers were the dominant factor hindering acceptance and engagement with intervention-related apps and chatbots, as shown in Figure 9. There were reported challenges with registration and onboarding, app crashes, and one chatbot giving non-satisfactory responses. These challenges were reported in the studies by Mancinelli et al. (2024), Nguyen et al. (2024), and Green et al. (2020).
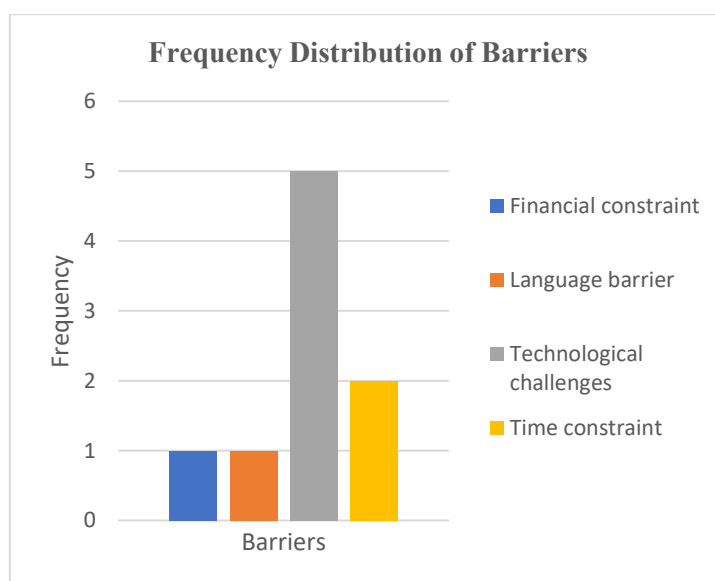
Figure 9: Frequency Distribution of The Barriers to Acceptance and Engagement with AI-Based Conversational Agents Identified Across the Included Studies. Own Figure.

Overall, the included studies each highlighted one factor that, through thematic synthesis, presented as recurring themes of either facilitators or barriers to the acceptance and engagement with conversational agents among perinatal women.

5. Discussion

5.1 Summary of Key Findings

This study aimed to present an opportunity for a more effective, scalable and real-time approach to address the global public health crisis of maternal mental health, with an emphasis on the perinatal period, by exploring the role of AI-based conversational agents in supporting maternal mental health. The main study approach to achieving this was by systematically synthesising the evidence available on AI-based conversational agents used in the maternal mental health context, specifically, by identifying the main features and specific functions of the kind of conversational agents that have been used, highlighting the impact of interactions with these agents on the mental health of perinatal women and exploring the unique factors that enhance or hinder their acceptance and continued use among this population.

Key findings of this review indicate that AI-based conversational agents explored in the area of maternal mental health share standard basic functionalities that enable their operation and use. They also have specific technological features which are usually unique and based on their targeted condition, platform of operation, intended aim and design. Half of the conversational agents explored by the studies in this review adopted rule-based chatbots, which could be considered a basic or lower-level form of AI conversational agents because their method of generating responses operates using predefined rules and decision trees, and they do not make use of advanced natural language processing and do not give more human-like responses. Although most of the reviewed studies did not utilise advanced-level AI-based conversational agents, the reported impact of interactions with AI-based conversational agents on perinatal women indicates that these agents positively affect the mental health, emotional, and physical wellbeing of perinatal women during the perinatal period. Consistent engagement with these conversational agents or chatbots and features of their associated apps significantly improved maternal mental health within the perinatal period, particularly depression and depressive symptoms.

The use of AI-based conversational agents as a mental health intervention is generally well accepted among perinatal women and perceived as a supportive tool for mental and emotional well-being. Although these agents were well received by perinatal women, certain external and intervention-related factors pose barriers to wider acceptance and continued use. At the same time, some factors, which could also be described as intrinsic or extrinsic, facilitate their acceptance and continued use. The following sections discuss the results of this study in detail.

5.1.1 Findings on Study Characteristics

This study reviewed six studies of different designs that explored the feasibility, acceptability, and use of conversational agents among the perinatal population. The use of conversational agents for mental health is an emerging area of research, and the evolving nature of this research area is evident in the study periods and the number of studies included in this review. Moreover, for a more specific and sometimes marginalised group, perinatal women, it is understandable that the identified studies would be limited in number, especially considering the developing nature of this topic. Nevertheless, as demonstrated by the results of this study, 50% of the reviewed studies were published in 2024, reflecting an increasing focus on the perinatal population.

Despite this increased interest, there was still a disparity in the number of studies conducted in HICs and LMICs. Only one study was published in a LMIC, Green et al. (2020). This corresponds to the findings of the review on conversational agents in healthcare by Car et al (2020), which reported scarce studies from middle-income countries and none from low-income countries. If the actual impact of these agents on this population is to be established, further studies need to be conducted in LMICs to address this issue within the global context effectively.

This also goes for the types of study designs that have been utilised and sample size of these studies; three of the included studies were RCTs, although given the number of studies in this review, this indicated a higher percentage, albeit in a general context, more studies in the clinical setting and studies with larger sample sizes are needed to have a more generalisable evidence base on the efficacy of these agents as digital interventions, as also suggested by Balan et al. (2024).

Most of the reviewed studies addressed depression and depressive symptoms as their intervention target for the perinatal population. Even though it is already established that the most recurring expressions of maternal mental health-related problems are depression and anxiety, as highlighted in the introduction, maternal mental health problems are also expressed in other forms, which should be given attention in research to address the wider scope of maternal mental health problems effectively.

Findings also showed that half of the studies adopted Cognitive Behavioural Therapy as the theoretical basis for their intervention. The efficacy of this framework is well established in therapeutic science; however, more studies need to apply other behavioural theories as a

conceptual framework for the development and application of digital mental health interventions, particularly in the use of conversational agents. As highlighted in Chapter 1.3.1, the SCT offers a sound conceptual basis for explaining the behavioural dynamics influencing interaction with digital mental health interventions.

5.1.2 Discussion of Results

The main research question guiding this review was *"How do Artificial Intelligence-based conversational agents support maternal mental health during the perinatal period, and what features and contextual factors influence their acceptance and engagement among perinatal women?"* To address this question, three further sub-questions were developed to guide this review in exploring the current scope of their use and application within the perinatal context, thereby highlighting their role. These questions were then used to report the study results. This section will now discuss the results based on the findings from these questions.

Technological Features

The findings of this study show that AI-based conversational agents that have been used for maternal mental health were developed with basic functionalities as conversational agents for other health fields and populations, as well as those reported in other reviews (Car et al., 2020; Balan et al., 2024; Abd-alrazaq et al., 2019). AI-based Conversational agents are implemented on platforms that make them easily accessible to their specific audience. These can either be web-based, mobile-based or multimodal applications. These chatbots can also be incorporated into third-party platforms, such as Facebook (Now Meta) and Telegram, as seen in the studies by Green et al. (2020) and Mancinelli et al. (2024). A behavioural chatbot, Tess, developed for adolescent patients with prediabetic symptoms, was similarly delivered via SMS text messaging and Facebook Messenger (Stephens et al., 2019). This integration of chatbots via these third-party platforms might seem counterproductive to the utilisation and interaction with these agents; on the contrary, this implementation across different platforms has been reported to increase engagement, particularly due to convenience and ease of not having to download multiple apps. This was attested to by the interview comments in one of the studies in this review (Mancinelli et al., 2024).

The modality of communication by the conversational agents in this study was mainly text-based. Even though conversational agents can engage in speech-based communication, as seen in one of the studies in this review, this text-based mode of communication is generally predominant among conversational agents in healthcare, as also highlighted in the scoping review by Car et al. (2020). This aspect should be addressed in the future development of conversational agents, as there is evidence that the younger generation prefers interacting with conversational agents via speech (H. Nguyen, 2022), which could make the absence of this feature unappealing to younger perinatal women.

The method by which an AI-based conversational agent processes inputs and generates responses typically shows how advanced it is. For the purpose of identifying artificial intelligence-based conversational agents for maternal mental health, this study classifies the available conversational agents in this topic area as AI-based. However, based on the response generation of the agents, half of the studies in this review adopted a rule-based conversational agent, which is a more basic form of AI-based conversational agent operating on predefined rules and without advanced natural language processing. These agents simulate human-like responses, but to a limited extent and mainly function as question-and-answer chatbots. On the other hand, the advanced form of AI-based conversational agents is powered by machine learning techniques and NLP. They go beyond predefined rules and have more human-like conversations.

Some of the participants in the studies were not satisfied with the responses of the chatbots to their questions (Nguyen et al., 2024; Mancinelli et al., 2024). This could be attributed to the limited and predefined rule-based nature of the chatbots used in the specified studies. However, this dissatisfaction with the chatbot response is not exclusive to interactions with rule-based chatbots. A similar dissatisfaction was reported in an RCT of users with chronic diseases after interaction with an artificial intelligence-powered conversational agent, with users describing the responses as generic (MacNeill et al., 2024). Despite these dissatisfactions, and in line with the existing literature in this topic area, findings show that acceptance and appreciation of interaction with these agents among perinatal women generally outweigh the dissatisfaction.

As part of their basic functionalities, each AI-based conversational agent in this study was uniquely identified and personalised by a name, which could also be the name of their host platform. This pattern is also seen across the literature on conversational agents and chatbots. Sometimes these names have a link to the persona of the chatbot and its intended use. As in one

of the reviewed studies, the app *Parentbot*-A Digital Healthcare Assistant, actually designed for parents, was named accordingly (Chua et al., 2024). Another chatbot, Dr. Joy, was similarly given its unique name and the persona of a female doctor, so that prenatal and postnatal users could perceive enjoyment when interacting with the chatbot and also have a feel of interacting with a professional (Chung et al., 2021).

Regarding the dialogue initiative, which is about who leads the conversation, this could be the user or the chatbot. In the reviewed studies, it was observed that the chatbots mainly led the conversations. The conversational agents whose response generation was driven by advanced artificial intelligence all led the conversations, and only one of the rule-based chatbots in the reviewed studies initiated the dialogue. This is to be expected since advanced natural language processing enables these agents to function beyond the limitations of predefined rules governing rule-based chatbots. One piece of information not reported in the available literature is whether there is a difference in the mental health outcomes of the dialogue initiative led by the user versus the chatbot. This also could not be deduced in the present review, as the interaction with these agents, regardless of who led the dialogue initiative, resulted in positive mental health impacts. This could be an aspect of research for future studies on this topic.

There were also features uniquely designed for each conversational agent or app, aside from the basic functional features general to all. These features are usually designed specifically for and related to the study intervention. Since the topic area is perinatal mental health, these features included maternal mental health-related content, maternal and child health information, wellbeing and care tips, mindfulness and behavioural support reinforcement, relaxation techniques, skill-building, emotional and mood management and other educational content. The emphasis and use of psychotherapeutic techniques were predominant across these features, and as most of the studies based their intervention framework around CBT, this would explain why.

Another important technological aspect of these conversational agents, which also plays a vital role in their acceptability and user engagement, is their design and aesthetic. Users were very pleased with the platform's aesthetic. This appreciation facilitated engagement, as participants also described the ease of using the apps and interacting with the agents. They also highlighted the pleasing and engaging design (Mancinelli et al., 2024; Nguyen et al., 2024). All unique features and basic functionalities of these agents not only served as tools for intervention implementation but also appealed to the target population and influenced how they accepted the intervention and engaged with these agents. This also emphasises the importance of

prioritising the user interface and design of future models of AI-based conversational agents, as this would drive their use and acceptance among perinatal women and thereby enhance their impact as digital mental health interventions.

