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Challenges and Trends in Neuroscience and Women's Mental Health: A Bibliometric Approach

Author's: Sanchez Caicedo Adriana Margarita1, Zea Vera Mónica Elizabeth2, Ruperti Lucero Erika Marissa3 y Kevin Gabriel Castillo Villegas4

1 Universidad Estatal de Milagro, Milagro, Guayas (Ecuador), Ciudadela universitaria Km. 1.5 vía al Km. 26, asanchezc4@unemi.edu.ec

2 Universidad Estatal de Milagro, Milagro, Guayas (Ecuador), Ciudadela universitaria Km. 1.5 vía al Km. 26, mzeav@unemi.edu.ec

3 Universidad Estatal de Milagro, Milagro, Guayas (Ecuador), Ciudadela universitaria Km. 1.5 vía al Km. 26, erupertil@unemi.edu.ec

4 Universidad Estatal de Milagro, Milagro, Guayas (Ecuador), Ciudadela universitaria Km. 1.5 vía al Km. 26, kcastillov@unemi.edu.ec

Abstract

Neuroscience and mental health have experienced exponential growth in recent decades, becoming key areas for understanding human well-being and the mechanisms that regulate behavior, cognition, and emotions. Women's mental health, in particular, deserves special attention, as it reveals challenges arising from the interaction of biological dimensions (hormones, reproductive cycle, aging), psychological aspects (stress, emotional regulation, resilience), and social factors (stigma, inequitable access to services, gender roles). Therefore, this study seeks to answer the question: What challenges emerge in the field of neuroscience and women's mental health based on the co-occurrence network analysis of terms in scientific production? To address this, we analyzed the co-occurrence network of 2,845 conceptual terms defined by 2,561 authors. The results identified four major clusters: Cluster 1: Neuroplasticity, sex hormones, and women's mental health. Cluster 2: Epidemiology, treatment, and social barriers in psychosis and women's mental health. Cluster 3: Clinical care, diagnosis, and mental health policies for women. Cluster 4: Neural circuits, neuroimaging, and innovative therapies in depression and women's emotional regulation. The findings open new research gaps that may be further explored through quantitative approaches, such as structural equation modeling, to formalize these clusters into new constructs.

Keywords: Neuroscience; Mental Health; Women; Bibliometrics; Python

1. Introduction

Neuroscience and mental health have undergone unprecedented development in recent decades, establishing themselves as priority fields for understanding human well-being and the factors that shape it. The expansion of knowledge in these areas has made it possible not only

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to identify the biological and cognitive mechanisms underlying brain functions, but also to highlight how these dimensions intersect with social, cultural, and gender-related variables [1]. Within this framework, the study of women's mental health has gained particular relevance, as research has confirmed significant differences compared to men in terms of disorder prevalence, risk factors, and treatment responses [2].

Studies demonstrate that phenomena such as hormonal cycles, motherhood, menopause, and exposure to contexts of violence or inequality have distinct impacts on women's mental health [3]. Similarly, psychosocial analyses reveal that women are more frequently exposed to conditions such as anxiety and depression, due to a combination of biological determinants and cultural pressures [4]. These realities have fostered growing interest in addressing neuroscience and mental health from a gender perspective, recognizing the need to integrate both biomedical frameworks and social determinants.

In parallel, bibliometric studies have emerged as a key tool to assess the evolution of this research field. Through indicators such as annual publication growth, average citations per document, and co-authorship networks, it is possible to identify consolidated thematic areas and emerging research trends [5]. The application of this approach has revealed that although scientific production has grown steadily, major limitations remain, including the underrepresentation of women in clinical studies and the concentration of research in high-income countries [6].

Current challenges, therefore, point to the need to diversify study populations, strengthen international collaborations, and adopt intersectional frameworks that account for variables such as social class, ethnicity, and age [7]. At the same time, promising trends are emerging, including the integration of multimodal data (genetic, neurocognitive, and social), the use of artificial intelligence in information analysis, and the incorporation of inclusive methodologies that capture women's specific experiences [8].

Accordingly, this study presents a bibliometric analysis of the challenges and trends in neuroscience and women's mental health, with the aim of providing a comprehensive overview of academic production, its achievements, and its limitations. This perspective not only allows for a better understanding of the field's trajectory but also highlights future opportunities for building a more equitable and representative scientific agenda.

1.1. Scientific Production and Temporal Evolution

The bibliometric analysis of neuroscience and women's mental health reveals sustained growth from the 1990s to the present [5]. This increase largely reflects the greater visibility that mental health issues have gained on both public and scientific agendas, driven by social movements demanding a gender perspective in biomedical research [6]. Over time, the literature shows a qualitative shift in focus: from initial studies centered on specific pathologies, such as

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depression or anxiety, to interdisciplinary approaches that integrate biological, social, and cultural factors.

Annual publication growth exhibits peaks during key historical moments, such as the consolidation of mental health policies in international organizations and the expansion of access to digital scientific databases [8]. These factors facilitated the dissemination of comparative studies and meta-analyses, thereby increasing the average citation rate per document. However, a strong geographical concentration persists: most of the output originates from the United States, Western Europe, and, more recently, Asian countries such as China and South Korea [9]. This bias underscores the challenge of expanding cultural and regional diversity in research, considering that women's mental health experiences vary significantly across socioeconomic contexts.

