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CONTENT

On the cover
Madonna and Child (Oil on wood, late 1480s)

Giovanni Bellini (1459-1516))

The Met Fifth Avenue, N.Y.
Credit: Rogers Fund, 1908

Instituto Nacional de Psiquiatría
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Directorio

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EDITORIAL
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Perinatal mental health: The launching spot to our mental health

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The complexity of caring for two minds at a single time, happens when an expecting mother is, in turn, taking care of her future baby. All the efforts of the health provider must converge at this moment to maintain the greatest well-being of both the mother and the fetus. However, in reality, difficulties are present and determine some mental symptoms. Moreover, illnesses like depression and anxiety are not discarded in the perinatal period. It is well known that emotional disorders are common during pregnancy, especially in vulnerable populations (WHO, 2021). In Mexican women, perinatal depression has been estimated to range from 8.2% to 20%, depending on the timing of the evaluation (Lara et al., 2015), while perinatal anxiety symptoms reported rate is 21% in the pregnancy and 18% in the postpartum (Juárez Padilla, 2021). Those disorders are frequently unrecognized and untreated, with the consequences that entail them (Flores-Ramos et al., 2013). Mental comorbidities during pregnancy exert important impacts on both growth and neurodevelopment of the fetus and the neonate, with adverse outcomes for both mother and the offspring in the postnatal life.

Depression affects the optimal function of the hypothalamic-pituitary-adrenal axis (HPA) during pregnancy, changing the cortisol milieu and reducing the activity of placental 11-β hydroxysteroid dehydrogenase type 2 (Gelman, 2015). In addition to the HPA-axis dysfunction, the immune system in the perinatal period is influenced by the presence of severe anxiety and depression, since changes in the pro-inflammatory cytokine profile was detected in pregnant women exhibiting both mood symptomology (Leff-Gelman et al., 2019). Depression affects the optimal function of the hypothalamic-pituitary-adrenal axis (HPA) during pregnancy, causing changes in the cortisol milieu, associated with a decrease activity of placental 11-β hydroxysteroid dehydrogenase type 2 (Gelman et al., 2015).

In line with the aforementioned, it is suitable and appropriate to currently assess the effects of hormone changes on the patients' mental health along pregnancy. It is believed that periods with important hormonal fluctuations, such as puberty or menopause transition, are related to mood and anxiety symptoms. Hence, one of the time periods in a woman´s life, in which higher hormonal adjustment occurs, is the perinatal period. Furthermore, the fact that the cortisol/DHEA-S index has been found increased in pregnant women with high anxiety levels, posits a crucial relevance in the analyses of stress-related steroid hormones in pregnant women with affective disorders (Leff-Gelman et al., 2020). However, further studies are still needed to elucidate the impact that such hormones possess on mood disorders during pregnancy.

The relevance of social and cultural conditions on mental health is undeniable, and the beliefs or ideas about maternity in different cultures may influence on the decisions taken by the mother regarding her own medical health care. The widely documented reports of the effects of social support on depression and anxiety, should not be overlooked mainly, when focusing on the perinatal mental health (Sufredini et al., 2022).

Actually, the paternal's mental health in the perinatal period has been accruing interest, due to the clear evidences shed on the role of father´s mental health in the child development and maternal well-being (Conde et al., 2022).

Overall, the complexity of this topic entails that biological, psychological, and sociocultural factors should be extensively considered when dealing with and researching perinatal mental health care.

Clinicians and researchers are urged to draw attention on this medical field, having in mind the current information and data related to perinatal mood disorders. Thus, clinical scenarios must implement screening services and tools to detect antenatal/perinatal depression, in addition to other mental disorders (Stewart & Payne, 2023). These scenarios may well propitiate deeper evaluation of how mental comorbidities influence and impact several aspects of perinatal outcomes.

Finally, researchers must lay their best efforts to inquire into and/or investigate perinatal psychiatry, taking in consideration the feasible and attainable opportunities to establish institutional collaborations and group networks with either national or international Ob-Gyn Clinics and Psychiatric Institutions worldwide.

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Circulating sex hormones in women with severe anxiety during pregnancy

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ABSTRACT

Introduction. Anxiety, mood- and stress-related behaviors are regulated by sex hormones in pregnant and non-pregnant women. Very scarce information exists about the role of sex steroids in pregnant women displaying high levels of anxiety. **Objective.** To determine sex hormones serum levels in pregnant women exhibiting high levels of anxiety symptoms. **Method.** The Hamilton Anxiety Rating Scale (HARS/ HAM-A) was used to assess the intensity of anxiety symptoms in third-trimester pregnant women. Two groups were included in the study, pregnant women exhibiting severe anxiety (ANX; HARS scores ≥ 25; n = 101) and healthy control subjects (CTRL; n = 40) displaying lower scores for anxiety (HARS scores ≤ 7). Estradiol (E2), progesterone (P4), and testosterone (T) serum levels were measured using a standard chemiluminescent immunoassay. Bivariate and partial correlations were performed to detect significant associations between groups, clinical measures, biochemical data, and HARS scores. **Results.** The anxiety group (ANX) showed an increase in E2 and T serum levels (p < .001) compared to CTRL. Conversely, significantly lower P4 levels were found in the symptomatic group (p < .001) as compared to the CTRL hormone values. The P4:E2 index was significantly reduced in pregnant women with high levels of anxiety (p < .001). Negative correlations between anxiety (HARS) scores, P4 serum levels (p = .02), and P4:E2 ratio (p = .04) were found in the symptomatic group. Conversely, T serum levels displayed a positive association (p = .001) with high levels of anxiety symptoms in the same group, after adjusting our data by clinical confounders. **Discussion and conclusion.** Serum levels of sex-steroid hormones are altered in pregnant women exhibiting severe anxiety.

Keywords: Estradiol, progesterone, testosterone, steroids, pregnancy, anxiety, stress.

RESUMEN

Introducción. La ansiedad, el estado de ánimo y el estrés están regulados por diversos esteroides sexuales. Existe poca información sobre el papel que juegan estos esteroides en mujeres embarazadas con niveles elevados de ansiedad. **Objetivo.** Determinar los niveles séricos de hormonas sexuales en mujeres embarazadas con altos índices de síntomas de ansiedad con respecto a mujeres gestantes sanas. **Método.** Determinación de la intensidad de síntomas ansiosos empleando la escala de Hamilton de Ansiedad (HAM-A) en 141 mujeres embarazadas en el tercer trimestre de gestación. Cuantificación de los niveles séricos de estradiol (E2), progesterona (P4) y testosterona (T) por inmunoensayo estándar. Aplicación de las correlaciones de Pearson para detectar asociaciones entre parámetros clínicos y valores hormonales entre los grupos de estudio. **Resultados.** Las mujeres con *ansiedad severa* (ANX; n = 101; HAM-A ≥ 25) mostraron niveles séricos más altos de E2 y T (p < .001), así como niveles más bajos de P4 (p < .001) en relación con el *grupo control* (CTRL, n = 40, HAM-A < 7). Se detectó una disminución significativa en el índice P4:E2 en el grupo de ANX (p < .001) y se observaron correlaciones negativas y positivas entre los puntajes elevados de ansiedad con los niveles circulantes de P4 (p = .02), en la taza P4:E2 (p = .04) y en los niveles séricos de T (p = .001) respectivamente, al ajustar nuestros datos con variables confusoras. **Discusión y conclusión.** Los niveles circulantes de los esteroides sexuales se encontraron alterados en mujeres con ansiedad severa.