Maternal Mental Health Impact

The findings on the mental health impact on perinatal women, after interaction with the conversational agents, were mainly very positive. Similar to reporting on depression scores in chatbot interventions for other populations (He et al., 2022; MacNeill et al., 2024), this study also reports significant reductions in depressive symptoms and changes in depression scores among perinatal participants after interactions with these conversational agents, post-intervention. In contrast, a recent RCT on a chatbot for subclinical young adults showed no significant differences between the intervention and control groups post-intervention; however, there were also reductions in depressive symptoms (Karkosz et al., 2024).

Apart from the dominance of the impact on depression, the reviewed studies also reported improvement on other mental health-related aspects such as mood ratings, stress symptoms and state anxiety. It is essential to point out that the study which reported a reduction in the state anxiety in mothers, (Chua et al., 2024) was initially designed to support parents (couples) and improve parenting outcomes during the perinatal period; however, subgroup analysis and results post-intervention were reported separately for mothers and fathers. Since this study focuses on perinatal women and mothers, it was only appropriate to report the findings for just the mothers.

The impact of the interaction with AI-based conversational agents on mood, stress and anxiety is of huge importance because these three conditions have an interconnected relationship that negatively affects maternal mental health and leads to psychological distress for women, particularly during pregnancy. Because antenatal depression is usually characterised by prolonged low mood, and antenatal anxiety is comorbid with depression (Hodgkinson et al., 2014; Staneva et al., 2015), introducing perinatal women early on in pregnancy to interaction with these agents will positively address these conditions simultaneously, and minimise the exacerbation of psychological distress on perinatal women globally. Interestingly, some of the participants in one of the reviewed studies also suggested in the qualitative feedback that the chatbot intervention be introduced during the early pregnancy period, the first trimester or the beginning of the second trimester (Mancinelli et al., 2024).

The interaction with these agents also allowed for a safe space for perinatal women to be open about mental health-related issues, without the feeling that they were being judged, thereby addressing the issue of the stigma associated with mental health. This also supports why the use of these agents will be beneficial to marginalised and underrepresented populations.

The other wellbeing-related impacts reported among perinatal women, such as improved self-care and self-love, better relationships and socialisation, emotional management and acquisition of skills, show that the impact of AI-based conversational agents extends beyond their intervention-targeted condition for the perinatal population. Just as the effects of maternal mental health-related problems affect not just the woman but also the family and can also have a future impact, the early use and application of these agents as intervention or support tools for the perinatal period help not just the woman but also the family and social relations.

Facilitators and Barriers to Engagement

In addition to the general acceptance and positive mental health impacts reported among perinatal participants across the reviewed studies, certain factors also emerged as prominent themes. Some of these factors were categorised as themes determining the acceptance of these agents and further interaction among the participants - *Facilitators*. While in contrast, the others were categorised as themes that presented limitations to engagement with these agents - *Barriers*. The themes that emerged as facilitators were: Psychological facilitators, Informational facilitators, Social and emotional needs, Socioeconomic facilitators and digital benefits. While financial constraints, Time constraints, Language barriers, and Technological challenges were identified as barriers to continued engagement.

The theme of digital benefits, which included ease of use, 24/7 availability and user experience with the apps and agents, was the dominant facilitator across the reviewed studies. This could, however, be expected, as the primary benefit of using these agents is that they offer an easier and faster approach to addressing mental health-related problems compared to traditional and in-person approaches. In addition to the emphasis on these digital benefits as drivers to engagement and use of these agents, which is also prominent in studies (Gaffney et al., 2019; Car et al., 2020; Chung et al., 2021), this study presents other intrinsic factors as facilitators. They are described as intrinsic drivers for engagement because they stemmed from the internal, immediate needs and struggles of the participants at that time, such as their self-image, their

sense of capability in caring for their babies, the emotions they were experiencing, and the need for connection and care.

The knowledge of these psychological facilitators can be utilised in driving awareness for engagement with these agents among perinatal women in subsequent interventions. The perinatal period for women and the physical and emotional changes associated with it can have a huge impact on the self-image and self-esteem of women, thereby further resulting in mental health conditions. Just as the study by Kamita et al. (2019) found significant improvements in the self-esteem of participants after interaction with a mental health course via a chatbot system, it is essential to capitalise on this knowledge when promoting conversational agents as digital mental health support for the perinatal population.

The other facilitators, socioeconomic and informational facilitators, which could be described as extrinsic factors, result from external situations that influence the participants, rather than the internal happenings within them. The need to know more about newborn care and other facts about the challenges associated with the perinatal period necessitated engagement with the conversational agents and an outpouring of questions to the chatbots. This is expected, particularly for first-time mothers, as the experience is new to them and would likely drive their information-seeking behaviour. Online health information-seeking behaviour has also been linked to decreased anxiety levels among pregnant women (Coglianese et al., 2020). Thus, improving this feature among the AI-based conversational agents and emphasising this benefit to perinatal women will facilitate future engagement with these agents and, in turn, provide more support for maternal mental health during the perinatal period.

The socioeconomic facilitators that drove acceptance and engagement with these agents were related to finance, level of education and, surprisingly, marital status. Some participants faced challenges with a stable source of income, which led to stress and facilitated their enrolment in the intervention programme and acceptance of engagement with the conversational agents. Although this challenge with finance would usually connote a negative factor, but in a positive spin in this context, it actually drove acceptance and engagement in the intervention and with the conversational agent. One of the studies, Green et al. (2020), reported higher levels of engagement among married participants and those with a higher level of education. It is not surprising that those with a higher level of education would engage more with these agents. As this is related to literacy levels, some aspects of the intervention or the platform may be confusing to individuals with lower literacy levels, resulting in lower engagement in the

intervention and with the agents. However, the higher level of engagement among married participants is worth highlighting. Although the reason for this was not stated, it can be inferred that the presence of a close support system, such as a partner, would lead to increased accountability and motivation to continue engaging in the intervention and subsequently with the conversational agent. This again reinforces the importance of social support for the perinatal population, and in this case, it is particularly relevant when promoting digital interventions in order to facilitate better engagement.

The factors identified as barriers to engagement among the participants were not uncommon, particularly the dominant barriers, which were related to technological challenges. As is often the case with technology, despite the significant benefits, there are usually some glitches or malfunctions in the process, especially with new products and innovations. Participants reported non-satisfactory responses from the chatbots, crashes on the app and challenges with onboarding. Similar challenges, such as chatbot responses, processing speed, and repetitive content, have also been reported in other studies (Ly et al., 2017; Ali et al., 2020). Addressing these prominent barriers will determine how effective and widely accepted these agents will continue to be as an intervention. If the acceptance rate and use among the perinatal population on a global scale are to be successful, then app developers must prioritise improving responses from these agents by utilising advanced NLP techniques for better responses and conducting more thorough app testing to prevent crashes.

Some participants were less engaged in the intervention and with the agents because they were distracted by caring for their newborn or by their full-time employment. One of the catch points for the use of these agents as a digital intervention is their availability and ease of use at any point in time, and anywhere, so these aforementioned factors being a barrier to engagement would beg the question on how engaging the content of the intervention and other features of the specific app are, because content that greatly improves newborn care will drive further engagement with these agents among perinatal women.

The issue of language can be expected to be a barrier, particularly in local settings, as most apps and digital tools are developed with the most common global language, English. Nevertheless, if the mental health of perinatal women in more local settings, marginalised communities and low-income settings is to be genuinely considered, then including additional and local languages in the features of these conversational agents should be prioritised.

5.2 Implications for Practice

Although this topic area is a growing field of research, findings from this review have shown the benefits of artificial intelligence-based conversational agents, including their design and features, as well as associated apps, on maternal mental health through their mitigating effects and supportive role during the perinatal period. These findings, therefore, suggest practical implications for maternal mental health support and other stakeholders.

First, in terms of access to care and better mental health support for perinatal women, the interaction with AI-based conversational agents and use of their associated platforms and features, can potentially enhance accessibility to personalised care for perinatal women, and allow for early detection of serious mental health challenges, which can be referred to professional mental services, as reported in some of the studies in this review. This is important, particularly for women facing barriers to traditional in-person services, such as those in low-income settings, those in communities with workforce shortages, and those still limited by the existing stigma around mental health issues. Thus, it is pertinent to maternal mental health to prioritise digital awareness of these agents for the perinatal population, make them available, and integrate them into professional mental health services. Additionally, the knowledge of the barriers to acceptance and engagement with these agents allows for these barriers to be addressed earlier, so they do not hinder engagement and use among perinatal women and thus the goal of mental health support.

Secondly, for developers of digital mental health tools and product owners in digital health industries, a more user-centred and context-aware design approach is essential in developing AI-based conversational agents for maternal mental health. They need to engage with perinatal users at different stages of the perinatal period to prioritise features needed at each stage and also accommodate a more diverse perinatal population. Knowledge should also be drawn from the facilitators and barriers to acceptance and continued engagement with these agents, so that features addressing them can be implemented early on.

Third, mental health professionals in perinatal clinical and community-based practice, as well as obstetricians and gynaecologists, need to be more digitally literate. Even though the utilisation of AI-based conversational agents and digital mental health tools cannot substitute for professional care, their awareness of these intervention agents and how they provide a buffer to mental health-related problems in perinatal women can enable them to utilise these agents to support patient and client care. Furthermore, encouraging collaboration between mental health

practitioners, software developers, and AI engineers is critical to bridging the gap between clinical insight and technological innovation.

Training programs for mental health professionals should include training on the utilisation of digital mental health products, including the use of AI-based conversational agents, so that they are better equipped with the knowledge and skills to reach perinatal women beyond traditional care practices.

Lastly, at the policy level, policymakers involved in digital health, mental health regulation, and maternal health need to collaborate in developing frameworks and regulations that address digital content and privacy in the use of these agents as interventions, as there are still gaps in existing literature regarding this.

5.3 Strengths and Limitations

This scoping review provides a comprehensive and detailed examination of a growing research area pertinent to the perinatal population. The scoping review framework, JBI recommendations and PRISMA-ScR checklist (Arksey & O'Malley, 2005; The Joanna Briggs Institute, 2015; Tricco et al., 2018), which guided the research process, enabled a rigorous and transparent mapping and synthesis of the available evidence on this interdisciplinary topic. The detailed inclusion and exclusion criteria enabled a defined search result that focused on the research aim. The inclusion of studies with different study designs and searches on databases related to computer science also allowed for a broader inclusion of articles within the topic area. Unlike other reviews on AI in mental health or for specific populations that emphasise usability and acceptability, this review presents a detailed description of the design features of AI-based conversational agents, their interaction impact and the factors influencing and impeding their acceptability and use among the perinatal population. This review also highlights that most AI-based conversational agents used as interventions for this population are of a lower level, that is, without the application of advanced NLP techniques, emphasising the need to prioritise this in future research and software development.

This study also demonstrated that, in addition to the positive mental health impact of AI-based conversational agents on perinatal women, their effects extended to their social relationships, self-esteem, skill development, and informational empowerment. Another key aspect was the identification of the facilitators and barriers to engagement. This study thematically identified

factors that could have been perceived as negative but were actually facilitators to engagement, and other intervention-related factors were identified as barriers to engagement with these agents. This therefore sheds light on what researchers and developers should consider in future research, development and promotion of these agents as mental health interventions.