From a thematic perspective, early studies focused on identifying gender differences in the incidence of mental disorders, while in the past two decades research has increasingly emphasized neurobiological mechanisms related to sex hormones, brain plasticity, and stress vulnerability [10]. The evolution of scientific production thus reflects a transition from descriptive approaches to explanatory and predictive research, supported by neuroimaging technologies and genomic analysis [11].

Bibliometric evidence also indicates an increase in the rate of collaboration per document, suggesting a growing interdisciplinarity among research teams [12]. Nevertheless, single-authored studies remain a minority, reinforcing the idea that this field requires multiple perspectives to address its complexity. In summary, the temporal evolution of scientific production demonstrates not only quantitative growth but also thematic and methodological diversification, laying the foundations for the field's future development [13].

1.2. Main Research Lines

Studies on neuroscience and women's mental health concentrate on key areas that reflect the interplay between biological, psychological, and social factors [9]. Among the most recurrent topics are depressive and anxiety disorders, which present higher prevalence rates in women than in men, as well as a differentiated impact on quality of life [10]. These disorders have been analyzed from multiple perspectives, including clinical, pharmacological, psychotherapeutic, and neurocognitive approaches.

Another central line of research is the study of the relationship between sex hormones and female brain functioning [11]. Investigations have demonstrated how the menstrual cycle, pregnancy, and menopause induce changes in neuronal activity and vulnerability to disorders such as postpartum depression and perimenopausal anxiety [12]. These approaches have enabled the connection of endocrinology with cognitive neuroscience, opening new perspectives for understanding the biological foundations of women's mental health.

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Perinatal health also constitutes an expanding line of research. Recent studies highlight the importance of experiences during pregnancy and postpartum as determinants of women's mental health, as well as the effects of these periods on child neurodevelopment. Similarly, menopause has emerged as a relevant topic, particularly in relation to cognitive decline and the risk of neurodegenerative diseases [14].

Finally, research is emerging that addresses the interaction between social and biological factors. Gender-based violence, chronic stress associated with workplace inequality, and the double burden of domestic and public work are identified as critical determinants of women's mental health [15]. This intersectional perspective represents an emerging trend that seeks to integrate not only biological dimensions but also structural factors shaping women's lived experiences.

1.3. Collaboration and Co-Authorship Networks

Bibliometric analysis shows that research on neuroscience and women's mental health increasingly relies on broader and more multidisciplinary collaboration networks [13]. Teams composed of specialists in neuroscience, psychiatry, psychology, endocrinology, and the social sciences work together to generate more comprehensive knowledge. Nevertheless, important limitations persist: international co-authorship remains limited, restricting the circulation of knowledge and the comparability of results across cultural contexts [14].

Quantitatively, indicators reveal a high average number of co-authors per document, reflecting the collaborative nature of the field. However, studies are still dominated by institutions in high-income countries, with limited participation from universities and research centers in Latin America and Africa [16]. This situation underscores the need to strengthen cooperation networks that enable data sharing, methodological standardization, and the development of more representative comparative frameworks.

Collaboration is also evident at the disciplinary level: basic neurosciences, traditionally focused on experimental models, increasingly interact with clinical and epidemiological approaches [17]. This convergence has given rise to innovative studies, such as those combining neuroimaging with clinical interviews or genomic analyses with sociocultural studies [18]. These methodological synergies not only enrich scientific knowledge but also increase the impact of publications.

Nonetheless, network analyses highlight significant gaps. Isolated research groups with weak connections to global networks persist [19]. This limits knowledge transfer and the capacity to construct universal frameworks that account for the diversity of women's experiences. In this regard, one of the main challenges is to consolidate truly international co-authorship networks, ensuring equitable participation of researchers from different regions and disciplines [20].

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1.4. Challenges and Emerging Trends

The most significant challenges in the field of neuroscience and women's mental health are linked to underrepresentation and lack of diversity in research studies. Despite the growth of scientific production, women remain underrepresented as research subjects in clinical studies, creating biases in the findings. This gap limits the ability of research outcomes to provide truly inclusive solutions tailored to women's specific needs [18].

Another fundamental challenge is the absence of intersectional approaches. Most studies analyze women's mental health from a homogeneous perspective, without considering differences related to social class, ethnicity, age, or geographic context. This limitation reinforces structural inequalities and obscures the diversity of experiences that shape women's mental health across cultural contexts [20].

In response to these challenges, promising trends are emerging. One of these is the use of artificial intelligence and big data to analyze large volumes of multimodal information, including genetic, neurocognitive, and social data [21]. Likewise, there is a growing incorporation of qualitative and participatory methodologies that aim to integrate women's voices into the research process [22]. These innovations help overcome traditional approaches and move toward a more inclusive and contextualized science.

Another trend is the increasing interest in exploring resilience and coping strategies in contexts of adversity, such as gender-based violence, natural disasters, or health crises [23]. In this regard, research is oriented not only toward identifying risk factors but also toward recognizing the resources and capacities that foster women's mental health [24]. Finally, there is a projected growth in studies that articulate neuroscience with public policy, seeking to design evidence-based interventions that address the specific needs of women across different life stages.