Palabras clave: Estradiol, progesterona, testosterona, esteroides, embarazo, ansiedad, estrés.

INTRODUCTION

Affective disorders contribute extensively to the worldwide burden of disease in non-developed (third world) countries (Walther et al., 2019a; WHO, 2017). Accumulated data have shown an increasing incidence of stress- and anxiety-related disorders. Likewise, these disorders are associated with an increase in severity comorbidity, and burden of affective disorders. In women, the prevalence of depression and the number of years living with disability are at least two-times higher than men (Li & Graham, 2017; WHO, 2017).

Sexual differences in anxiety-related disorders appear at puberty or in early childhood, and women have an increased risk to develop anxiety disorders and/or exacerbation of anxiety symptoms during the different phases in the reproductive cycle (i.e., menstruation, postpartum, menopause) that are influenced by fluctuations in hormone levels (Li & Graham, 2017; Kaspi et al., 1994; Labad et al., 2005; van Veen et al., 2009; Steiner et al., 2003). The higher prevalence rates for mood-related disorders among women appear to be partly due to the fluctuation of sex steroids, which participate in mood disorders pathophysiology (Li & Graham, 2017).

Interestingly, some authors have proposed two wide and extensive mechanisms regarding fluctuations of sexual hormones that appear to influence the gender imbalance exposed to stressors and anxiety. It is believed that sex hormones could mediate this imbalance through the increase in high-risk factors commonly linked to the appearance of anxiety disorders or by enabling a long-term manifestation of anxiety, with implications in the modulation of the neural systems that regulate stress, and the responses produced by psychological and/or drug-associated treatments, among other responses (Li & Graham, 2017).

Animal studies have extensively shown that estradiol (E2) and progesterone (P4) play critical roles in behavioral and cognitive pathways (Li & Graham, 2017). However, it has been challenging to conclude the precise role of sex hormones based on the findings reported from animals and human studies, in naturally cycling rodents and reproductive women (Li & Graham, 2017).

Stress-related disorders and anxiety are characterized by altered activity in several cell-signaling molecules, usually modulated by steroid hormones, neurotransmitters [i.e., serotonin (5-HT)], and the P4-associated neurosteroid, allopregnanolone (ALLO; Cover et al., 2014; Le Mellédo & Baker, 2004; Rubinow et al., 1998; Schüle et al., 2014).

It has been shown that the downregulation of serotonergic function and ALLO activity in rodents are involved in the increased expression of anxiety-related behaviors, for instance, panic disorders and/or post-traumatic stress disorder (PTSD; Holmes et al., 2003; Maron et al., 2004; Murrough et al., 2011). Earlier studies demonstrated the role of sex steroids in improving depression and anxiety symptoms (Li & Graham, 2017; Fiacco et al., 2019; Walther et al., 2019b). Dehydroepiandrosterone (DHEA), P4, and testosterone (T) administration in rodents promotes an increase in ALLO secretion and facilitates antidepressant-inducing neuronal plasticity in regions of the hippocampus (Walther et al., 2019a; Li & Graham, 2017; Walther et al., 2019c). These data are in line with clinical observations indicating that T and DHEA supplementation produce antidepressive and anxiolytic responses in reproductive women (Walther et al., 2019a; Fiacco et al., 2019).

Sex steroids are neuroactive mediators that directly influence mood and behavior and bind their cognate receptors, which are distributed throughout the brain, particularly in areas involved in depression and anxiety-related behaviors (Schiller et al., 2016; Mahmoud et al., 2016).

However, clinical studies concerning the modulation of sex steroids in affective disorders in reproductive-age women shed conflicting results. Some studies report no associations between sex steroids and these disorders, while others have exhibited positive or negative associations between sex hormones and depressive illness (Asselmann et al., 2019; Giltay et al., 2017). Pregnant women displaying high levels of anxiety are associated with several adverse effects that impact the maternal mental health and birth outcome, and thereby, represent a risk factor for developing post-partum depression (PPD). Prenatal anxiety impacts the fetal heart rate and motor activity, predisposing to obstetric complications, preterm delivery, and altered changes in infant behavior (Alipour et al., 2012; Monk et al., 2003; Mancuso et al., 2004; Davis et al., 2004). The effects of prenatal anxiety responses continue in the offspring during infancy and childhood, negatively affecting their emotions and mental development (Field, 2017).

During pregnancy, the fetoplacental unit becomes the primary source of sex steroids, among other active mediators (i.e., growth factors, neuroactive hormones), which enhance significant modifications in maternal physiology (Costa, 2016; Edey et al., 2018; Napso et al., 2018). For instance, E2 and P4 are crucial for the mother's insulin sensitivity and glucose metabolism (Napso et al., 2018). Furthermore, a reduction of E2 and P4 blood levels appear to deprive the organism of its natural defense against postpartum depression (Trifu et al., 2019).

Regarding testosterone, high T levels are believed to be associated with an increase in anxiety symptoms in humans, as shown by Walther and collaborators who found an association between a higher K6 scale punctuation and T levels after adjusting for confounders (Walther et al., 2019a). Similarly, studies in female rats with induced polycystic ovary syndrome (PCOS), have demonstrated a correlation between prenatal androgens exposure and anxiety-like behavior (ALB) in the offspring of PCOS females. Besides, an association between T microinjections into the amygdala of female mice and ALB was observed (Hu et al., 2015; Risal et al., 2021).

Interestingly, another recent study found a significant association between anxiety and circulatory T levels in subjects

exhibiting PCOS, but not in women without PCOS (Glowinska et al., 2020). In spite of the vast number of reports showing the functional role of sex steroids in depression in non-pregnant women (Walther et al., 2019a; Matsuzaka et al., 2013; Weber et al., 2000) or in healthy pregnant women during mid and late gestation and the peripartum (Trifu et al., 2019; Martínez-Paredes & Jácome-Pérez, 2019); there is scarce information concerning the role of sex hormones in women with severe anxiety in late pregnancy. Thus, in the present paper, we quantified P4, E2, and T serum levels in women with high levels of anxiety during late pregnancy.

METHOD

Design of the study

A quantitative, cross-sectional, analytical study was conducted.