Despite the highlighted strengths, this review, however, also had some limitations. The limited number of studies reviewed and the small sample size across the studies restrict the ability to generalise the findings of the study to a broader population. Also, due to the heterogeneity of the studies and the limited number of RCTs, the actual effectiveness of these agents as interventions cannot be determined. Because scoping reviews allow for the non-assessment of risk of bias and appraisal of the sources, the quality of the evidence sources in this review can not be ascertained.

Another limitation was in the filters applied during the search strategy. This restriction to studies published in the English language may have excluded studies that could have contributed to the findings in this review.

5.4 Recommendations for Future Research

Drawing from the limitations already mentioned and gaps in current literature, future studies should prioritise ascertaining the actual effectiveness of these agents on maternal mental health by carrying out studies with stronger methodological designs and more RCTs, utilising a broader and more diverse sample size of perinatal women. As most of the reviewed studies were carried out in HICs, more attention should be given to LMICs, LICs and marginalised societies.

Studies should also move from pilot and acceptability testing and focus on long-term impacts of the application and usage of these agents on maternal mental health, particularly showing the differences in effectiveness at the different stages and experiences of the perinatal period.

Another identified gap is that most studies focus on perinatal or postpartum depression and sometimes include anxiety, stress and mood. Attention should be given to other expressions of mental health-related problems among perinatal women, like self-harm, suicidal ideation, sleep disturbances, eating disorders and substance use during the perinatal period.

Furthermore, the engagement periods with these agents reported in studies are usually short-term. Studies should be carried out to investigate the longer-term use and engagement with these agents, not just engagement at specific periods of the perinatal period, such as during

pregnancy or postpartum, but from the first trimester to the late postpartum period. Changes in engagement levels, as well as the specific design features and contextual factors that influence them, should also be investigated.

Lastly, mental health practitioners and clinicians should also be involved in the research process, as their feedback and input on their clients' and patients' engagement with these agents, as well as the impacts, will be valuable.

6. Conclusion

Maternal mental health-related issues still remain a public health crisis that needs innovative approaches to address. Advancements in technology have drawn attention to digital health interventions and tools in the mental health space, with recent interest in the use of artificial intelligence-based conversational agents. This thesis, therefore, aimed to highlight the role these agents play in supporting the mental health of women during the perinatal period.

AI-based conversational agents used within the maternal mental health context, along with the design features in their associated platforms, serve as a scalable digital intervention tool to support maternal mental health during the perinatal period. The ease of use, their 24/7 availability, the provision of real-time maternal and child care-related information, the prompt responses to questions, emotional management, and the sense of care and connection to these agents reported by perinatal users have positive impacts on maternal mental health, particularly on depression and depressive symptoms. However, the actual effectiveness of their impact is uncertain, as this gap still exists in the available literature, and future research needs to prioritise addressing this gap to inform evidence-based practices, clinical decisions, and policymaking.

The knowledge of digital benefits as a dominant facilitator and technological challenges as a dominant barrier to use and engagement with these agents among perinatal women offers valuable insights for the future application of these agents as interventions, as well as for their design and the inclusion of specific features. Hence, future research and app development within the maternal mental health context should prioritise applying this knowledge as well as developing and utilising AI-based conversational agents that employ advanced-level NLP techniques to enhance intervention content and facilitate better engagement among the perinatal population.

AI-based conversational agents play a crucial role in maternal mental health support. They offer a valuable intervention approach to addressing some existing limitations to care services in health systems, by supporting perinatal women in real-time and generally improving maternal well-being. The findings from this review contribute to this growing field of research and lay the groundwork for future studies.

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Statutory Declaration

I hereby certify that I am the author of this thesis, and I have written it without the assistance of others. I further confirm that all materials, ideas and verbatim quotations taken from other works are fully referenced.

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Obiageli Karine Okwechime

30-06-2025, Hamburg

Appendix

Appendix 1: Search Terms and Keywords

Category	Keyword	MeSH Term	
Maternal-related Keywords	Maternal health	maternal health	
	Pregnancy	Pregnancy	
	Mothers	pregnant women	
	childbirth	postpartum women	
	antenatal*	postnatal care	
	Pregnant women	prenatal care	
	Postpartum women	perinatal care	
	Preg*	antenatal screening	
	postpartum care	postpartum period	
	Perinatal women	childbirth	
	Postnatal women		
	Perinatal period		
	Postnatal period		
	Motherhood		
	First-time mothers		
	Postpartum period		
	maternity		
	Perinata*		
	Maternal care		
	Maternal assessment		
	maternal well-being		
	New mothers		
	High-risk pregnancies		

Search string	"Maternal health" OR Pregnancy OR Mothers OR childbirth OR antenatal* OR "pregnant women" OR "postpartum women" OR Preg* OR "Postpartum care" OR "perinatal women" OR "postnatal women" OR "perinatal period" OR "postnatal period" OR motherhood OR "first-time mothers" OR "postpartum period" OR maternity OR perinata* OR "maternal care" OR "maternal assessment" OR "maternal well-being" OR "new mothers" OR "high-risk pregnancies"	search string 2	"Maternal health" OR Pregnancy OR "pregnant women" OR "postpartum women" OR "Postpartum care" OR "perinatal period" OR "perinatal care" OR "postpartum period" OR perinata*
Mental Health-related keywords	Mental health	Mental health	
	Psychological health	Mental Disorder	
	Psychological well-being	Depression	
	Psychological stress	Anxiety	
	Mental disorder	stress, psychological	
	Depression	mood Disorder	
	Depressive symptoms	anxiety Disorders	
	Depressive disorder	obsessive compulsive disorder	
	Anxiety	postpartum depression	
	Mood disorder		
	Anxiety disorder		
	Obsessive-compulsive disorder (OCD)		
	Psychological support		
	Postpartum depression		

	Postpartum anxiety		
	Postnatal depression		
	Post-traumatic stress disorder (PTSD)		
	Maternal blues		
	psychologic assessment		
Search string	"Mental health" OR "Psychological health" OR "psychological well-being" OR "psychological stress" OR "mental disorder" OR depression OR "depressive symptoms" OR "depressive disorder" OR anxiety OR "mood disorder" OR "anxiety disorder" OR "obsessive-compulsive disorder" OR "psychological support" OR "postpartum depression" OR "postpartum anxiety" OR "postnatal depression" OR "post-traumatic stress disorder" "maternal blues" OR "psychologic assessment"	Search string 2	"Mental health" OR "Psychological health" OR "mental disorder" OR depression OR anxiety OR "mood disorder" OR "anxiety disorder" OR "obsessive-compulsive disorder" OR "psychological support" OR "postpartum depression" OR "postpartum anxiety"
Digital health-related keywords	Digital therapeutics	Telehealth	
	Mobile therapy	Internet-based intervention	
	Smartphone app	Smartphone application	
	Mobile application	digital health	
	Telehealth	mobile app	
	Web-based*	Mobile application	
	Online intervention	Telemedicine	
	Digital care	Cognitive Behavioral Therapy	

	Digital health	ehealth	
	Mobile health	Computer-Assisted Therapy	
	mHealth	Remote Consultation	
	eHealth		
	Mental health app		
	Remote therapy		
	Mental health technology		
	Digital mental health		
	Digital psychotherapy		
	mobile-based mental health		
	Digital health tool		
	Digital intervention		
	Online counselling		
	Virtual counselling		
	virtual health platform		
	health technology		
	digital consultation		
	mental health support		
	web-based mental health intervention		
	digital cognitive-behavioral therapy		
	Mental health assessment		
	mental health diagnostic		
	Mental health monitoring		
	mood tracking		
	Self-assessment tool		
	interdisciplinary care		
	Remote Consultation		

Search string	"digital therapeutics" OR "mobile therapy" OR "smartphone app" OR "mobile application" OR Telehealth OR web-based* OR "online intervention" OR "digital care" OR "digital health" OR "mobile health" OR "mhealth" OR "ehealth" OR "mental health app" OR "remote therapy" OR "mental health technology" OR "digital mental health" OR "Digital psychotherapy" OR "mobile based mental health" OR "digital health tool" OR "digital intervention" OR "online counselling" OR "virtual counselling" OR "virtual health platform" OR "health technology" OR "digital consultation" OR "mental health support" OR "web-based mental health intervention" OR "digital cognitive-behavioral therapy" OR "mental health assessment" OR "mental health diagnostic" OR "mental health monitoring" OR "mood tracking" OR "self-assessment tool" OR "interdisciplinary care" OR "remote consultation"	Search string 2	"digital health" OR Telemedicine OR Telehealth OR web-based* OR "smartphone app" OR "mobile application" OR "online intervention" OR "mobile health" OR "mhealth" OR ehealth OR "mental health app" OR "digital mental health app" OR "Digital psychotherapy" OR "digital intervention" OR "online counselling" OR "virtual health platform" OR "cognitive behavioral therapy" OR "web-based mental health intervention"
AI Related Keywords	Artificial intelligence	Artificial Intelligence	
	"AI"	ai artificial intelligence	
	Machine learning	Natural language processing	
	chatbot*	machine learning	

	Conversational agent	Computational intelligence	
	Virtual agent	Deep Learning	
	Virtual conversational agent		
	AI chatbots		
	Virtual coach		
	Natural language processing		
	Deep learning		
	Generative Pre-trained Transformer		
	GPT's		
	Chat GPT		
	Voicebot*		
	Dialogue system		
	Conversational AI		
	Virtual assistant		
	Digital assistant		
	Automated agent		
	Human-computer interaction		
	AI-based platform		
	AI intervention		
	Intelligent system		
	Voice assistant		

Search string	"Artificial Intelligence" OR "AI" OR "Machine Learning" OR chatbot* OR "conversational agent" OR "virtual agent" OR "virtual conversational agent" OR "AI chatbot" OR "virtual coach" OR "Natural Language Processing" OR "deep learning" OR "Generative Pre-trained Transformer" OR "GPT's" OR "chat GPT" OR voicebot* OR "dialogue system" OR "converstional AI" OR "virtual assistant" OR "Digital assistant" OR "automated agent" OR "Human-computer interaction" OR "AI-based platform" OR "AI intervention" OR "intelligent system" OR "voice assistant"	Search string 2	"Artificial Intelligence" OR "AI" OR "Machine Learning" OR chatbot* OR "conversational agent" OR "virtual conversational agent" OR "AI chatbot" OR "virtual coach" OR "Natural Language Processing" OR "deep learning" OR "chat GPT" OR voicebot* OR "dialogue system" OR "converstional AI" OR "virtual assistant" OR "Digital assistant" OR "automated agent" OR "Human-computer interaction" OR "AI-based platform" OR "AI intervention" OR "intelligent system" OR "voice assistant"
Adjusted search string for specific databases	"Artificial Intelligence" OR "AI" OR "Machine Learning" OR chatbot* OR "conversational agent" OR "virtual conversational agent" OR "AI chatbot" OR "virtual coach" OR "Natural Language Processing" OR "deep learning" OR "chat GPT" OR voicebot* OR "dialogue system" OR "converstional AI" OR "virtual assistant" OR "Digital assistant" OR "automated agent" OR "Human-computer interaction" OR "AI-based platform" OR "AI intervention" OR "intelligent system" OR "voice assistant"		
	AND		