1.5. Application of the PRISMA Methodology in Neuroscience and Mental Health Studies

The PRISMA methodology (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) constitutes an international standard for conducting systematic reviews and meta-analyses, and its application in the field of neuroscience and mental health has proven crucial for ensuring research quality and transparency [5]. This method establishes rigorous guidelines that structure the search, selection, and analysis of studies, thereby reducing information dispersion and the biases commonly found in traditional narrative reviews [25].

In research focusing on women, PRISMA holds particular relevance given the historical underrepresentation of women in clinical trials and neuroscientific studies [7]. By applying well-defined inclusion and exclusion criteria, analyses can ensure more representative samples, which enhances the external validity of results and strengthens the comparability of findings across different populations. This approach not only helps to make visible the biological and

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social diversity of women but also identifies knowledge gaps, such as the scarcity of studies on perinatal health, menopause, or the effects of chronic stress on brain health [9].

The utility of PRISMA is also evident in its ability to structure the phases of bibliographic search and data screening, facilitating the construction of robust documentary bases that can subsequently be analyzed using bibliometric techniques. In neuroscience and mental health studies, this step is indispensable, as databases often contain thousands of records that, without a systematic filtering process, hinder the analysis of trends, term co-occurrences, and scientific collaboration networks [26].

Furthermore, the PRISMA methodology enhances the reproducibility of studies, a key aspect in fields where evidence must guide the formulation of public policies and the design of clinical interventions. For example, systematic reviews applying PRISMA have enabled the more precise identification of effective interventions for the prevention of postpartum depression, the early detection of anxiety disorders, and the impact of gender-based violence on women's mental health[27].

In conclusion, the incorporation of PRISMA into neuroscience and mental health research not only strengthens the methodological quality of reviews but also establishes a bridge with bibliometric analysis, ensuring that the documents included in the evaluation more accurately reflect the state of scientific knowledge. This dual contribution systematic rigor and robustness in the quantitative analysis of the literatura makes PRISMA an indispensable tool for consolidating a comprehensive understanding of the challenges and trends in women's mental health.

1.6. The Interquartile Range in Scientific Publications and Its Relationship to Neuroscience and Mental Health

The interquartile range (IQR) is a statistical measure that allows the analysis of data dispersion within a set of scientific publications, offering a more precise perspective than the mean by excluding extreme values. In the field of neuroscience and mental health, its use is fundamental for understanding variability in indicators such as citation counts, keyword distribution, or author productivity [28], [29]. Through this approach, it becomes possible to identify which research areas show greater homogeneity, such as studies on depression and its associated factors [30], and which display greater dispersion, such as works addressing the relationship between the social environment and mental health [31].

The IQR also contributes to classifying the relevance of findings according to their placement in impact quartiles, distinguishing between central and peripheral publications within the scientific output. For instance, studies on the increase of mental health problems in specific populations or the prevalence of disorders in contexts of inequality tend to be located in the upper quartiles, consolidating their academic importance. Conversely, emerging studies, such

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as those linking periconceptional diet with neurological health or the association of musculoskeletal diseases with mental comorbidities [32], [33], reflect greater variability in citation patterns, which is evidenced by a wider interquartile range.

In summary, the IQR emerges as a strategic indicator in bibliometric analyses of neuroscience and mental health, as it enables the detection of both consolidated areas and emerging lines of research. Its application facilitates objective comparison across journals and topics, supporting decision-making in source selection, the design of systematic reviews, and the identification of knowledge gaps relevant to scientific advancement [34], [35].

Accordingly, this study seeks to answer the following research question: *What challenges emerge in the field of neuroscience and women's mental health based on the co-occurrence network analysis of terms in scientific production?* It proposes the following hypothesis: **H1:** Co-occurrence network analysis of terms will make it possible to identify the challenges related to neuroscience and women's mental health.

The proposed hypothesis is justified by the evidence available in the literature related to the field of study.

First, the literature demonstrates a broad thematic dispersion ranging from the study of affective and depressive disorders to research on neurobiological factors, brain circuits, neuronal plasticity, and functional connectivity. This conceptual diversity highlights the need to integrate findings into an analytical structure that can identify common patterns and emerging areas of research.

Second, most research on women's mental health focuses on specific risk factors (such as stress, early trauma, hormonal vulnerability, or social inequalities) and on clinical intervention strategies (pharmacological, psychotherapeutic, or neuromodulation-based). The use of co-occurrence analysis enables the mapping of how these concepts interrelate, thereby revealing both persistent challenges (e.g., insufficient attention to gender differences in clinical trials) and emerging trends (e.g., the application of neuroimaging and non-invasive brain stimulation).

Third, the literature emphasizes the importance of contextual and socioeconomic factors in mental health, such as marginalization, unequal access to services, and structural barriers to care. Co-occurrence analysis allows these social determinants to be linked with neurobiological and clinical variables, providing a more comprehensive picture of current challenges.

Finally, given the large number of terms associated with diagnosis, treatment, neural networks, and mental health policies, the construction of co-occurrence maps is presented as the most suitable tool for synthesizing this volume of information, identifying thematic cores, and establishing the hierarchy of challenges in research on neuroscience and women's mental health.

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In sum, the hypothesis is justified because co-occurrence network analysis not only organizes and makes visible the complexity of the field but also facilitates the identification of gaps, trends, and priority areas for intervention, offering a solid framework to guide future research.