Subjects / description of the sample

A non-probabilistic sample of pregnant woman between 18 to 30 years old, who attended the outpatient department, was invited to participate in the present study.

Places

Pregnant women were interviewed and evaluated at the OB-Gyn Department at General Hospital of Mexico (Hospital General de Mexico, Dr. Eduardo Liceaga of Mexico, Mexico City).

Measurements

Anxiety Scale: Properties

The Hamilton Anxiety Rating Scale (HARS) is a reliable and adequate psychometric instrument, use to assess the severity of anxiety in a global context, in patients who meet the criteria for anxiety or even depression. This scale exhibits similar properties reported in the original scales (Hamilton, 1959; Maier et al., 1988) rendering it a highly useful instrument in healthcare practice and clinical research in our country.

The psychometric properties of the scale reported by Lobo et al. (2002); consist of the following: 1. Discriminant validity (MADRS/HARS-Clinical Global Impression of Severity: $p < .001$). 2. Convergent validity (MADRS-Hamilton Depression Rating Scale: $p < .05$ and .01, respectively; MADRS/HARS-EuroQoL 5D: $p < .05$; HARS-State Trait Anxiety Inventory: $p < .05$). 3. Internal consistency (Cronbach's α: MADRS = .88; HARS = .89). 4. Test-retest and inter-observer reliability (intraclass correlation coefficient: MADRS = .94 and .98, respectively; HARS = .92 and .92). 5. Sensitivity to change (effect size: MADRS = 2.05; HARS = 1.36).

Anxiety scale: Characteristics

The anxiety scale consists of 14 items designed to assess the severity of a patient's anxiety. Each of the 14 items contains a number of signs and symptoms. Each group of signs/symptoms is rated on a scale of zero to four, with four being the most severe (i.e., each item measures the frequency and intensity of anxiety symptoms on a 0–4 Likert-type scale) (Hamilton, 1959; Maier et al., 1988). Although the symptoms enlisted within each item facilitate the assessment of anxiety, no specific anchor points are considered in this tool, when compared to other rating-scale measuring anxiety symptoms. One point to consider is that this instrument takes no more than 30 minutes to complete in the interviewer's presence. Moreover, 13 out of the 14 items, refer to the assessment of anxiety symptoms, and the last item (14), evaluates the patient's behavior after the interview. The rating score ranges from 0 to 56 points; thus, the final score results from the sum of the points considered from each item. Worth noting is that two main points are merely measured throughout the scale; psychic anxiety (items 1-6, and item 14) and somatic anxiety (items 7-12, and item 13) respectively (Hamilton, 1959; Maier et al., 1988). Interestingly, this scale is highly useful to quantify the symptomatic variations overtime during or after exposure to drug treatment.

This instrument has been shown to be a highly reliable, specific, and sensitive tool (Maier et al., 1988) and has been validated in the local language (Lobo et al., 2002).

Participants during late pregnancy showing higher scores on the HARS scale (≥ 25) were considered as subjects, exhibiting high levels of anxiety symptoms; while pregnant women showing lower scores in the HARS questionnaire (≤ 7) were treated as healthy control subjects.

Moreover, pregnant women included in the study were evaluated by psychiatric interviews based on the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association, 2013). Patients with high levels of anxiety were referred to the Psychiatry Department for evaluation and management of their symptomology. All clinical and psychometric evaluations were registered in a constructed clinical database.

Procedure

Pregnant women underwent a complete clinical evaluation, both psychiatric and OB-GYN assessment, including sociodemographic and anthropometric measurements. Patients who voluntarily agreed to participate in the study were requested to sign a written informed consent before beginning the study. At entry, pregnant women required second and third-trimester lab tests (blood count, biochemical testing, urinalysis, thyroid function, 2D fetal ultrasound, and Doppler monitoring; data not shown). Participants were either inhabitants of Mexico City and/or surrounding state areas.

During the initial clinical intervention, women (18-30 years old) coursing a normo-evolutive pregnancy, during the third trimester (28-40 gwk), were assessed for OB-GYN status and previous illnesses and acute and chronic pathologies.

At entry, the anxiety-rating scale questionnaire (HARS or HAM-A) was applied to the participants by the clinician, in order to rate the severity or intensity of anxiety symptoms (Hamilton, 1959). This instrument has been widely used in different clinical and research settings (Maier et al., 1988).

Women recruited into the study had no history of smoking, alcohol consumption, drug use, or abuse, including other mental disorders, such as schizophrenia, psychosis, bipolar disorder, and/or neuropsychiatric pathologies [e.g., seizures, attention-deficit/hyperactivity disorder (ADHD), obsessive-compulsive disorder] except for anxiety without depression. Twin or multi-pregnancies were excluded. Pregnant women exhibiting anxiety plus comorbid depression were discarded from the study, according to Psychiatric evaluation and Hamilton depression rating scale scores higher than seven points. Similarly, subjects included in the protocol were not medicated before the study began. However, women requiring psychotropic medication before or during pregnancy were eliminated from the study.

Exclusion criteria included participants receiving neuropsychiatric medication and/or medications interfering with their anxious-associated symptomology. Patients with a history of illegal substance use or abuse, previous psychiatric disorders, obstetric pathologies (i.e., diabetes, preeclampsia), acute or chronic infections, and other medical illnesses (i.e., metabolic, cardiovascular, autoimmune, neuroendocrine, and/or rheumatic diseases) in addition of assisted conception, were excluded from the study. Furthermore, subjects showing incomplete questionnaires, absence or incomplete laboratory tests, and/or inconsistencies in the evaluation of their mood and emotional status were similarly eliminated from the protocol.

Thus, as mentioned earlier, the study comprised 141 pregnant subjects. Depending on the intensity of anxiety symptoms, patients were clustered into the anxiety group (ANX, n = 101) or control group (CTRL, n = 40). Once patients completed the HARS questionnaire; participants (with 8-12 h fasting conditions) were remitted to the HGM/central lab for collection of blood samples, used to determine sex steroid hormones. Important to mention, clinical and psychometric data collected during the interview from control and anxious (experimental) groups, were used to make all mathematical and statistical calculations.

Blood sampling

Briefly, blood sampling was as carried out at daylight hours (7:00-9:00 am) and 5.0 mL of venous blood was collected in sterile 13 x 100/Vacutainer BD Hemogard Tubes (Becton & Dickinson, USA) used for serum separation. Tubes were allowed to clot at room temperature for 1 h and centrifuged at 1600 x G for 15 min at 4ºC. The prepared serum samples were then aliquoted into 1.5 mL Eppendorff vials. Vials were further stored at -70ºC until use.