	"Maternal health" OR Pregnancy OR "pregnant women" OR "postpartum women" OR "Postpartum care" OR "perinatal period" OR "perinatal care" OR "postpartum period" OR perinata* OR "Mental health" OR "Psychological health" OR "mental disorder" OR "perinatal mental health" OR "postpartum depression" OR "postpartum anxiety"		

Appendix 2: Search Histories

PubMed

28/10/2024	# (No.)	Query	Filters	Results
	#1	(((((((((((((((((((((((((((((maternal health[MeSH Terms]) OR (Pregnancy[MeSH Terms])) OR (pregnant women[MeSH Terms])) OR (postpartum women[MeSH Terms])) OR (postnatal care[MeSH Terms])) OR (prenatal care[MeSH Terms])) OR (perinatal care[MeSH Terms])) OR (antenatal screening[MeSH Terms])) OR (postpartum period[MeSH Terms])) OR (childbirth[MeSH Terms])) OR ("Maternal health"[Title/Abstract]))) OR (Pregnancy[Title/Abstract])) OR (Mothers[Title/Abstract])) OR (childbirth[Title/Abstract])) OR (antenatal*[Title/Abstract])) OR ("Pregnant women"[Title/Abstract])) OR ("Postpartum women"[Title/Abstract])) OR (Preg*[Title/Abstract])) OR ("postpartum care"[Title/Abstract])) OR ("perinatal women"[Title/Abstract])) OR ("perinatal period"[Title/Abstract])) OR ("postnatal period"[Title/Abstract])) OR (Motherhood[Title/Abstract])) OR ("first-time mothers"[Title/Abstract])) OR ("postpartum period"[Title/Abstract])) OR (maternity[Title/Abstract])) OR (Perinata*[Title/Abstract])) OR ("Maternal care"[Title/Abstract])) OR ("Maternal assessment"[Title/Abstract])) OR ("maternal well-being"[Title/Abstract])) OR ("new mothers"[Title/Abstract])) OR ("High-risk pregnancies"[Title/Abstract])		1,399,150
	#2	((((((((((((((((((((((((mental health[MeSH Terms]) OR (mental disorder[MeSH Terms])) OR (depression[MeSH Terms])) OR (anxiety[MeSH Terms])) OR (stress, psychological[MeSH Terms])) OR (mood disorder[MeSH Terms])) OR (anxiety disorder[MeSH Terms])) OR (obsessive compulsive disorder[MeSH Terms])) OR (postpartum depression[MeSH Terms])) OR ("mental health"[Title/Abstract])) OR ("psychological health"[Title/Abstract])) OR ("psychological well-being"[Title/Abstract])) OR ("psychological stress"[Title/Abstract])) OR ("mental disorder"[Title/Abstract])) OR (depression[Title/Abstract])) OR ("depressive symptoms"[Title/Abstract])) OR ("depressive disorder"[Title/Abstract])) OR (anxiety[Title/Abstract])) OR ("mood disorder"[Title/Abstract])) OR ("anxiety disorder"[Title/Abstract])) OR ("obsessive-compulsive disorder"[Title/Abstract])) OR ("psychological support"[Title/Abstract])) OR ("postpartum depression"[Title/Abstract])) OR ("postpartum anxiety"[Title/Abstract])) OR ("postnatal depression"[Title/Abstract])) OR ("post-traumatic stress disorder"[Title/Abstract])) OR ("maternal blues"[Title/Abstract])) OR ("psychologic assessment"[Title/Abstract])		2,197,257

| | #3 | (((((((((((((((((((((((((((((((telehealth[MeSH Terms]) OR (internet-based intervention[MeSH Terms])) OR (smartphone application[MeSH Terms])) OR (digital health[MeSH Terms])) OR (mobile app[MeSH Terms])) OR (mobile application[MeSH Terms])) OR (telemedicine[MeSH Terms])) OR (cognitive behavioral therapy[MeSH Terms])) OR (ehealth[MeSH Terms])) OR (computer-assisted therapy[MeSH Terms])) OR (remote consultation[MeSH Terms])) OR ("digital therapeutics"[Title/Abstract])) OR ("mobile therapy"[Title/Abstract])) OR ("smartphone app"[Title/Abstract])) OR ("mobile application"[Title/Abstract])) OR (Telehealth[Title/Abstract])) OR (web-based*[Title/Abstract])) OR ("online intervention"[Title/Abstract])) OR ("digital care"[Title/Abstract])) OR ("digital health"[Title/Abstract])) OR ("mobile health"[Title/Abstract])) OR ("mhealth"[Title/Abstract])) OR ("eHealth"[Title/Abstract])) OR ("mental health app"[Title/Abstract])) OR ("remote therapy"[Title/Abstract])) OR ("mental health technology"[Title/Abstract])) OR ("digital mental health"[Title/Abstract])) OR ("digital psychotherapy"[Title/Abstract])) OR ("mobile-based mental health"[Title/Abstract])) OR ("digital health tool"[Title/Abstract])) OR ("digital intervention"[Title/Abstract])) OR ("online counselling"[Title/Abstract])) OR ("virtual counselling"[Title/Abstract])) OR ("virtual health platform"[Title/Abstract])) OR ("health technology"[Title/Abstract])) OR ("digital consultation"[Title/Abstract])) OR ("mental health support"[Title/Abstract])) OR ("web-based mental health intervention"[Title/Abstract])) OR ("digital cognitive behavioral therapy"[Title/Abstract])) OR ("mental health assessment"[Title/Abstract])) OR ("mental health diagnostic"[Title/Abstract])) OR ("mental health monitoring"[Title/Abstract])) OR ("mood tracking"[Title/Abstract])) OR ("self-assessment tool"[Title/Abstract])) OR ("interdisciplinary care"[Title/Abstract])) OR ("remote consultation"[Title/Abstract]) | | 237,427 |
| | #4 | (((((((((((((((((((((((artificial intelligence[MeSH Terms]) OR (ai artificial intelligence[MeSH Terms])) OR (natural language processing[MeSH Terms])) OR (machine learning[MeSH Terms])) OR (computational intelligence[MeSH Terms])) OR (deep learning[MeSH Terms])) OR ("artificial intelligence"[Title/Abstract])) OR ("AI"[Title/Abstract])) OR ("machine learning"[Title/Abstract])) OR (chatbot*[Title/Abstract])) OR ("conversational agent"[Title/Abstract])) OR ("virtual agent"[Title/Abstract])) OR ("virtual conversational agent"[Title/Abstract])) OR ("AI chatbot"[Title/Abstract])) OR ("virtual coach"[Title/Abstract])) OR ("Natural language processing"[Title/Abstract])) OR ("deep learning"[Title/Abstract])) OR ("generative pre-trained transformer"[Title/Abstract])) OR ("GPT's"[Title/Abstract])) OR ("chat GPT"[Title/Abstract])) OR (voicebot*[Title/Abstract])) OR ("dialogue system"[Title/Abstract])) OR ("conversational AI"[Title/Abstract])) OR ("virtual assistant"[Title/Abstract])) OR ("digital assistant"[Title/Abstract])) OR ("automated agent"[Title/Abstract])) | | 382,319 |

		OR ("human-computer interaction"[Title/Abstract])) OR ("AI-based platform"[Title/Abstract])) OR ("AI intervention"[Title/Abstract])) OR ("intelligent system"[Title/Abstract])) OR ("voice assistant"[Title/Abstract])		
	#5	(#1) AND (#2)		104,087
	#6	(#2) AND (#3)		57,406
	#7	(#6) AND (#4)		1,217
	#8	((#5) AND (#6)) AND (#4)		33
	#9	((#5) AND (#6)) AND (#4)	Humans, 2014 - 2024	20
	#10	((#5) AND (#6)) AND (#4)	Humans, 2014 - 2024, English	19

Cochrane Central

31/10/2024	# (No.)	Query	Filters	Results
	#1	MeSH descriptor: [Maternal Health] explode all trees		131
	#2	MeSH descriptor: [Pregnancy] explode all trees		34620
	#3	MeSH descriptor: [Pregnant Women] explode all trees		1041
	#4	MeSH descriptor: [Postpartum Period] explode all trees		2880
	#5	MeSH descriptor: [Prenatal Diagnosis] explode all trees		1270
	#6	MeSH descriptor: [Perinatal Care] explode all trees		852
	#7	MeSH descriptor: [Postnatal Care] explode all trees		598
	#8	MeSH descriptor: [Prenatal Care] explode all trees		2393

	#9	("Maternal health" OR Pregnancy OR Mothers OR childbirth OR antenatal* OR "pregnant women" OR "postpartum women" OR Preg* OR "Postpartum care" OR "perinatal women" OR "postnatal women" OR "perinatal period" OR "postnatal period" OR motherhood OR "first-time mothers" OR "postpartum period" OR maternity OR perinata* OR "maternal care" OR "maternal assessment" OR "maternal well-being" OR "new mothers" OR "high-risk pregnancies"):ti,ab,kw		113382
	#10	#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9		113885
	#11	MeSH descriptor: [Mental Health] explode all trees		3390
	#12	MeSH descriptor: [Mental Disorders] explode all trees		109218
	#13	MeSH descriptor: [Depression, Postpartum] explode all trees		1041
	#14	("Mental health" OR "Psychological health" OR "psychological well-being" OR "psychological stress" OR "mental disorder" OR depression OR "depressive symptoms" OR "depressive disorder" OR anxiety OR "mood disorder" OR "anxiety disorder" OR "obsessive-compulsive disorder" OR "psychological support" OR "postpartum depression" OR "postpartum anxiety" OR "postnatal depression" OR "post-traumatic stress disorder" "maternal blues" OR "psychologic assessment"):ti,ab,kw		178263
	#15	#11 OR #12 OR #13 OR #14		243474
	#16	MeSH descriptor: [Telemedicine] explode all trees		5100
	#17	MeSH descriptor: [Internet-Based Intervention] explode all trees		775
	#18	MeSH descriptor: [Mobile Applications] explode all trees		2150
	#19	MeSH descriptor: [Cognitive Behavioral Therapy] explode all trees		14497
	#20	MeSH descriptor: [Therapy, Computer-Assisted] explode all trees		3254

	#21	("digital therapeutics" OR "mobile therapy" OR "smartphone app" OR "mobile application" OR Telehealth OR web-based* OR "online intervention" OR "digital care" OR "digital health" OR "mobile health" OR "mhealth" OR "ehealth" OR "mental health app" OR "remote therapy" OR "mental health technology" OR "digital mental health" OR "Digital psychotherapy" OR "mobile based mental health" OR "digital health tool" OR "digital intervention" OR "online counselling" OR "virtual counselling" OR "virtual health platform" OR "health technology" OR "digital consultation" OR "mental health support" OR "web-based mental health intervention" OR "digital cognitive-behavioral therapy" OR "mental health assessment" OR "mental health diagnostic" OR "mental health monitoring" OR "mood tracking" OR "self-assessment tool" OR "interdisciplinary care" OR "remote consultation"):ti,ab,kw		28503
	#22	#16 OR #17 OR #18 OR #19 OR #20 OR #21		47370
	#23	MeSH descriptor: [Artificial Intelligence] explode all trees		3347
	#24	MeSH descriptor: [Deep Learning] explode all trees		339
	#25	MeSH descriptor: [Natural Language Processing] explode all trees		75
	#26	MeSH descriptor: [Machine Learning] explode all trees		1035
	#27	("Artificial Intelligence" OR "AI" OR "Machine Learning" OR chatbot* OR "conversational agent" OR "virtual agent" OR "virtual conversational agent" OR "AI chatbot" OR "virtual coach" OR "Natural Language Processing" OR "deep learning" OR "Generative Pre-trained Transformer" OR "GPT's" OR "chat GPT" OR voicebot* OR "dialogue system" OR "converstional AI" OR "virtual assistant" OR "Digital assistant" OR "automated agent" OR "Human-computer interaction" OR "AI-based platform" OR "AI intervention" OR "intelligent system" OR "voice assistant"):ti,ab,kw		13018
	#28	#23 OR #24 OR #25 OR #26 OR #27		14611
	#29	#10 AND #15		13397
	#30	#15 AND #22		20883