2. Methodology

2.1. Document Selection

The selection of documents was carried out following the best practices established by the PRISMA methodology (see Figure 1). Subsequently, search equations were designed for each bibliographic source, retrieving a total of records as shown in Table 1.

Figure 1. Flow diagram PRISMA

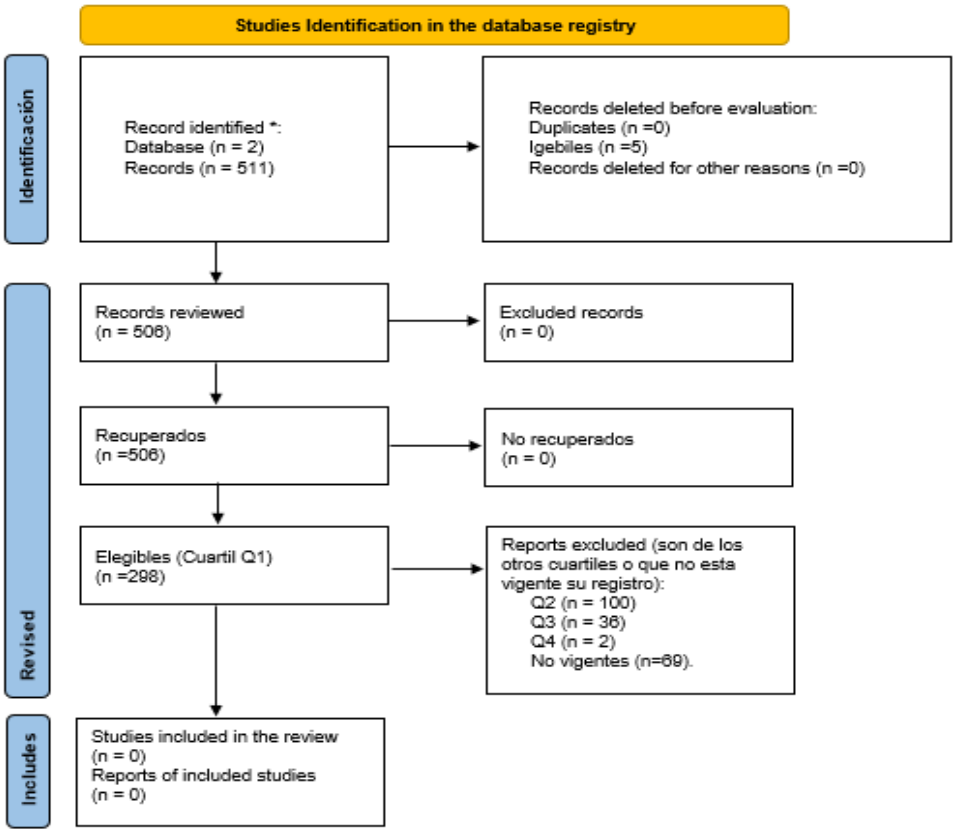

Table 1. Search Equation

Base de datos	Search equation	Total
Scopus	TITLE-ABS-KEY ((Neuroscience AND "mental health") AND disorders AND ("Application" OR "Intervention" OR "Treatment" OR "Evaluation" OR "diagnosis" OR	137

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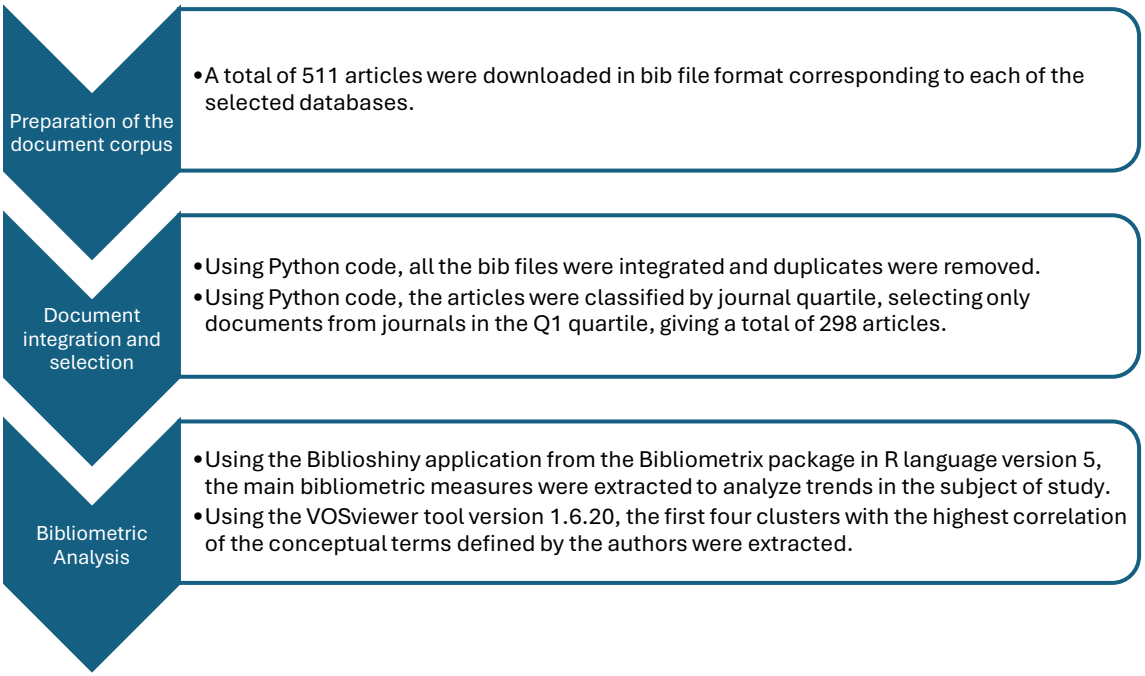
	"diagnostic") AND (female OR woman OR women)) AND (LIMIT-TO (DOCTYPE , "ar"))	
Web Of Science	((Neuroscience AND "mental health") AND disorders) All Field and ("Application" OR "Intervention" OR "Treatment" OR "Evaluation" OR "diagnosis" OR "diagnostic") All Field and (female OR woman OR women) Document Type: Article	374
Summary		511