Quantification of sex hormones

Quantification of sex hormones was performed according to standard procedures depicted in BMC Psychiatry (2020). Briefly, Estradiol-17β (E2), progesterone (P4), and total testosterone (T) were measured using a two-step chemiluminescent enzyme immunoassay (IMMULITE 2000 Analyzer System, Siemens USA) following manufacturer instructions. Serum samples (.5 mL) were incubated with their specific polyclonal steroid antibody followed by colorimetric detection using the enzyme-labeled chemiluminescent substrate (IMMULITE 2000, USA). Previous studies showed that triglyceride concentrations (≥ 3000 mg/dL) had no effect on immunoassays measuring steroid hormones in either serum, heparinized or EDTA-treated plasma (Lee et al., 1991). Nonetheless, serum lipemic samples were centrifuged (1600 x g/15 min at 4ºC) in order to collect free-lipemic serum fractions, avoiding thus, any interference with steroid readings. E2 was assayed using the L2KE22 analytical kit (sensitivity, 55 pmol/L). P4 was assayed through the L2KPW2 kit (Analytical sensitivity, .3 nmol/L). T was tested using the LKTW1 kit (sensitivity, .5 nmol/L). Both intra- and inter-assay covariances was < 4.0% and < 7.5%, respectively.

Statistical analyses

The mean ± SEM of each sex hormone serum concentration was calculated and used to create the plots depicted herein. Data collected and calculated either as, the mean ± SEM obtained from the estimated steroids' serum concentrations, and/or the mean ± SD obtained from clinical and psychometric (HARS) measures described in the text, were used to detect significant differences in the clinical measures between the control and anxious groups, using the parametric t-test analysis with Welch correction. Moreover, the demographic parameters were analyzed by calculating the percentage (%) from the total population recruited in each tested group. In addition, bivariate Person correlation analysis was applied to detect plausible associations between steroids and clinical measures among the study groups. In the same line, partial Pearson correlation analysis was used to estimate the significant associations between serum steroids and clinical measures in each of the tested groups after controlling parameters by clinical confounders. Both GraphPad Prism 7 (GraphPad Softwares Inc. USA) and SPSS software v.24.0 (Armonk, NY: IBM Corp) were used for the statistical analysis. The statistical significance was established at a p-value < .05.

Ethical considerations

Both Ethics and Research Committees from the Institution Ethical Committee approved the human study and gave

their permission to involve human participants. All participants provided a signed written informed consent before their recruitment into the study. The human study was performed according to the Declaration of Helsinki. Approval from the Institution Ethical Committee was obtained prior to the beginning of the study (HGM, D1/14/112/04/072, 2014-2016; INPer Grant. No. 212250-07311, 2013-2015).

Table 1
Sociodemographic and clinical characteristics

Participants *n = 141*	*CTRL* *n = 40*	*ANX* *n = 101*
Parameters	mean (SD)	mean (SD)
Age (year)	28.2 (6.6)	24.2 (5.0)**
BMI (kg/m^2)	28.4 (3.5)	28.1 (3.7)
Weight (kg)	68.3 (10.2)	67.4 (8.9)
HARS (Score)	3.1 (0.6)	27.1 (4.2)**
Gestation weeks	33.9 (3.4)	34.7 (4.4)
gwk intervals	n (%)	n (%)
27-29	6 (15)	20 (19.8)
30-32	8 (22.5)	16 (15.8)
33-35	11 (27.5)	13 (12.9)
36-38	12 (30)	24 (23.7)
39-41	3 (7.5)	28 (27.8)
Marital status	n (%)	n (%)
Never married	9 (23)	19 (28.8)
Married	4 (10)	24 (23.7)
Divorced	12 (30)	16 (15.8)
Cohabiting	15 (38)	42 (41.6)
Education level	n (%)	n (%)
Elementary school	0 (0)	8 (7.9)
Middle school	22 (55)	28 (27.7)
High school	11 (28)	35 (34.7)
Bachelor's degree	7 (18)	18 (17.9)
Postgraduate	0 (0)	5 (4.9)
Technician degree	0 (0)	7 (6.9)
Working status	n (%)	n (%)
Employee	9 (23)	26 (23.7)
Unemployed	0 (0)	0 (0)
Home labor	24 (60)	49 (48.5)
Commerce	7 (18)	13 (12.9)
Profession	0 (0)	5 (4.9)
Other	0 (0)	8 (7.9)

Notes: Both clinical and psychometric data collected from both control and anxious (experimental) groups, were used to make all mathematical and statistical calculations. As such, the non-parametric, t-test with Welch's correction was used to detect statistical differences between clinical measures in the tested groups. Data are expressed as the mean ± SD. (**) $p < .001$, indicates the differences found in age and HARS scores in the tested groups. (%) Percentages obtained from total subjects in each group. Abbreviations: CTRL, control; ANX, severe anxiety; HARS, Hamilton Anxiety Rating Scale; BMI, Body Mass Index; gwk, gestational weeks. Significant differences were established at a $p < .05$. Data were calculated using GraphPad v.7 and SSPS software v.25.

RESULTS

Demographic and clinical measures

The sociodemographic characteristics of non-white Latin pregnant women ($n = 141$) is depicted in Table 1. This table shows third trimester pregnant women displaying an average age of 25.7 ± 6.1 years-old and a mean gwk of 34.2 ± 4.1 among the study groups. Healthy subjects (CTRL) were older than women with anxiety. No significant differences in the gwk period were observed among the study groups. T-test analysis shed significant differences between age ($p = .001$) among groups.

Serum steroids

Figure 1 shows the serum levels of E2, P4, and T between anxious patients and control subjects. As depicted, the ANX group showed significant higher levels of E2 and T (Figures 1A and 1C), than those detected in the CTRL group (*t*-test, $p = .001$). As opposed, the anxiety group displayed lower serum levels of P4 (*t*-test, $p = .001$; Figure 1B). The estimated P4:E2 ratio estimated in the anxiety group was 2.0 times lower than that shown in the CTRL group (*t*-test, $p = .001$; Figure 1D).

Correlations between steroids and intensity of anxiety adjusted by clinical parameters

The partial correlations observed between serum steroids and the anxiety-rated scale in the tested groups are shown in Table 2. As shown, T serum levels showed a positive correlation with the estimated mean (HARS) scores for anxiety (Pearson, $p = .001$) in the symptomatic (ANX) group. Conversely, P4 levels displayed a significant negative association with the estimated HARS scores in the anxious group (Pearson, $p = .02$). In the same line, the calculated P4:E2 ratio in the symptomatic group showed a similar negative correlation with the estimated scores for anxiety (Pearson, $p = .04$).

Furthermore, partial correlations were found between E2 and gwk (Pearson, $p = .000$), E2 and T (Pearson, $p = .015$), and between T and gwk (Pearson, $p = .003$) in the anxiety group, after controlling clinical parameters by age. However, no significant correlations were observed between serum steroids and HARS or between the clinical measures used in the study and HARS, as well (data not shown).