	#31	#28 AND #30		303
	#32	#29 AND #31		23
	#33	#29 AND #31	with Publication Year from 2014 to 2024, with Cochrane Library publication date from Jan 2014 to Oct 2024, in Trials	22

Scopus

31/10/2024	# (No.)	Query	Filters	Results
	1	(TITLE-ABS-KEY ("Maternal health" OR pregnancy OR "pregnant women" OR "postpartum women" OR "Postpartum care" OR "perinatal period" OR "perinatal care" OR "postpartum period" OR perinata*) AND TITLE-ABS-KEY ("Mental health" OR "Psychological health" OR "mental disorder" OR depression OR "depressive disorder" OR anxiety OR "mood disorder" OR "anxiety disorder" OR "obsessive-compulsive disorder" OR "psychological support" OR "postpartum depression" OR "postpartum anxiety"))		65,421
	2	TITLE-ABS-KEY ("digital health" OR telemedicine OR telehealth OR web-based* OR "smartphone app" OR "mobile application" OR "online intervention" OR "mobile health" OR "mhealth" OR ehealth OR "mental health app" OR "digital mental health app" OR "Digital psychotherapy" OR "digital intervention" OR "online counselling" OR "virtual health platform" OR "cognitive behavioral therapy" OR "web-based mental health intervention")		367,542

	3	TITLE-ABS-KEY ("Artificial Intelligence" OR "AI" OR "Machine Learning" OR chatbot* OR "conversational agent" OR "virtual conversational agent" OR "AI chatbot" OR "virtual coach" OR "Natural Language Processing" OR "deep learning" OR "chat GPT" OR voicebot* OR "dialogue system" OR "converstional AI" OR "virtual assistant" OR "Digital assistant" OR "automated agent" OR "Human-computer interaction" OR "AI-based platform" OR "AI intervention" OR "intelligent system" OR "voice assistant")		1,994,507
	4	1 AND 2 AND 3		65
	5	1 AND 2 AND 3 = ((TITLE-ABS-KEY ("Maternal health" OR pregnancy OR "pregnant women" OR "postpartum women" OR "Postpartum care" OR "perinatal period" OR "perinatal care" OR "postpartum period" OR perinata*) AND TITLE-ABS-KEY ("Mental health" OR "Psychological health" OR "mental disorder" OR depression OR "depressive disorder" OR anxiety OR "mood disorder" OR "anxiety disorder" OR "obsessive-compulsive disorder" OR "psychological support" OR "postpartum depression" OR "postpartum anxiety"))) AND (TITLE-ABS-KEY ("digital health" OR telemedicine OR telehealth OR web-based* OR "smartphone app" OR "mobile application" OR "online intervention" OR "mobile health" OR "mhealth" OR ehealth OR "mental health app" OR "digital mental health app" OR "Digital psychotherapy" OR "digital intervention" OR "online counselling" OR "virtual health platform" OR "cognitive behavioral therapy" OR "web-based mental health intervention")) AND (TITLE-ABS-KEY ("Artificial Intelligence" OR "AI" OR "Machine Learning" OR chatbot* OR "conversational agent" OR "virtual conversational agent" OR "AI chatbot" OR "virtual coach" OR "Natural Language Processing" OR "deep learning" OR "chat GPT" OR voicebot* OR "dialogue system" OR "converstional AI" OR "virtual assistant" OR "Digital assistant" OR "automated agent" OR "Human-computer interaction" OR "AI-based platform" OR "AI intervention" OR "intelligent system" OR "voice assistant")) AND PUBYEAR > 2013 AND PUBYEAR < 2025 AND (LIMIT-TO (LANGUAGE , "English"))	2014 -2024, English	63

CINAHL via EBSCO

31/10/2024	# (No.)	Query	Filters	Results	
		TI (MH ("Maternal health" OR Pregnancy OR "pregnant women" OR "postpartum women" OR "Postpartum care" OR "perinatal period" OR "perinatal care" OR "postpartum period" OR perinata*) OR TI ("Maternal health" OR Pregnancy OR "pregnant women" OR "postpartum women" OR "Postpartum care" OR "perinatal period" OR "perinatal care" OR "postpartum period" OR perinata*) AND MH ("Mental health" OR "Psychological health" OR "mental disorder" OR depression OR "depressive disorder" OR anxiety OR "mood disorder" OR "anxiety disorder" OR "obsessive-compulsive disorder" OR "psychological support" OR "postpartum depression" OR "postpartum anxiety")) AND MH ("digital health" OR Telemedicine OR Telehealth OR web-based* OR "smartphone app" OR "mobile application" OR "online intervention" OR "mobile health" OR "mhealth" OR ehealth OR "mental health app" OR "digital mental health app" OR "Digital psychotherapy" OR "digital intervention" OR "online counselling" OR "virtual health platform" OR "cognitive behavioral therapy" OR "web-based mental health intervention") AND MW ("Artificial Intelligence" OR "AI" OR "Machine Learning" OR chatbot* OR "conversational agent" OR "virtual conversational agent" OR "AI chatbot" OR "virtual coach" OR "Natural Language Processing" OR "deep learning" OR "chat GPT" OR voicebot* OR "dialogue system" OR "converstional AI" OR "virtual assistant" OR "Digital assistant" OR "automated agent" OR "Human-computer interaction" OR "AI-based platform" OR "AI intervention" OR "intelligent system" OR "voice assistant")	Find any of my search terms/ apply equivalent subjects/ apply related words. Search Field = Title TI, MH= Exact subject heading MW = Word in Subject heading	7	

| | | (MH ("Maternal health" OR Pregnancy OR "pregnant women" OR "postpartum women" OR "Postpartum care" OR "perinatal period" OR "perinatal care" OR "postpartum period" OR perinata*) OR TI ("Maternal health" OR Pregnancy OR "pregnant women" OR "postpartum women" OR "Postpartum care" OR "perinatal period" OR "perinatal care" OR "postpartum period" OR perinata*) AND MH ("Mental health" OR "Psychological health" OR "mental disorder" OR depression OR "depressive disorder" OR anxiety OR "mood disorder" OR "anxiety disorder" OR "obsessive-compulsive disorder" OR "psychological support" OR "postpartum depression" OR "postpartum anxiety")) AND ("digital health" OR Telemedicine OR Telehealth OR web-based* OR "smartphone app" OR "mobile application" OR "online intervention" OR "mobile health" OR "mhealth" OR ehealth OR "mental health app" OR "digital mental health app" OR "Digital psychotherapy" OR "digital intervention" OR "online counselling" OR "virtual health platform" OR "cognitive behavioral therapy" OR "web-based mental health intervention") AND ("Artificial Intelligence" OR "AI" OR "Machine Learning" OR chatbot* OR "conversational agent" OR "virtual conversational agent" OR "AI chatbot" OR "virtual coach" OR "Natural Language Processing" OR "deep learning" OR "chat GPT" OR voicebot* OR "dialogue system" OR "converstional AI" OR "virtual assistant" OR "Digital assistant" OR "automated agent" OR "Human-computer interaction" OR "AI-based platform" OR "AI intervention" OR "intelligent system" OR "voice assistant") | find any of my search terms/ apply equivalent subjects/ apply related words. MH = Exact subject heading, TI= Title, Search Field = All fields | 19

Total =26 | |

ACM Digital Library

03/11/2024	# (No.)	Query	Filters	Results
		[[Abstract: "artificial intelligence"] OR [Abstract: "ai"] OR [Abstract: "machine learning"] OR [Abstract: chatbot*] OR [Abstract: "conversational agent"] OR [Abstract: "virtual conversational agent"] OR [Abstract: "ai chatbot"] OR [Abstract: "virtual coach"] OR [Abstract: "natural language processing"] OR [Abstract: "deep learning"] OR [Abstract: "chat gpt"] OR [Abstract: voicebot*] OR [Abstract: "dialogue system"] OR [Abstract: "converstional ai"] OR [Abstract: "virtual assistant"] OR [Abstract: "digital assistant"] OR [Abstract: "automated agent"] OR [Abstract: "human-computer interaction"] OR [Abstract: "ai-based platform"] OR [Abstract: "ai intervention"] OR [Abstract: "intelligent system"] OR [Abstract: "voice assistant"]] AND [[Abstract: "maternal health"] OR [Abstract: pregnancy] OR [Abstract: "pregnant women"] OR [Abstract: "postpartum women"] OR [[Abstract: perinata*] AND [Abstract: "mental health"]] OR [Abstract: "psychological health"] OR [Abstract: "mental disorder"] OR [Abstract: "postpartum depression"] OR [Abstract: "postpartum anxiety"]] AND [E-Publication Date: (01/01/2014 TO 31/12/2024)]	2014-2024	314

IEEE Xplore

05/11/2024	# (No.)	Query	Filters	Results	
		("Abstract":"Artificial Intelligence" OR "Abstract":"AI" OR "Abstract":"Machine Learning" OR "Abstract":chatbot* OR "Abstract":"conversational agent" OR "Abstract":"virtual conversational agent" OR "Abstract":"AI chatbot" OR "Abstract":"virtual coach" OR "Abstract":"Natural Language Processing" OR "Abstract":"deep learning" OR "Abstract":"chat GPT" OR "Abstract":voicebot* OR "Abstract":"dialogue system" OR "Abstract":"converstional AI" OR "Abstract":"virtual assistant" OR "Abstract":"Digital assistant" OR "Abstract":"automated agent" OR "Abstract":"Human-computer interaction" OR "Abstract":"AI-based platform" OR "Abstract":"AI intervention" OR "Abstract":"intelligent system" OR "Abstract":"voice assistant") AND ("Abstract":"Maternal health" OR "Abstract":Pregnancy OR "Abstract":"pregnant women" OR "Abstract":"postpartum women" OR "Abstract":"Postpartum care" OR "Abstract":"perinatal period" OR "Abstract":"perinatal care" OR "Abstract":"postpartum period" OR "Abstract":perinata* OR "Abstract":"Mental health" OR "Abstract":"Psychological health" OR "Abstract":"mental disorder" OR "Abstract":"perinatal mental health" OR "Abstract":"postpartum depression" OR "Abstract":"postpartum anxiety")	2014-2024	1,523	

90

Science Direct

06/11/2024	# (No.)	Query	Filters	Results
		"Maternal health" OR "pregnant women" AND "mental health" OR "perinatal mental health" AND "Artificial intelligence" OR "chatbots" OR "conversational agent"	2014-2024, English, Research articles.	2,621