2.2. Bibliometric Analysis

To address the challenges and trends of the topic under investigation, the following workflow was developed (see Figure 2):

Figure 2. Bibliometric workflow



3. Results

3.1. Analysis of Trends in the Main Bibliometric Indicators

The bibliometric analysis of challenges and trends in neuroscience and women's mental health covered a time span from 1992 to 2025, revealing a trajectory of more than three decades of sustained scientific production (see Figure 3). During this period, a total of 290 documents were retrieved, published across 119 sources, including scientific journals (see Figure 4A). The

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production shows an average annual growth rate of 11.28%, confirming the consolidation and progressive expansion of this field within the international scientific agenda.

Regarding the visibility of the documents, the average age of publications was 6.77 years, indicating that most of the analyzed works belong to the last decade and reflect a marked recent interest. The mean number of citations per document (6.769) reveals a moderate impact, but with a significant accumulation of 13,457 references, underscoring the breadth of the theoretical and experimental support sustaining this domain (see Figure 4B).

From a content perspective, the analyzed documents included a total of 784 Keywords Plus and 2,845 authors' keywords, demonstrating thematic diversity and the consolidation of multiple research lines around the intersection of neuroscience, mental health, and women. Among the most prominent terms are neuroplasticity, emotional regulation, depression, early-life stress, mental health policies, and social barriers to treatment access (see Figure 4D).

In terms of authorship, the database recorded the participation of 2,561 researchers, of which only three documents were single-authored, reflecting a strong predominance of scientific collaboration. The indicator of 10.3 co-authors per document further confirms the highly collaborative nature of this research area (see Figure 4C).

Overall, the results demonstrate that neuroscience and women's mental health constitute an emerging and dynamic research field, characterized by sustained growth, notable academic collaboration, and high thematic diversity.

Figure 3. Bibliometric measures

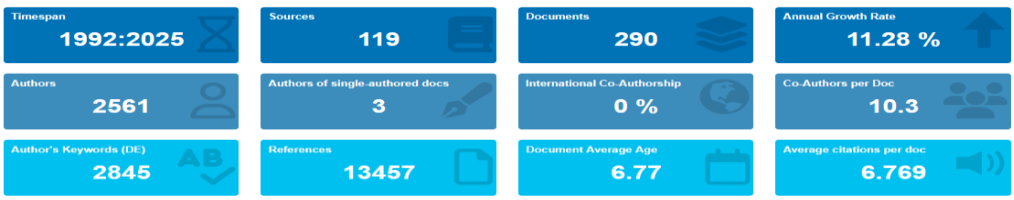
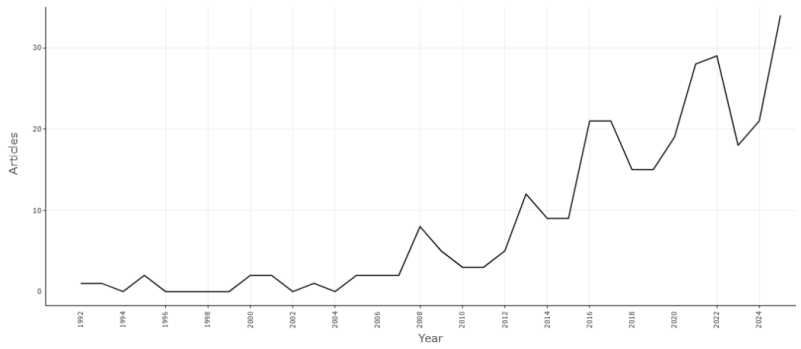


Figure 4. bibliometric trend

A)



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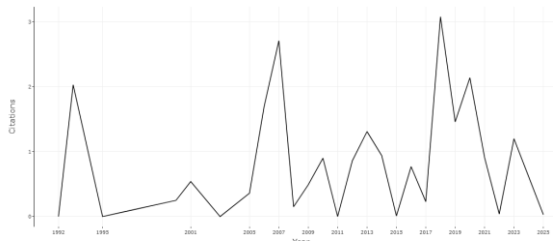
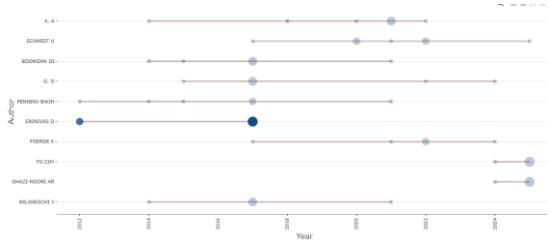
B)



C)



D)