DISCUSSION AND CONCLUSION

Pregnancy is a crucial biological process that comprises physiological and emotional changes (Costa, 2016; Napso

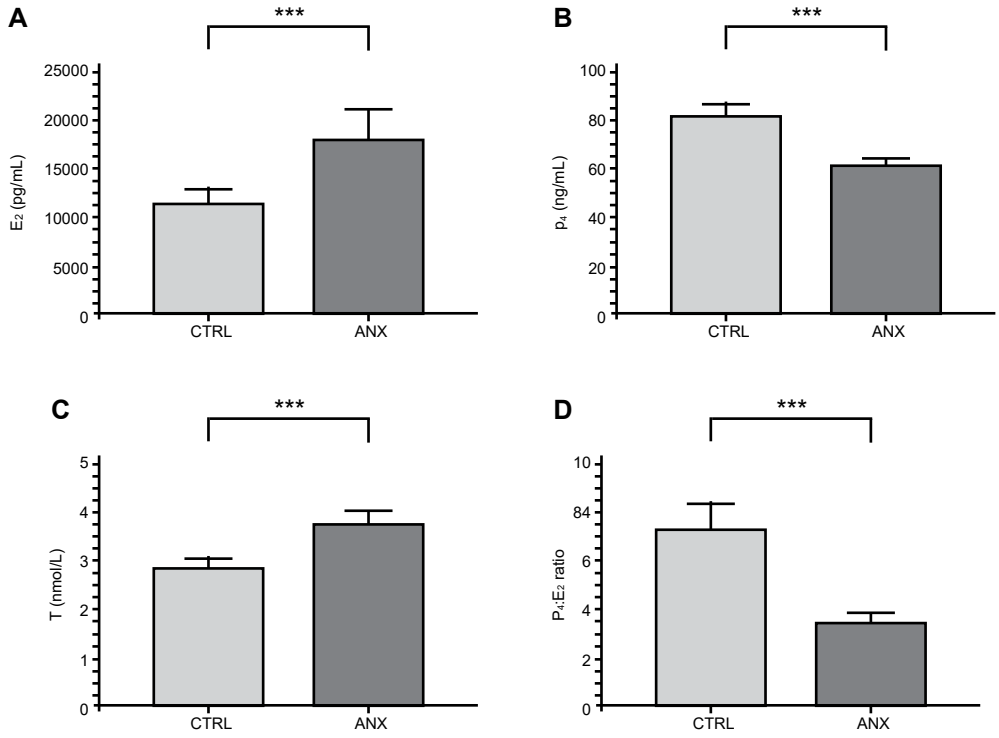

Figure 1. Serum concentration of sex hormones and the estimated P4 and E2 ratios in pregnant women. The figure depicts the serum concentration of E2 ***(A)***, P4 ***(B)*** and T (C) in addition of the estimated ratios between P4 and E2 serum levels detected among the study groups ***(D)*** in the 3rd trimester of pregnancy. Hormones were quantified by two step chemiluminescent enzyme immunoassay (see methods). The concentration values of ***E2*** are expressed as the *mean* ± *SEM*: ***CTRL*** (11751 ± 1483 pg/mL), ***ANX*** (18291 ± 2893 pg/mL). The concentration values of ***P4*** are expressed as the *mean* ± *SEM*; ***CTRL*** (80.8 ± 5.4 ng/mL), ***ANX*** (56.5 ± 3.04 ng/mL). The concentration values of ***T*** are expressed as the *mean* ± *SEM*, as described: ***CTRL*** (2.8 ± .2 nmol/L), ***ANX*** (3.8 ± .3 nmol/L). The ratio values estimated between P4 and E2 serum levels are expressed as the *mean* ± *SEM*. The mean ratio values calculated in both ***CTRL*** and ***ANX*** groups were 7.2 ± .04 and 3.6 ± .02, respectively. T-test analysis with Welch's correction was used to estimate the *p* values of the steroid serum concentrations and the related ***P4:E2*** ratios estimated among the studied groups. (***) $p < .0001$. Significant differences were established at $p < .05$. Data was calculated using GraphPad Prism v.7 and SPSS v.25.

et al., 2018; Soma-Pillay et al., 2016). Signs and symptoms appearing during pregnancy (i.e., nausea, vomiting, facial pigmentation, body shape transformation) represent acute stressors that impinge on women during pregnancy (Soma-Pillay et al., 2016).

Social stress increases during pregnancy due to individual risk factors (i.e., unexpected pregnancy, young age, poor education and low socioeconomic condition, sexual abuse, among others; Hall et al., 2019) which creates an adverse impact on the psychological responses in vulnerable women (Zou et al., 2009).

Several studies showed that emotional disorders are common among pregnant women, mainly anxiety and depression reported as usual causes of mental distress in such populations (Baker et al., 2008).

Using the 14-item Hamilton anxiety questionnaire (HARS) to evaluate psychological and somatic anxiety symptoms in 308 pregnant women, Zou and collaborators showed a prevalence of severe anxiety in 5.1% of women in the first trimester of pregnancy, and a global prevalence of low to moderate anxiety in 31.2% of women exhibiting anxiety and comorbid depression from mid-to-late pregnancy (Zou et al., 2009).

However, Nakić Radoš and collaborators reported a prevalence of anxiety symptoms in 17.3% from late pregnancy to early postpartum (Radoš et al., 2018).

During pregnancy, steroid hormones such as progestogens, estrogens, androgens, glucocorticoids, and cholesterol, are needed to accomplish a full-term pregnancy, including a successful delivery, and a healthy neonate (Costa, 2016). The human placenta is a crucial endocrine tissue involved in the synthesis and metabolic process of steroid hormones, including the exchange of steroids between the fetal and maternal compartments (Chatuphonprasert et al., 2018). According to Zou and collaborators circulatory levels of E2 and P4 increase in 1st trimester of pregnan-

Table 2
Pearson correlations between serum steroids and HARS scores adjusted by gwk

ANX	*HARS*	*E2*	*P4*	*T*	*P4:E2*
HARS					
Corr.	1	.06	-.26	.39**	-.22*
Sig.		.32	.02	.001	.04
E2					
Corr.	.06	1	.06	.13	-.64**
Sig.	.32		.34	.15	.001
P4					
Corr.	-.26	.06	1	.29*	.60**
Sig.	.02	.34		.01	.001
T					
Corr.	.39**	.13	.29*	1	.14
Sig.	.001	.15	.01		.16
P4:E2					
Corr.	-.22*	-.64**	.60**	.14	1
Sig.	.04	.001	.001	.16	

Notes: SSPS software v.25.0 was used to determine the Pearson partial correlations between the anxiety-rated scale and sex steroids in the ANX group, adjusted by gwk. (**) Significant differences at $p < .01$ (bilateral). (*) Significant differences at $p < .05$ (bilateral). Abbreviations: ANX, severe anxiety; HARS, Hamilton Anxiety Rating Scale; E2, estradiol; P4, progesterone; T, testosterone; P4:E2, progesterone: estradiol ratio; Corr., correlation; Sig., significance. Significant differences were established at a $p < .05$.

cy, remain stable in the 2nd and 3rd trimesters and rapidly decrease after delivery (Zou et al., 2009). They observed that E2 and P4 blood levels were associated with depressive symptoms, but not with anxiety during pregnancy and postpartum (Zou et al., 2009).