Google Scholar

07/11/2024	# (No.)	Query	Filters	Results
		pregnancy OR perinatal* OR postpartum OR mothers AND chatbot OR AI OR voicebot AND "maternal mental health" OR "perinatal mental health" OR "postpartum period" AND "artificial intelligence" OR "conversational agent" OR "digital intervention" OR "digital mental health intervention" OR "virtual assistant"	2014-2024	1,470

Appendix 3: Full-text screening and Excluded Articles

Total = 75		
Excluded = 69		
Included = 6		
Status	**Reason**	**Article**
Excluded	Full text not available	74: Acceptability of postnatal mood management through a smartphone-based automated conversational agent | Cochrane Library. (n.d.). https://doi.org/10.1002/central/CN-02077341
Excluded	Full text not available	116: Effect of an automated conversational agent on postpartum mental health: a randomized, controlled trial | Cochrane Library. (n.d.). https://doi.org/10.1002/central/CN-02074405
Excluded	Proposed study	Alam, T. B. (2023). Telepsychiatry for the Treatment of Postpartum Depression in Women in Urban and Rural Areas of Bangladesh. International Journal of Medical and Health Research, 1(1), 41–50.
Excluded	Digital intervention without CA	Allen, K., Rodriguez, S., Hayani, L., Rothenberger, S., Moses-Kolko, E., Simhan, H. N., & Krishnamurti, T. (2024). Digital phenotyping of depression during pregnancy using self-report data. Journal of Affective Disorders, 364, 231–239. https://doi.org/10.1016/j.jad.2024.08.029
Excluded	Digital intervention without CA	Andreasen, K., Fernandez Lopez, R., Wu, C., Linde, D. S., Oviedo-Gutiérrez, A., López Megías, J., Martín-de-las-Heras, S., Ludmila Zapata-Calvente, A., Ankerstjerne, L., de-León-de-León, S., Dokkedahl, S., Schei, B., & Rasch, V. (2024). The effect of a digital intervention on symptoms of depression in pregnant women exposed to Intimate partner violence in Denmark and Spain (STOP study). European Journal of Obstetrics & Gynecology and Reproductive Biology, 301, 120–127. https://doi.org/10.1016/j.ejogrb.2024.07.025
Excluded	No participant interaction with CA	Bartal, A., Jagodnik, K. M., Chan, S. J., & Dekel, S. (2023). ChatGPT demonstrates potential for identifying psychiatric disorders: Application to childbirth-related post-traumatic stress disorder. Research Square, 19, 3–53.
Excluded	No participant interaction with CA	Bartal, A., Jagodnik, K. M., Chan, S. J., & Dekel, S. (2024). AI and narrative embeddings detect PTSD following childbirth via birth stories. Scientific Reports, 14(1), 8336.

Excluded	Digital intervention without CA	Basílio, G. A., Pereira, T. B., Koerich, A. L., Dias, L., Teixeira, M. das G. da S., Sousa, R. T., Hisatugu, W. H., Mota, A. S., Garcia, A. S., Galletta, M. A. K., Tavares, H., & Paixão, T. M. (2024). AI-Driven Early Mental Health Screening with Limited Data: Analyzing Selfies of Pregnant Women (arXiv:2410.05450). arXiv. http://arxiv.org/abs/2410.05450
Excluded	Non-mental health-related outcomes	Bickmore, T., Zhang, Z., Reichert, M., Julce, C., & Jack, B. (2020). Promotion of Preconception Care Among Adolescents and Young Adults by Conversational Agent. Journal of Adolescent Health, 67(2), S45–S51. https://doi.org/10.1016/j.jadohealth.2019.09.006
Excluded	Study protocol	Bilal, A. M., Fransson, E., Bränn, E., Eriksson, A., Zhong, M., Gidén, K., Elofsson, U., Axfors, C., Skalkidou, A., & Papadopoulos, F. C. (2022). Predicting perinatal health outcomes using smartphone-based digital phenotyping and machine learning in a prospective Swedish cohort (Mom2B): Study protocol. BMJ Open, 12(4), e059033. https://doi.org/10.1136/bmjopen-2021-059033
Excluded	Digital intervention without CA	Chiou, W.-K., Kao, C.-Y., Lo, L.-M., Huang, D.-H., Wang, M.-H., & Chen, B.-H. (2017). Feasibility of utilizing E-mental health with mobile app interface for social support enhencement: A conceptional solution for postpartum depression in Taiwan. In Marcus A. & Wang W. (Eds.), Lect. Notes Comput. Sci.: Vol. 10289 LNCS (pp. 198–207). Springer Verlag; Scopus. https://doi.org/10.1007/978-3-319-58637-3_15
Excluded	Mental health outcomes not clearly defined	Chua, J. Y. X., Choolani, M., Chee, C. Y. I., Yi, H., Chan, Y. H., Lalor, J. G., Chong, Y. S., & Shorey, S. (2024a). Parents' Perceptions of Their Parenting Journeys and a Mobile App Intervention (Parentbot—A Digital Healthcare Assistant): Qualitative Process Evaluation. Journal of Medical Internet Research, 26, e56894.
Excluded	Duplicate	Chua, J. Y. X., Choolani, M., Chee, C. Y. I., Yi, H., Chan, Y. H., Lalor, J. G., Chong, Y. S., & Shorey, S. (2024b). Parents' Perceptions of Their Parenting Journeys and a Mobile App Intervention (Parentbot-A Digital Healthcare Assistant): Qualitative Process Evaluation. Journal of Medical Internet Research, 26, e56894. https://doi.org/10.2196/56894
Included		CHUA, J. Y. X., CHOOLANI, M., CHEE, C. Y. I., YI, H., CHAN, Y. H., LALOR, J. G., CHONG, Y. S., & SHOREY, S. (2024). The effectiveness of Parentbot—A digital healthcare assistant—On parenting outcomes: A randomised controlled trial. International Journal of Nursing Studies, 160. Scopus. https://doi.org/10.1016/j.ijnurstu.2024.104906
Excluded	Mental health outcomes not clearly defined	Chung, K., Cho, H. Y., & Park, J. Y. (2021). A chatbot for perinatal women⇔s and partners⇔ obstetric and mental health care: Development and usability evaluation study. JMIR Medical Informatics, 9(3). Scopus. https://doi.org/10.2196/18607

Excluded	No participant interaction with CA	Claisse, C., Durrant, A. C., & Lie, M. (2024). Understanding Antenatal Care Needs through Co-Creation with Roma Women to Inform the Design of mHealth Technologies. Proceedings of the 2024 CHI Conference on Human Factors in Computing Systems, 1–16. https://doi.org/10.1145/3613904.3642584
Excluded	Intervention not related to CA	Clapp, M. A., Ray, A., Liang, P., James, K. E., Ganguli, I., & Cohen, J. L. (2024). Postpartum primary care engagement using default scheduling and tailored messaging: A randomized clinical trial. JAMA Network Open, 7(7), e2422500–e2422500.
Excluded	Expert review	Darcy, A., Beaudette, A., Chiauzzi, E., Daniels, J., Goodwin, K., Mariano, T. Y., Wicks, P., & Robinson, A. (2023). Anatomy of a Woebot® (WB001): Agent guided CBT for women with postpartum depression. Expert Review of Medical Devices, 20(12), 1035–1049. https://doi.org/10.1080/17434440.2023.2280686
Excluded	Digital intervention without CA	Davis, J. A., Ohan, J. L., Gregory, S., Kottampally, K., Silva, D., Prescott, S. L., & Finlay-Jones, A. L. (2023). Perinatal Women's Perspectives of, and Engagement in, Digital Emotional Well-Being Training: Mixed Methods Study. Journal of Medical Internet Research, 25, e46852.
Excluded	Proposed intervention	Dharmadasa, O., Pushpamal, K. M. T., Senevirathna, K., Chathurika, K., Thilakarathna, H., & Ruggahakotuwa, L. (2023). Mom Care: A smart medical app for pregnant women. https://www.academia.edu/download/104182918/IRJET_V10I602.pdf
Excluded	Proposed intervention	Duckworth, M., Garfield, C. F., Santiago, J. E., Gollan, J., O'sullivan, K., Williams, D., Lee, Y., Muhammad, L. N., & Miller, E. S. (2024). The design and implementation of a multi-center, pragmatic, individual-level randomized controlled trial to evaluate Baby2Home, an mHealth intervention to support new parents. Contemporary Clinical Trials, 142, 107571.
Excluded	Duplicate	Feasibility and impact of a mental health chatbot on postpartum mental health: A randomized controlled trial	Cochrane Library. (n.d.). https://doi.org/10.1002/central/CN-02588399
Excluded	Non-mental health-related outcomes	Fietta, V., Rizzi, S., De Luca, C., Gios, L., Pavesi, M. C., Gabrielli, S., Monaro, M., & Forti, S. (2024). A Chatbot-Based Version of the World Health Organization-Validated Self-Help Plus Intervention for Stress Management: Co-Design and Usability Testing. JMIR Human Factors, 11, e64614. https://doi.org/10.2196/64614
Excluded	No participant interaction with CA	Gray, M., Baird, A., Sawyer, T., James, J., DeBroux, T., Bartlett, M., Krick, J., & Umoren, R. (2024). Increasing Realism and Variety of Virtual Patient Dialogues for Prenatal Counseling Education Through a Novel Application of ChatGPT: Exploratory Observational Study. JMIR Medical Education, 10, e50705.

Included		Green, E. P., Lai, Y., Pearson, N., Rajasekharan, S., Rauws, M., Joerin, A., Kwobah, E., Musyimi, C., Jones, R. M., Bhat, C., Mulinge, A., & Puffer, E. S. (2020). Expanding access to perinatal depression treatment in Kenya through automated psychological support: Development and usability study. JMIR Formative Research, 4(10). Scopus. https://doi.org/10.2196/17895
Excluded	Study protocol	Green, E. P., Pearson, N., Rajasekharan, S., Rauws, M., Joerin, A., Kwobah, E., Musyimi, C., Bhat, C., Jones, R. M., & Lai, Y. (2019). Expanding access to depression treatment in Kenya through automated psychological support: Protocol for a single-case experimental design pilot study. JMIR Research Protocols, 8(4). Scopus. https://doi.org/10.2196/11800
Excluded	Full text not available	Guiroy, I. M., Rodman, J. C. S., Kuhn, E., & Semple, R. J. (2024). The Necessity and Acceptability of Text Message Therapy to Peripartum Mothers. Telemedicine and E-Health, tmj.2024.0354. https://doi.org/10.1089/tmj.2024.0354
Excluded	Study partially reported	Gunaseelan, A., Ramachandran, M., Suharwardy, S., Leonard, S., Robinson, A., & Judy, A. (2021). Efficacy of an Automated Conversational Agent on Postpartum Mental Health: A Randomized, Controlled Trial. https://escholarship.org/uc/item/6tk8x6px
Excluded	Digital intervention without CA	Hassdenteufel, K., Müller, M., Abele, H., Brucker, S. Y., Graf, J., Zipfel, S., Bauer, A., Jakubowski, P., Pauluschke-Fröhlich, J., Wallwiener, M., & Wallwiener, S. (2023). Using an Electronic Mindfulness-based Intervention (eMBI) to improve maternal mental health during pregnancy: Results from a randomized controlled trial. Psychiatry Research, 330, 115599. https://doi.org/10.1016/j.psychres.2023.115599
Excluded	Digital intervention without CA	Huang, D.-H., Lai, S.-C., Lo, L.-M., Hong, T.-H., & Chiou, W.-K. (2020). Subjective Usability and Will of Use on mHealth Application for Postpartum Emotional Disorder—A Case of We'll. In Stephanidis C., Marcus A., Rosenzweig E., Rau P.-L.P., Moallem A., & Rauterberg M. (Eds.), Lect. Notes Comput. Sci.: Vol. 12423 LNCS (pp. 696–709). Springer Science and Business Media Deutschland GmbH; Scopus. https://doi.org/10.1007/978-3-030-60114-0_45
Included		Inkster, B., Kadaba, M., & Subramanian, V. (2023). Understanding the impact of an AI-enabled conversational agent mobile app on users' mental health and wellbeing with a self-reported maternal event: A mixed method real-world data mHealth study. Frontiers in Global Women's Health, 4, 1084302.
Excluded	Digital intervention without CA	Jhawar, S., Gupta, S. D., & Das, A. (2022). Maternal depression: Technology enabled self screening in real time. Health Care for Women International, 43(12), 1449–1463. https://doi.org/10.1080/07399332.2022.2037603
Excluded	Full text not available	Jiménez-Serrano, S., Tortajada, S., & García-Gómez, J. M. (2015). A Mobile Health Application to Predict Postpartum Depression Based on Machine Learning. Telemedicine Journal and E-Health: The Official Journal of the American Telemedicine Association, 21(7), 567–574. https://doi.org/10.1089/tmj.2014.0113
Excluded	Digital intervention without CA	Krishnamurti, T., Allen, K., Hayani, L., Rodriguez, S., & Davis, A. L. (2022). Identification of maternal depression risk from natural language collected in a mobile health app. Procedia Comput. Sci., 206(C), 132–140. https://doi.org/10.1016/j.procs.2022.09.092