A) Annual Scientific Production. B) Average Citations Per Year. C) Authors' Production over Time. D) WordCloud

3.2. Co-Occurrence Network Analysis of Terms

Based on the analysis of 2,845 conceptual terms defined by 2,561 authors, a co-occurrence network of terms was designed (see Figure 5), allowing the extraction of four main clusters that concentrate the highest correlations among terms. The first cluster was designated as Neuroplasticity, Sex Hormones, and Women's Mental Health. The second cluster was titled Epidemiology, Treatment, and Social Barriers in Psychosis and Women's Mental Health. The third cluster was named Clinical Care, Diagnosis, and Mental Health Policies for Women, and the fourth cluster was defined as Neural Circuits, Neuroimaging, and Innovative Therapies in Depression and Women's Emotional Regulation. The following sections provide a literature review and definition of each cluster.

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3.2.1. Cluster 1: Neuroplasticity, Sex Hormones, and Women's Mental Health

Cluster 1 addresses the interaction between neuroplasticity, sex hormones, and women's mental health, highlighting how neuroendocrine processes shape the reorganization of the nervous system and condition women's psychological experience (see Figure 6A). This perspective emphasizes that hormonal variations across the life cycle adolescence, reproductive age, and menopause play a decisive role in emotional regulation, memory, and vulnerability to stress [36].

Multiple studies have demonstrated that estrogens play a protective role in promoting synaptic plasticity, enhancing learning and memory processes, and providing defense against cognitive decline and neurodegenerative diseases [37]. However, the estrogenic decrease characteristic of menopause has been linked to an increase in the prevalence of affective disorders, particularly depression and anxiety, confirming the close relationship between hormonal changes and women's mental health [38].

The literature also indicates that other hormones, such as progesterone and testosterone, play modulatory roles in neuroplasticity and stress response. While progesterone has been associated with the regulation of inhibitory circuits and anxiety control, testosterone contributes to motivation and the regulation of social behavior, influencing risk perception and behavioral adaptability [39]. Moreover, the interaction of these hormones with environmental factors such as prolonged exposure to stress can alter brain connectivity and help explain women's greater predisposition to certain psychiatric disorders [40].

Taken together, the contributions of this cluster reinforce the idea that women's mental health cannot be fully understood without integrating the neuroendocrine dimension. Within this framework, more personalized intervention strategies are emerging, such as the use of hormone therapies, cognitive stimulation programs, and comprehensive well-being approaches aimed at effectively preventing and treating the most common conditions in this population group.

3.2.2. Cluster 2: Epidemiology, Treatment, and Social Barriers in Psychosis and Women's Mental Health

Cluster 2 focuses on the interrelation between the epidemiology of psychosis, the treatment strategies available, and the social barriers women face regarding their mental health (see Figure 6B). The literature shows that psychosis presents a gender-differentiated epidemiological pattern: women tend to experience later onset, attenuated symptoms, and better functional prognosis compared to men, yet they also face greater stigmatization and inequality in accessing specialized services [20]. These epidemiological factors suggest that the design of care models must account for the specificities of women's mental health to ensure timely diagnosis and treatment.

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With regard to treatment, advances in pharmacotherapy and psychotherapy are noteworthy, with studies highlighting the effectiveness of combined interventions that integrate antipsychotic medication with psychosocial support programs [41]. However, clinical practice still faces limitations related to treatment adherence, which is influenced both by the side effects of medications and by cultural and gender-related factors that condition continuity of care [42]. This scenario calls for tailored strategies that incorporate community education, family support, and policies aimed at reducing inequalities in mental health.

The analysis of social barriers underscores how stigma, discrimination, and gender roles affect the clinical trajectory of women with psychosis [43]. Many women face additional obstacles when seeking help, such as the invisibilization of their symptoms, the lack of support networks, or the prioritization of domestic responsibilities over self-care [44]. These conditions not only delay access to services but also worsen the course of the illness and limit opportunities for comprehensive rehabilitation.

In this regard, the studies included in this cluster converge on the notion that the response to psychosis in women must be articulated through a biopsychosocial approach, recognizing the interaction between clinical, epidemiological, and social factors. There is a clear need for public policies that guarantee equity in access to mental health services, community awareness programs, and the strengthening of women-centered support networks [22]. Thus, Cluster 2 reveals that understanding the epidemiology and improving the treatment of psychosis will only be effective if the social barriers that perpetuate inequality in women's mental health are dismantled.

3.2.3. Cluster 3: Clinical Care, Diagnosis, and Mental Health Policies for Women

Cluster 3 focuses on clinical care, early diagnosis, and the implementation of mental health policies targeted at female populations (see Figure 6C). The reviewed literature indicates that mental disorders in women present differentiated and in many cases underestimated prevalence, due to diagnostic biases and the limited training of professionals in gender-sensitive approaches [45]. This situation has resulted in delayed access to specialized services and the underrepresentation of women in prevention programs and clinical follow-up initiatives [46].

Several studies demonstrate that depression, anxiety, and psychotic disorders require diagnostic strategies tailored to women's sociocultural context and life cycle [47]. For example, it has been observed that traditional clinical criteria tend to obscure atypical symptoms, leading to misdiagnoses or delayed diagnoses [48]. In response, the integration of gender-sensitive clinical protocols and continuous training of healthcare personnel emerge as indispensable measures to improve diagnostic accuracy [49].