Stress and general anxiety have been hypothesized to promote changes in the bioactivity of the HPA axis and the fetoplacental unit (Van den Bergh et al., 2005; Kane et al., 2014).

Previously, it has been shown that women with high levels of anxiety during late pregnancy, exhibit an increase in cortisol (CORT) serum levels and a higher CORT: DHEA-S ratio (Leff-Gelman et al., 2020). In the present study, we show that pregnant women with severe anxiety display high levels of E2 and T and lower levels of P4. These findings posit that sex hormones and the P4:E2 ratio might represent an indicator of altered mood disorders and affective symptoms in pregnant women.

Moreover, our findings could result in the hormonal-induced regulatory effects on brain neurotransmitters (Rubinow et al., 1998; Schüle et al., 2014) and cell-signaling cascades in brain areas implicated in mood disorders (Kalin, 2020; Cover et al., 2014; Le Mellédo & Baker, 2004) in pregnant women exhibiting anxiety (Li & Graham, 2017; Holmes et al., 2003; Murrough et al., 2011).

Sex steroid hormones exert pleiotropic effects in the central nervous system (Diotel et al., 2018) and exert diverse physiological functions in the body (Pillerová, et al., 2021) by activating cell-signaling pathways, via binding their cognate intracellular and transmembrane receptors (Pillerová et al., 2021). Both E2 and P4 are indispensable for reproductive function and sexual behaviors. However, fluctuations in hormone levels in reproductive women, impact the female brain morphology functionality (Marrocco & McEwen, 2016) neurochemistry (Barth et al., 2015), and are contributors among other mediators (i.e., cortisol, cytokines,) to female-specific risks for neuropsychiatric conditions such as, depression and anxiety disorders (Pillerová et al., 2021; Altemus et al., 2014).

Pathological anxiety is characterized by an excessive, inadequate anxiety response occurring in situations that normally would not occur in healthy people (Kalin, 2020). Pathological anxiety is defined by different features, including excessive worry, physiological arousal, and avoidance behavior (Pillerová et al., 2021; Kalin, 2020). Patients suffering from pathological anxiety display affective symptoms, which includes nervousness, frustration, impatience, and fearfulness (Pillerová et al., 2021). At the cognitive level, patients with cognitive dysfunction show hypervigilance for threats, poor concentration, and impaired memory (Pillerová et al., 2021; Kalin, 2020). Regarding behaviors, patients with pathological anxiety display higher readiness to respond to danger, restlessness, and agitation (Pillerová et al., 2021; Kalin, 2020).

Interestingly, animal studies revealed that sex-dependent effect of high prenatal T exposure, can increase the risk for anxiety disorders, particularly in adult women. In the same line, the effects of prenatal dysregulation of estrogens and progesterone and/or their metabolites on the brain, on either cognitive or behavioral consequences in adulthood, are still lacking (Pillerová et al., 2021).

Our findings partially match the results obtained in a previous cohort study, which concluded that high levels of depressive and anxiety symptoms were associated with high serum levels of T and P4 in pregnant women living in rural areas (Walther et al., 2019a).

Reduced 5-HT levels and decreased neuroplasticity have been hypothesized to represent a major central mechanism that predisposes individuals to depression and anxiety (Walther et al., 2019a). In this line, sex steroids appear to work as endogenous mood stabilizers, facilitating both anxiolytic and anti-depressive effects by increasing the release of 5-HT and promoting neuroplasticity in the cortex and hippocampal formation (Walther et al., 2019a; Maron et al., 2004).

Regarding androgens and anxiety, several reports have shown controversial results. A report on a male cohort study found a negative correlation between testosterone levels in blood and anxiety symptomology, showing that men exhibiting a T deficiency, are highly vulnerable to anxiety (Berglund et al., 2011; Santoro et al., 2005).

On the other hand, animal and human studies conducted on pregnant females or females with PCOS found a significant positive association between testosterone (T) levels and increased levels of anxiety (Risal et al., 2021; Glowinska et al., 2020; Matsuzaka et al., 2013).

Thus, our findings about the increase in T serum levels in the ANX group, suggest that T may exert an important role in modulating the intensity of anxiety symptoms.

In addition, several studies have demonstrated that both 5-HT and ALLO (synthesized from P4 and positively modulated by E2 and P4, exert a central anxiolytic activity by inducing adaptive stress responses (Andréen et al., 2009). Thus, estradiol (E2) and progesterone (P4) strongly contribute to the regulation of 5-HT and ALLO (Genazzani et al., 1998; Frye et al., 2000).

However, a decrease in sex hormones caused by stress exposure, causing hypothalamic amenorrhea, increases women's vulnerability to enhance the development of anxiety disorders, or the exacerbation of pre-existing anxious symptoms (Genazzani et al., 2006; Berga & Loucks, 2006). This leads to a pathological downregulation of 5-HT and ALLO bioactivities (Schüle et al., 2014).

Menstruation, hormonal contraceptive use, postpartum, and menopause are associated with low E2 and P4 levels (Walther et al., 2019a). This impairs the hypothalamic-pituitary-gonadal (HPG) axis functioning, causing a reduced effective stress response regulation (Walther et al., 2019a; Andréen et al., 2009).

Thus, it might be feasible to argue that the high serum levels of E2 and T found in women with severe anxiety, could work as a counterbalance mechanism to ameliorate the deleterious effects of the lower P4 levels found in women with high anxiety (Walther et al., 2019a). Furthermore, the significant reduction in the P4:E2 ratios in women with severe anxiety in the 3rd trimester of pregnancy supports the hypothesis that the reduction in progesterone (P4) levels may be linked with high anxiety levels, as detected by the negative associations found between P4, P4:E2 ratio and high scores for anxiety in the symptomatic group. These observations may result from a decreased activity of the allosteric modulation induced by ALLO on the GABA-A receptor, in addition to the negative modulation on the HPA axis (Schüle et al., 2014). This ultimately translates into a decrease in the ALLO-homeostatic function in the presence of acute stressors and distress in vulnerable people (Schüle et al., 2014).

Finally, the reduced activity of ALLO on the HPA axis may result in its functional dysregulation, leading to altered levels of circulating adrenal steroids (Bali & Jaggi, 2014). Thus, the altered response on the HPA axis could be linked to changes in cortisol levels (hypercortisolemia) in pregnant women exhibiting major depression or severe anxiety (Gelman et al., 2015).