Excluded	Digital intervention without CA	Kuipers, Y. J., Bleijenbergh, R., Rimaux, S., & Mestdagh, E. (2024a). Evaluation of a web-based intervention to optimize perinatal emotional wellbeing: A nested case-control study. International Journal of Clinical and Health Psychology, 24(1), 100422.
Excluded	Digital intervention without CA	Kuipers, Y. J., Bleijenbergh, R., Rimaux, S., & Mestdagh, E. (2024b). The effect of a web-based intervention on perinatal emotional wellbeing and coping: A nested case-control study. Mental Health & Prevention, 33, 200332.
Excluded	Digital intervention without CA	Kwok, S. W. H., Kotz, J., Reibel, T., Wang, G., Walker, R., & Marriott, R. (2023). Coupling Machine Learning Models with Innovative Technology-based Screening Tool for Identifying Psychological Distress among Aboriginal Perinatal Mothers. Annual International Conference of the IEEE Engineering in Medicine and Biology Society. IEEE Engineering in Medicine and Biology Society. Annual International Conference, 2023, 1–4. https://doi.org/10.1109/EMBC40787.2023.10340563
Excluded	Mental health outcomes not clearly defined	Lai, Y.-J., Lee, Y.-C., Chang, C.-C., Dai, W.-T., & Chen, Y.-Y. (2024). Exploring the Role of Mom's Chat Groups in the Messaging App: Enhancing Support and Empowerment for Stay-At-Home Mothers. Proc. ACM Hum.-Comput. Interact., 8(GROUP), 3:1-3:20. https://doi.org/10.1145/3633068
Excluded	Digital intervention without CA	Lawson, A., Dalfen, A., Murphy, K. E., Milligan, N., & Lancee, W. (2019). Use of Text Messaging for Postpartum Depression Screening and Information Provision. Psychiatric Services, 70(5), 389–395. https://doi.org/10.1176/appi.ps.201800269
Excluded	Digital intervention without CA	Leng, L. L., Yin, X. C., Chan, C. L. W., & Ng, S. M. (2023). Antenatal mobile-delivered mindfulness-based intervention to reduce perinatal depression risk and improve obstetric and neonatal outcomes: A randomized controlled trial. Journal of Affective Disorders, 335, 216–227.
Excluded	Study not related to CA	Levey, E. J., Onyeaka, H., Bartles, S. M., Sanchez Calderon, E., Sanchez, S. E., Prom, M. C., Fesseha, E. M., & Gelaye, B. (2021). Mobile Technology Access and Use Among Adolescent Mothers in Lima, Peru: Mixed Methods Study. JMIR Pediatrics and Parenting, 4(3), e30240.
Excluded	Digital intervention without CA	Mancinelli, E., Gabrielli, S., & Salcuni, S. (2024). A Digital Behavioral Activation Intervention (JuNEX) for Pregnant Women With Subclinical Depression Symptoms: Explorative Co-Design Study. JMIR Human Factors, 11, e50098.
Included		Mancinelli, E., Magnolini, S., Gabrielli, S., & Salcuni, S. (2024). A Chatbot (Juno) Prototype to Deploy a Behavioral Activation Intervention to Pregnant Women: Qualitative Evaluation Using a Multiple Case Study. JMIR Formative Research, 8. Scopus. https://doi.org/10.2196/58653

Excluded	Digital intervention without CA	Marcano-Belisario, J. S., Gupta, A. K., O'Donoghue, J., Ramchandani, P., Morrison, C., & Car, J. (2017). Implementation of depression screening in antenatal clinics through tablet computers: Results of a feasibility study. BMC Medical Informatics and Decision Making, 17(1), 1–11. Scopus. https://doi.org/10.1186/s12911-017-0459-8
Excluded	Non-mental health-related outcomes	Montenegro, J. L. Z., da Costa, C. A., & Janssen, L. P. (2022). Evaluating the use of chatbot during pregnancy: A usability study. Healthcare Analytics, 2, 100072. https://doi.org/10.1016/j.health.2022.100072
Excluded	Digital intervention without CA	Moorhead, A., Bond, R. R., Mulvenna, M., O'Neill, S., & Murphy, N. (2018). A Self-management app for maternal mental health. British HCI Conference 2018. https://pure.ulster.ac.uk/en/publications/a-self-management-app-for-maternal-mental-health
Excluded	Digital intervention without CA	Myneni, S., Zingg, A., Singh, T., Ross, A., Franklin, A., Rogith, D., & Refuerzo, J. (2024). Digital health technologies for high-risk pregnancy management: Three case studies using Digilego framework. JAMIA Open, 7(1). Scopus. https://doi.org/10.1093/jamiaopen/ooae022
Excluded	Full text not available	Narvekar, M., Kansara, V., & Harkare, V. (2024). Sakhi: An AI-Empowered Chatbot for Women's Health, Safety and Well-Being in Rural India. In Modernizing Maternal Care With Digital Technologies (pp. 341–370). IGI Global. https://www.igi-global.com/chapter/sakhi/352264
Excluded	Study protocol	NCT05463926. (n.d.). Effect of 'Parentbot—A Digital Healthcare Assistant (PDA)' in Improving Parenting Outcomes During the Perinatal Period	Cochrane Library. https://doi.org/10.1002/central/CN-02430999
Included		Nguyen, Q. C., Aparicio, E. M., Jasczynski, M., Doig, A. C., Yue, X., Mane, H., Srikanth, N., Gutierrez, F. X. M., Delcid, N., & He, X. (2024). Rosie, a Health Education Question-and-Answer Chatbot for New Mothers: Randomized Pilot Study. JMIR Formative Research, 8(1), e51361.
Excluded	Digital intervention without CA	Nissen, M., Barrios Campo, N., Flaucher, M., Jaeger, K. M., Titzmann, A., Blunck, D., Fasching, P. A., Engelhardt, V., Eskofier, B. M., & Leutheuser, H. (2023). Prevalence and course of pregnancy symptoms using self-reported pregnancy app symptom tracker data. NPJ Digital Medicine, 6(1), 189.
Excluded	Non-mental health-related outcomes	Ochieng', S., Hariharan, N., Abuya, T., Okondo, C., Ndwiga, C., Warren, C. E., Wickramanayake, A., & Rajasekharan, S. (2024). Exploring the implementation of an SMS-based digital health tool on maternal and infant health in informal settlements. BMC Pregnancy and Childbirth, 24(1), 222. https://doi.org/10.1186/s12884-024-06373-7
Excluded	Intervention not related to CA	Parang, L., Vakili, V., & Aliabadi, M. M. (2023). Impact of maternal psychosomatic empowerment during pregnancy on the improvement of mental health and maternal and fetal outcomes: A pilot study. Patient Education and Counseling, 109, 107625. https://doi.org/10.1016/j.pec.2023.107625

Excluded	Duplicate	Parents' Perceptions of Their Parenting Journeys and a Mobile App Intervention (Parentbot-A Digital Healthcare Assistant): Qualitative Process Evaluation | Cochrane Library. (n.d.). https://doi.org/10.1002/central/CN-02726676
Excluded	Digital intervention without CA	Qin, X., Liu, C., Zhu, W., Chen, Y., & Wang, Y. (2022). Preventing postpartum depression in the early postpartum period using an app-based cognitive behavioral therapy program: A pilot randomized controlled study. International Journal of Environmental Research and Public Health, 19(24), 16824.
Excluded	Non-mental health-related outcomes	Rivera, J. N. R., AuBuchon, K. E., Smith, M., Starling, C., Ganacias, K. G., Danielson, A., Patchen, L., Rethy, J. A., Blumenthal, H. J., Thomas, A. D., & Arem, H. (2024). Development and Refinement of a Chatbot for Birthing Individuals and Newborn Caregivers: Mixed Methods Study. JMIR Pediatrics and Parenting, 7(1), e56807. https://doi.org/10.2196/56807
Excluded	Study protocol	Rizzi, S., Poggianella, S., Pavesi, M. C., Gios, L., Bincoletto, G., Scolari, I., Paoli, C., Marroni, D., Tassinari, I., Baietti, B., Gianatti, A., Albertini, V., Burlon, B., Chiodega, V., Endrizzi, B., Benini, E., Guella, C., Gadotti, E., Forti, S., & Taddei, F. (2024). A Mindfulness-Based App Intervention for Pregnant Women: Protocol for a Pilot Feasibility Study. JMIR Research Protocols, 13, e53890. https://doi.org/10.2196/53890
Excluded	Digital intervention without CA	Ronen, K., Gewali, A., Dachelet, K., White, E., Jean-Baptiste, M., Evans, Y. N., Unger, J. A., Tandon, S. D., & Bhat, A. (2024). Acceptability and Utility of a Digital Group Intervention to Prevent Perinatal Depression in Youths via Interactive Maternal Group for Information and Emotional Support (IMAGINE): Pilot Cohort Study. JMIR Formative Research, 8(1), e51066.
Excluded	Study not related to CA	Saade, G. R. (2020). 73: Maternal CMV screening in a large unselected population. American Journal of Obstetrics & Gynecology, 222(1), S61–S62.
Excluded	Intervention not related to CA	Salamanca-Sanabria, A., Liew, S. J., Mair, J., De Iorio, M., Ling, Y. D. Y., Tint, M. T., Wei, Y. T., Lim, K., Ong, D., Chooi, Y. C., Tay, V., & Eriksson, J. G. (2024). A holistic lifestyle mobile health intervention for the prevention of type 2 diabetes and common mental disorders in Asian women with a history of gestational diabetes: A randomised control trial with 3-year follow-up protocol. Trials, 25(1), 443. https://doi.org/10.1186/s13063-024-08247-x
Excluded	Digital intervention without CA	Sansone, A., Stapleton, P., & Patching, A. (2024). A Qualitative Investigation of a Prenatal Mindfulness Relationship-Based (PMRB) Program to Support Maternal Mental Health and Mother–Baby Relationship During Pregnancy and Post-Partum. Mindfulness, 15(7), 1759–1777. https://doi.org/10.1007/s12671-024-02399-2
Excluded	Digital intervention without CA	Schmidt-Hantke, J., Vollert, B., Nacke, B., Hagner, F., Brüderl, H., & Jacobi, C. (2024). PandaMom – Feasibility and acceptability of an internet- and mobile-based intervention to enhance peripartum mental well-being and to prevent postpartum depression. Internet Interventions, 37, 100765. https://doi.org/10.1016/j.invent.2024.100765
Excluded	Proposed study	Silva, L. A., Gil, B. M. B., Robledo, F. P., Pires, I. M., Leithardt, V. R. Q., & da Rocha Fernandes, A. M. (2024). Integrating AI and Telemedicine in Maternal-Infant Care: An Innovative Approach for Personalized Healthcare. Procedia Computer Science, 241, 600–605. https://doi.org/10.1016/j.procs.2024.08.087