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Similarly, public mental health policies show heterogeneous development. In some countries, community-based programs have been implemented to reduce access barriers, promote equity in care, and prioritize maternal and perinatal mental health. However, the lack of funding and limited interinstitutional coordination restrict the sustainability of these policies. This is reflected in the persistence of territorial and socioeconomic gaps that limit access for women in vulnerable situation [50].

Finally, this cluster highlights the need to move toward a comprehensive model of women's mental health, combining timely clinical care, gender-sensitive diagnosis, and inclusive public policies that reduce inequities. The incorporation of digital technologies in screening and monitoring disorders, together with the promotion of awareness campaigns, represent emerging trends aimed at strengthening women's quality of life across diverse contexts.

3.2.4. Cluster 4: Neural Circuits, Neuroimaging, and Innovative Therapies in Depression and Women's Emotional Regulation

Cluster 4 addresses the interrelation between brain neural circuits, neuroimaging, and innovative therapies applied to depression and women's emotional regulation (see Figure 6D). This field has gained great relevance in recent years, recognizing that affective disorders in women are explained not only through traditional clinical perspectives but also by the functional and structural brain patterns underlying emotional response and vulnerability to depression [47].

Neuroimaging has made it possible to identify specific alterations in regions such as the prefrontal cortex, the amygdala, and the hippocampus, which are part of the circuits involved in emotional regulation. Functional magnetic resonance imaging studies have shown that women with depression exhibit hyperactivation in limbic areas associated with sadness processing and hypoactivation in cognitive control networks, which contributes to difficulties in modulating negative emotions [49]. These findings strengthen the notion that neurobiological markers can support the development of differentiated, gender-sensitive treatments.

In this regard, therapeutic advances have focused on the use of non-invasive brain stimulation techniques, such as repetitive transcranial magnetic stimulation (rTMS), which has demonstrated clinical efficacy in reducing depressive symptoms by modulating activity in the dorsolateral prefrontal cortex [14]. Available evidence suggests that intensive rTMS protocols not only achieve remission rates comparable to traditional approaches but also shorten hospitalization times, representing a benefit in both treatment effectiveness and healthcare costs.

Another innovative approach is neurofeedback-based therapy, which allows patients to train the self-regulation of their emotional states through feedback from their own brain activity. The

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ability to modify neural patterns in real time opens avenues for personalized interventions, particularly for women who show resistance to conventional pharmacological treatments. Additionally, correlations have been documented between the volume of prefrontal structures and women's self-perception of energy and general health, demonstrating how neuroanatomical changes can directly influence the subjective experience of well-being [49].

Taken together, this cluster underscores the importance of an integrative perspective on women's depression, in which research on neural circuits, neuroimaging tools, and the development of innovative therapies converge. The future challenge lies in advancing methodological designs that incorporate women's hormonal and social specificities, with the aim of achieving more effective treatments and greater clinical relevance.

Figure 5. co occurrence Network

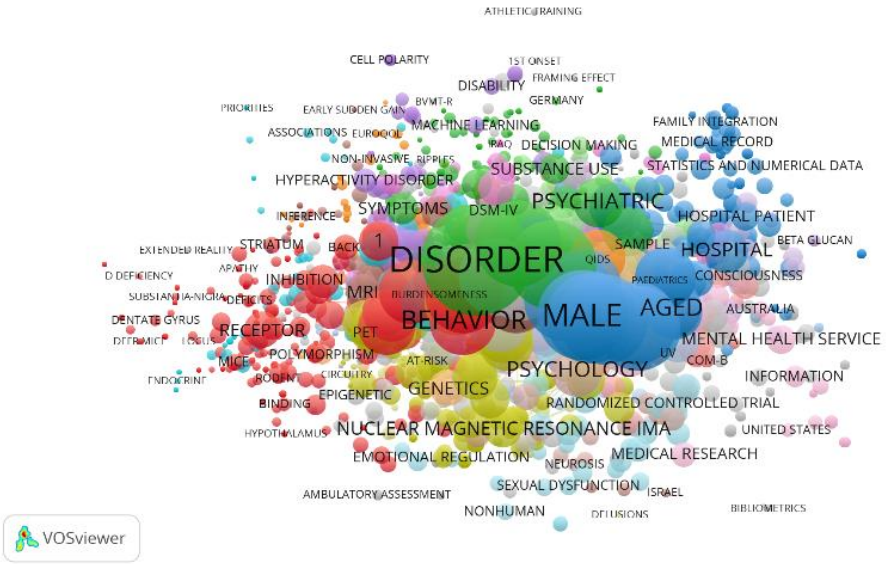
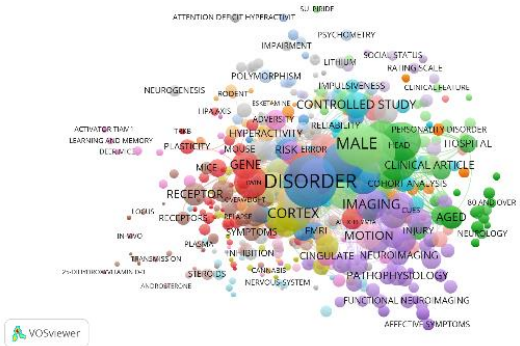
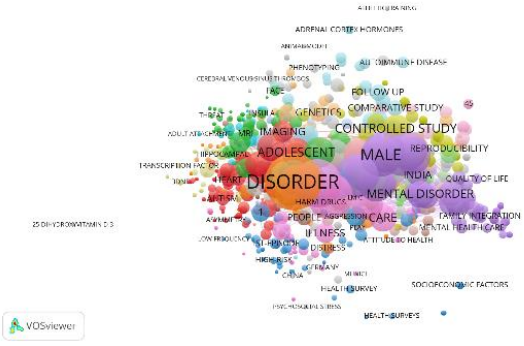