Our study shows that pregnant women displaying high levels of anxiety show significant increases in circulating estradiol and testosterone and an important reduction in serum progesterone, in contrast to the healthy controls. Based on the fact that anxiety and depression are commonly comorbid, it's necessary to carry out complementary investigations that may help to find significant associations between endocrine hormones and the high levels of anxiety symptoms in pregnant women, who are prone to develop mood-related disorders and altered behaviors.

Perspectives

Despite our findings showing the circulating levels of sex steroids in pregnant women with severe anxiety, further studies are needed to explore the relations between serum concentrations of sex hormones and their bioactive metabolites (i.e., ALLO, DHEA-S) in women exhibiting high levels of anxiety symptoms during pregnancy (second and third trimester) and early postpartum (PP, 2-6 weeks). As stress and anxiety symptoms are highly linked, other standardized and structured psychometric-scale instruments are needed to explore the presence or absence of anxiety symptoms, generalized anxiety disorders (GAD), perception of stressors or perceived stress (PS), depressive symptoms (merely due that anxiety is commonly associated with depression) and cognitive functions in vulnerable pregnant women. Furthermore, biological and molecular approaches should be explored and used when investigating anxiety and comorbid mental disabilities, in order to comprehend the cellular mechanism implicated in triggering or promoting affective disorders and their related symptomology.

Limitations

There are some limitations that need to be mentioned herein. We used the anxiety-related questionnaire to measure the intensity of anxiety symptoms in a pregnant population. Albeit, this instrument has not been applied frequently on pregnant women, because they are commonly evaluated with other instruments in this population (e.g., the CES-D, EPDS, and GAD-7); and anxious symptoms have been less evaluated in pregnant women using the State and Trait Anxiety Inventory (Chinchilla-Ochoa et al., 2019). Moreover, the study used a single blood sample to measure serum steroids. However, two-time blood-sampling points should have been taken into consideration to estimate the serum concentration of the steroids in our pregnant population. In addition, cigarette smoking was not considered as a clinical parameter in our study groups. Previous reports showed that cigarette smoking reduced maternal serum levels of E2, P4, and hCG levels in early pregnancy (Bernstein et al., 1989). Although these data could explain some of the adverse effects that smoking produces in pregnant women, our study showed no history of smoking in our recruited population. Finally, the pre-gestational weight could have contributed

to the clinical data, regarding the relation that weight gain and BMI have circulating sex hormones (Wuu et al., 2002).

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Conflict of interest

The authors declare they have no conflicts of interest.

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Depressive symptoms in pregnant women treated at the Hospital Infantil del Estado de Sonora

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ABSTRACT

Introduction. Pregnancy, being a situation of vulnerability and with its inherent changes, places women at a great risk of depression. In Mexico, the prevalence of probable depression in pregnant women treated at the Instituto Nacional de Perinatología, was 17.8%, assessed using the Edinburgh Perinatal Depression Scale (EPDS). To date, there are no data regarding this issue in Sonora. **Objective.** To determine the prevalence of depressive symptoms in pregnant women treated at the Hospital Infantil del Estado de Sonora (México). **Method.** An observational, descriptive, transversal, and prospective study was conducted in 2021, applying the EPDS in 168 2nd/3rd trimester pregnant women, selected by non-probabilistic sampling by consecutive cases. Sociodemographic variables, pathological/non-pathological, gynecological, and obstetrical personal history were explored. The analysis was performed using measures of central tendency and dispersion for quantitative variables; for qualitative variables, frequency and percentage; χ^2 test to assess differences in distribution of depressive symptomatology by age and the rest of variables. **Results.** A global prevalence of "probable depression" of 14.3% was determined. The majority, within 20-29 age group, with a partner and a planned/desired pregnancy. High school educational level, 50%. History of intimate partner violence, 54.2%. Almost 40%, primigravida. Substance use, denied. Overweight/obesity, in 70%. **Discussion and conclusion.** There is a high prevalence of depressive symptoms during pregnancy, going unnoticed for reasons such as insufficient knowledge (patient/health care providers), since there is no routine screening. It is imperative to work on prevention, detection and treatment, since it entails multiple consequences at a binomial, family, and social level.

Keywords: Depression, pregnancy, screening, Edinburgh, Sonora.

RESUMEN

Introducción. El embarazo, al ser una situación de vulnerabilidad y los cambios que conlleva, ubica a las mujeres en mayor riesgo de padecer depresión. En México, la prevalencia de probable depresión en embarazadas en el Instituto Nacional de Perinatología, fue del 17.8%, mediante la Escala de Depresión Perinatal de Edimburgo (EPDS). Hasta hoy, no se cuenta con datos en Sonora sobre este problema. **Objetivo.** Determinar la prevalencia de sintomatología depresiva en embarazadas atendidas en el Hospital Infantil del Estado de Sonora (México). **Método.** Se realizó un estudio observacional, descriptivo, transversal y prospectivo en 2021, utilizando la EPDS en 168 embarazadas cursando 2º/3er trimestre, seleccionadas por muestreo no probabilístico por casos consecutivos. Se exploraron variables sociodemográficas, antecedentes patológicos/no patológicos y ginecoobstétricos. El análisis se realizó mediante medidas de tendencia central y dispersión para variables cuantitativas; para cualitativas, frecuencia y porcentaje; prueba de χ^2 para evaluar diferencias en distribución de sintomatología depresiva por edad y resto de variables. **Resultados.** Se determinó prevalencia global de "probable depresión" de 14.3%. La mayoría, grupo etario 20-29 años, con pareja y embarazo planeado/deseado. Escolaridad preparatoria, 50%. Antecedente de violencia de pareja, 54.2%. Casi 40%, primigestas. Consumo de sustancias, negado. Sobrepeso/obesidad, en 70%. **Discusión y conclusión.** Existe una alta prevalencia de sintomatología depresiva durante el embarazo, pasando desapercibida por motivos como conocimiento insuficiente (paciente y proveedores de salud), pues no se cuenta con un tamizaje rutinario. Es apremiante trabajar en prevención, detección y tratamiento, ya que conlleva múltiples consecuencias a nivel binomio, familiar y social.

Palabras clave: Depresión, embarazo, tamizaje, Edimburgo, Sonora.

INTRODUCTION

The World Health Organization (WHO, 2021) describes depression as a mood disorder characterized by a predominantly low and/or irritable mood, with a variety of symptoms, which can include –but is not limited to– significantly diminished interest or pleasure in all, or almost all, activities, excessive or inappropriate guilt, feelings of worthlessness, hopelessness, lack of motivation, weight loss or weight gain, increased or decreased appetite, psychomotor retardation, insomnia or hypersomnia. Thus, it does not only affect the person who suffers from it, but their entire environment, including his/her partner, family, friends, etc. Literature indicates that 9.2% of the general population has suffered at least one depressive episode, and that one out of five persons will present one before the age of 75 (Wagner et al., 2012). The WHO (WHO, 2021) established depression as the leading global cause of disability.