Excluded	Not primary study	Silveira, R., Pernencar, C., de Sousa, F., Gomes, K., Oliveira, D., Saboia, I., Mourão, C., Monteiro, O., & Barreto, I. (2023). GISSA intelligent chatbot experience – How effective was the interaction between pregnant women and a chatbot during the COVID-19 pandemic? Procedia Computer Science, 219, 1271–1278. https://doi.org/10.1016/j.procs.2023.01.411
Excluded	Digital intervention without CA	Steinman, S. A., Edwards, C. B., Snider, M. D. H., Billingsley, A. L., Ponzini, G. T., Evey, K. J., Doss, B., & Timpano, K. R. (2024). Preventing Postpartum Anxiety and Obsessive-Compulsive Disorder Over the Internet: An Open-Trial Pilot Study. Behavior Therapy. https://doi.org/10.1016/j.beth.2024.05.007
Included		Suharwardy, S., Ramachandran, M., Leonard, S. A., Gunaseelan, A., Lyell, D. J., Darcy, A., Robinson, A., & Judy, A. (2023). Feasibility and impact of a mental health chatbot on postpartum mental health: A randomized controlled trial. AJOG Global Reports, 3(3). Scopus. https://doi.org/10.1016/j.xagr.2023.100165
Excluded	Digital intervention without CA	Vanderkruik, R. C., Ferguson, C., Kobylski, L. A., Locascio, J. J., Hamlett, G. E., Killenberg, P. C., Lewis, R., Jones, N., Rossa, E. T., & Dineen, H. (2024). Testing a Behavioral Activation Gaming App for Depression During Pregnancy: Multimethod Pilot Study. JMIR Formative Research, 8(1), e44029.
Excluded	Non-mental health-related outcomes	Verduci, E., Vizzuso, S., Frassinetti, A., Mariotti, L., Del Torto, A., Fiore, G., Marconi, A., & Zuccotti, G. V. (2021). Nutripedia: The Fight against the Fake News in Nutrition during Pregnancy and Early Life. Nutrients, 13(9), 2998–2998. https://doi.org/10.3390/nu13092998
Excluded	Study partially reported	WANG, G., BENNAMOUN, H., KWOK, W. H., MARRIOTT, R., WALKER, R., & KOTZ, J. (2024). Codesigning a Clinical Prediction Model for Aboriginal Perinatal Mental Health and Lived Experience Using Glassbox AI and Aboriginal Wisdom...28th Australian Digital Health and Health Informatics Conference (HIC 2024), August 5-7, 2024, Brisbane, Queensland. Studies in Health Technology & Informatics, 318, 196–197. https://doi.org/10.3233/SHTI240925
Excluded	Digital intervention without CA	Wang, Y., Yan, P., Wang, G., Liu, Y., Xiang, J., Song, Y., Wei, L., Chen, P., & Ren, J. (2024). Trajectory on postpartum depression of Chinese women and the risk prediction models: A machine-learning based three-wave follow-up research. Journal of Affective Disorders, 365, 185–192. https://doi.org/10.1016/j.jad.2024.08.074
Excluded	No participant interaction with CA	Wang, R., Wang, J., Liao, Y., & Wang, J. (2020). Supervised Machine Learning Chatbots for Perinatal Mental Healthcare. 2020 International Conference on Intelligent Computing and Human-Computer Interaction (ICHCI), 378–383. https://doi.org/10.1109/ICHCI51889.2020.00086
Excluded	Intervention not related to CA	Waqas, A., & Rahman, A. (2021). Does One Treatment Fit All? Effectiveness of a Multicomponent Cognitive Behavioral Therapy Program in Data-Driven Subtypes of Perinatal Depression. Frontiers in Psychiatry, 12. Scopus. https://doi.org/10.3389/fpsyt.2021.736790

Excluded	Digital intervention without CA	Xie, W., Wang, M., Ng, S., Lu, S., Yeung, A., Chan, K. P., & Lo, H. H. M. (2024). Effects of a Mindfulness-Based Intervention Delivered by Mobile Phone on Perinatal-Specific Stress and Neonatal Outcomes: A Randomized Controlled Trial. Mindfulness. https://doi.org/10.1007/s12671-024-02457-9
Excluded	No participant interaction with CA	Yang, S., Lee, J., Sezgin, E., Bridge, J., & Lin, S. (2021). Clinical Advice by Voice Assistants on Postpartum Depression: Cross-Sectional Investigation Using Apple Siri, Amazon Alexa, Google Assistant, and Microsoft Cortana. JMIR mHealth and uHealth, 9(1), e24045. https://doi.org/10.2196/24045
Excluded	Study not related to CA	Zingg, A., Singh, T., & Myneni, S. (2021). Analysis of Online Peripartum Depression Communities: Application of Multilabel Text Classification Techniques to Inform Digitally-Mediated Prevention and Management. Frontiers in Digital Health, 3. Scopus. https://doi.org/10.3389/fdgth.2021.653769
Note: CA-Conversational Agent		

Appendix 4: Thematic Coding Table

Key statement	Code	Theme	Category	Study
"being married and more educated are associated with more engagement"	Marital status and Level of education	Socio-economic facilitators	Facilitators	Green et.al, 2020
"they were either ashamed of their bodies or worried about experiencing miscarriage"	Self-image and fear	Psychological facilitators	Facilitators	Green et.al, 2020
"anxiety and stress during pregnancy"	Mental wellbeing	Psychological facilitators	Facilitators	Green et.al, 2020
"many postpartum women did not feel confident in their roles as new mothers"	Self-efficacy	Psychological facilitators	Facilitators	Green et.al, 2020
"many of the women interviewed did not have a stable source of income, causing them stress"	Financial problems	Socio-economic facilitators	Facilitators	Green et.al, 2020
"having the benefit of perceived anonymity and privacy of chatting with a machine"	Privacy & anonymity	Digital benefits	Facilitators	Green et.al, 2020
"feeling connected to someone who cares"	Connection & care	Social and emotional needs	Facilitators	Green et.al, 2020
"Some users used the app to explore and express their feelings or concerns"	Openness	Social and emotional needs	Facilitators	Inkster et.al., 2023
"Some users actively and repeatedly used sleep, relaxation and anxiety-related tools or techniques to manage their emotional states"	Emotional management	Social and emotional needs	Facilitators	Inkster et.al., 2023
"Participants were satisfied with the chatbot due to increased availability"	24/7 availability	Digital benefits	Facilitators	Suharwardy et.al., 2023
"the ability to check in on their mental health at their own convenience at any time of the day or night"	24/7 availability for mental check-up	Digital benefits	Facilitators	Suharwardy et.al., 2023
"Most users reported that Rosie was easy to use and that they received a response from Rosie quickly"	Ease of use & Immediate feedback	Digital benefits	Facilitators	Nguyen et.al., 2024
"The esthetic...was very pleasing and able to hook the person's interest"	Pleasing and engaging esthetic	Digital benefits	Facilitators	Mancinelli et.al., 2024
"Easy to use and intuitive"	Ease of use	Digital benefits	Facilitators	Mancinelli et.al., 2024

"The Education Centre was the most frequently used component of the mobile application"	Knowledge seeking	Informational facilitators	Facilitators	Chua et.al., 2024
"From the knowledge base, parents tended to view information regarding tips and challenges of caring for their newborns as well as information about their baby's nutritional needs"	Information seeking	Informational facilitators	Facilitators	Chua et.al., 2024
"There were also > 1000 questions directed to the in-built chatbot (Parentbot) in the Education Center"	Information seeking	Informational facilitators	Facilitators	Chua et.al., 2024
"being employed outside of the home are associated with less engagement"	Full time employment	Time constraint	Barriers	Green et.al, 2020
"almost every woman said they preferred to chat with Zuri through SMS. The main reason being that SMS was free, whereas chatting through Facebook Messenger required them to buy data bundles to access the internet."	Internet access and cost	Financial constraint	Barriers	Green et.al, 2020
"Some women either damaged or lost their phones and did not know how to reconnect with Zuri"	Connectivity	Technological challenges	Barriers	Green et.al, 2020
"women were easily (and understandably) distracted by their new baby and forgot to complete open sessions"	Infant care	Time constraint	Barriers	Green et.al, 2020
"the registration process was very confusing for some women, especially early on in the study"	Registration and onboarding process	Technological challenges	Barriers	Green et.al, 2020
"We were limited in our pursuit of these objectives given that we only offered screening and conversations in English"	Language	Language barrier	Barriers	Green et.al, 2020
"crashing of the app during attempted use"	Technical problems	Technological challenges	Barriers	Nguyen et.al., 2024
"they were not satisfied with some of Rosie's answers"	non-satisfactory chatbot response	Technological challenges	Barriers	Nguyen et.al., 2024
"The technical problems made it confusing"	Technical problems	Technological challenges	Barriers	Mancinelli et.al., 2024

Appendix 5: PRISMA Scoping Review Checklist

Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
TITLE			
Title	1	Identify the report as a scoping review.	Click here to enter text.
ABSTRACT			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	Click here to enter text.
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	Click here to enter text.
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	Click here to enter text.
METHODS			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	Click here to enter text.
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	Click here to enter text.
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	Click here to enter text.
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	Click here to enter text.
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	Click here to enter text.
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	Click here to enter text.
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	Click here to enter text.
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	Click here to enter text.
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	Click here to enter text.
RESULTS			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	Click here to enter text.

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	Click here to enter text.
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	Click here to enter text.
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	Click here to enter text.
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	Click here to enter text.
DISCUSSION			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	Click here to enter text.
Limitations	20	Discuss the limitations of the scoping review process.	Click here to enter text.
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	Click here to enter text.
FUNDING			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	Click here to enter text.

JBI = Joanna Briggs Institute; PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.

* Where *sources of evidence* (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and websites.

† A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with *information sources* (see first footnote).

‡ The frameworks by Arksey and O'Malley (6) and Levac and colleagues (7) and the JBI guidance (4, 5) refer to the process of data extraction in a scoping review as data charting.

§ The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 and 16 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document).