Figure 6. Clusters

A) B)





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C) D)

Note: A) Cluster 1: Neuroplasticity, Sex Hormones, and Women's Mental Health
B) Cluster 2: Epidemiology, Treatment, and Social Barriers in Psychosis and Women's Mental Health C) Cluster 3: Clinical Care, Diagnosis, and Mental Health Policies for Women Cluster 4: Neural Circuits, Neuroimaging, and Innovative Therapies in Depression and Women's Emotional Regulation

4. Discussion

The findings confirm that research on neuroscience and women's mental health is undergoing a process of consolidation and sustained expansion. The trajectory of more than three decades, with an annual growth rate of 11.28% and a corpus of 290 documents, reflects not only the maturity of the field but also a renewed interest in the last decade. The moderate average number of citations, together with the large number of references collected, demonstrates a robust theoretical foundation, although there remains room for strengthening in terms of academic impact and practical transferability.

A noteworthy aspect is the high level of scientific collaboration. The average of 10.3 co-authors per document and the low proportion of single-authored works highlight that production is supported by consolidated academic networks, with a strong emphasis on interdisciplinarity. This feature represents both a strength and a challenge: while it fosters methodological richness and the integration of perspectives, it also requires greater coordination and leadership from local research groups, particularly in contexts where women's mental health issues exhibit specific cultural and socioeconomic particularities.

From a thematic perspective, the co-occurrence analysis identified four clusters that structure the field. Each contributes a specific perspective that, taken together, forms an integrated framework. Cluster 1 underscored the decisive role of sex hormones in neuroplasticity and emotional regulation, emphasizing the importance of the neuroendocrine dimension in women's mental health. Cluster 2 demonstrated how psychosis in women is shaped by differentiated epidemiological factors, therapeutic advances, and, above all, social and cultural barriers that limit access and treatment adherence. Cluster 3 highlighted deficiencies in clinical

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care and public policy, where diagnostic biases and the lack of gender-sensitive approaches remain persistent obstacles. Finally, Cluster 4 projects an innovative horizon through the integration of neuroimaging and non-invasive therapies, which open new avenues for more personalized and effective interventions.

Overall, the discussion of these results reveals that the field has evolved from traditional approaches centered on symptomatology to a multidimensional model that combines biological, clinical, social, and technological factors. Nevertheless, significant challenges remain, including the need to reduce equity gaps in access to gender-sensitive mental health services, to strengthen the impact of scientific production by extending its reach beyond academia into public policies and clinical practices, to foster interdisciplinary and regional research ensuring that advances in neuroscience and innovative therapies reach resource-limited contexts, and to promote an inclusive agenda that incorporates women's hormonal, social, and cultural perspectives into methodological designs and intervention strategies.

In conclusion, the results indicate that neuroscience and women's mental health constitute an emerging, diverse, and highly collaborative field, in which therapeutic innovations and neuroscientific advances must be integrated with inclusive policies and equitable care strategies to achieve not only progress in knowledge production but also real transformation in women's quality of life across diverse contexts.

5. Conclusions

The conclusions of this bibliometric study confirm that neuroscience and women's mental health constitute a field in the process of consolidation, characterized by sustained growth, increasing thematic diversity, and a strong collaborative orientation. The review of more than three decades of scientific production demonstrates that progress has made it possible to highlight the influence of biological, hormonal, social, and cultural factors on women's mental health, underscoring the need for comprehensive and gender-sensitive approaches. The identification of four thematic clusters provides a solid analytical framework: the interaction between neuroplasticity and sex hormones; the epidemiology and treatment of psychosis along with social barriers; clinical care and mental health policies; and finally, neural circuits and innovative therapies related to depression and emotional regulation. Collectively, these axes reveal a shift from descriptive perspectives to multidimensional approaches supported by technologies such as neuroimaging and non-invasive brain stimulation.

The analysis also reveals significant challenges that should guide the future scientific agenda. These include the need to reduce inequalities in access to specialized services, diversify study populations, and incorporate intersectional frameworks that account for variables such as ethnicity, age, and social class. Likewise, it is a priority to strengthen international collaboration—particularly with underrepresented regions such as Latin America and Africa—

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in order to construct a more global and inclusive vision. Similarly, there is an urgent need to overcome diagnostic and clinical biases through the training of professionals in gender-sensitive approaches and the development of public policies that guarantee equity in care.

Finally, this study confirms that the integration of bibliometrics with systematic methodologies such as PRISMA provides a rigorous foundation for mapping the advances and gaps in the field. The findings not only enrich scientific knowledge but also open opportunities for neuroscience applied to women's mental health to translate into more effective interventions, inclusive policies, and tangible improvements in the quality of life of women across diverse contexts.

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