Depression, in the context of pregnancy, can have important repercussions on self-care and on the developing baby, and can even culminate in maternal death due to suicide or complications from the mother's comorbidities (Jadresic, 2014). Another possibility is the death of the mother-baby binomial. Deaths by suicide are a leading cause of maternal mortality in the United States. Yet, the prevalence and trends in suicidality (suicidal ideation and/or intentional self-harm) among pregnant women remain poorly described. Suicidal ideation and intentional self-harm, one year before and after giving birth, increased significantly between 2006 and 2017. Those with depression, had larger escalations (Admon et al., 2021). Other possible consequences are emphasized by Mitchell et al. (2023), including preterm birth, substance use, continued depression and anxiety; once again, mentioning suicide. Whatever the outcome, it would indisputably have a severe impact on the woman's environment. Vázquez-Rojas (2020), in a study carried out in the city of Hermosillo, Sonora, in patients who had attempted suicide, observed that the diagnoses of major depressive disorder and persistent depressive disorder were presented in 30% and 14%, respectively. Although this study was not conducted in pregnant women, but rather men and women, it highlights the great influence of depressive disorders on a possible fatal outcome and contributes to local statistics.

Furthermore, depressed pregnant women are at greater risk of neglecting their pregnancy, abandoning prenatal care or not carrying it out properly, or not following medical instructions or following them erroneously, compared to non-depressed pregnant women. Additionally, they are more exposed to possible substance abuse such as tobacco, alcohol, and drugs in general, which can affect the obstetric outcome, with significant repercussions on the binomial. In turn, some depressive symptoms such as anorexia or hyporexia, can alter some aspects of the pregnancy and contribute to adverse results; for example, the expected weight gain. There exists an underdiagnosis of depression from early stages of pregnancy (Jadresic, 2014). The American Psychiatric Association (APA) did not mention perinatal depression prior to its fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5). In said edition, it is included as a specifier "major depressive disorder with peripartum onset" (APA, 2013). However, it does not differ from a depressive disorder in other contexts. That is a rather relevant matter, since, as Lartigue et al. (2008) describe, the consequences of perinatal depression can have a much bigger impact than other subtypes of depressive disorders. The National Institute of Mental Health (NIMH) states that perinatal depression does not have a single cause. Instead, research suggests that it is a result of a combination of genetic and environmental factors. Life stress, the physical and emotional demands of childbearing and caring for a new baby, and changes in hormones that occur during and after pregnancy can contribute to the development of perinatal depression. (NIMH, 2020). Postpartum depression is a topic generally better explored than depression during pregnancy. However, it should be noted that the APA states that about 50% of postpartum major depressive episodes, begin prior to delivery. The APA also states, in its most recent edition of the Diagnostic and Statistical Manual of Mental Disorders –Fifth Edition, Text Revision– (DSM-5-TR), that approximately 9% of women will experience a major depressive episode between conception and birth (APA, 2022). Morales and collaborators describe in their study conducted on pregnant women treated at the Instituto Nacional de Perinatología (INPer), in Mexico City, that the prevalence of probable depression was 17.8% (Morales et al., 2004).

Unfortunately, there are not enough records on this matter; although there are some figures in certain regions of the country, there is nothing similar at the regional or local level in the state of Sonora. Unfortunately, there are not enough records on this matter; although there are some figures in certain regions of the country, there is nothing similar at a regional or local level in the state of Sonora.

As evidenced in the literature, the presence of depressive symptomatology in this population is high and, on several occasions, enough attention is not given by patients and/or clinicians (Ortega et al., 2001). Previous undiagnosed depressive episodes have also been uncovered in the outpatient service of the Hospital Psiquiátrico "Cruz del Norte" (HPCN), in Hermosillo, Sonora, particularly in the perinatal and childhood history, which have sometimes led to complications in pregnancy and poor attachment after birth. In addition, a deterioration in self-care has been observed, which may be associated with greater use of tobacco, alcohol and illicit drugs, little physical activity and not adequately carrying out prenatal care (Gaviria et al., 2019). By performing an intentional search for depressive symptoms, it could be detected and addressed promptly.

The present work was conducted during the third quarter of 2021 at the Hospital Infantil del Estado de Sonora (HIES), particularly in the Hospital Integral de la Mujer del Estado de Sonora (HIMES) service. The detection of depressive symptomatology was sought by applying the Edinburgh Perinatal Depression Scale (EPDS) to pregnant women who were in the second or third trimester, with no prior diagnosis or treatment of affective disorders.

The aforementioned scale is self-applied and consists of 10 items, which evaluate the patient's affective state in the two weeks prior to its application. It is focused on screening for depressive symptoms exclusively in women during pregnancy and postnatal period, being the only one of its field to have been validated in Mexican context (Lartigue et al., 2004).

Thereupon, avoiding the consequences of presenting depressive symptoms during pregnancy can be essential for the mother-child bond, as well as for the entire family, due to the type of effects they yield on them. By neglecting their pregnancy due to depressive symptoms, undoubtedly, the problem can be rather critical.

Hence, the objective of this research was to determine the prevalence of depressive symptoms in pregnant women treated at HIES/HIMES. The obtained information could work as a base for new protocols focused on the detection and treatment of depression during pregnancy and the arising of its consequences.

METHOD

Design of the study, subjects, and places

During the third quarter of 2021, an observational, descriptive, transversal, and prospective study was carried out in 168 pregnant women, treated at HIES/HIMES in Hermosillo, Sonora, selected by non-probabilistic sampling by consecutive cases. They all were in the 2nd/3rd trimester and had no previous history of affective disorders diagnosis and/or treatment. HIES is a hospital located in Hermosillo city, Sonora, providing secondary and tertiary health care and an estimate of 4000 deliveries per year take place there (Secretaría de Salud Pública del Estado de Sonora, 2019). All participants had the right to voluntarily participate in the study. The inclusion criteria were women in fertile age who were able to fully understand and respond the contents of the EPDS. Given the high prevalence of adolescent pregnancy receiving medical care at HIES, we decided not to exclude this age group. Apart from those who were unable to read and write, the exclusion criteria, in order to avoid possible biases caused by diagnoses such as bipolar depression or treatment-resistant depression, exclusion criteria were women with a previous diagnosed affective disorder and/or who had received treatment for depressive symptoms. The purpose of this study was not to assess the therapeutic efficacy of pharmacological and/or psychotherapy treatment, as it has already been proved effective for depression, but rather to detect those women with compatible symptoms who could have otherwise been left undetected and their current overall state. It is also important to state that, had they presented an affective disorder before, it could have led them to this point. Hence, the importance of making this a first episode exploration, to the extent possible.

Procedure

Sample size was determined based on a proportion of depressive symptomatology of 17.8% reported in a previous study in Mexico with similar characteristics, using the Edinburgh Perinatal Depression Scale (EPDS; Morales et al., 2004). However, since the findings were diverse –sometimes higher, sometimes lower– we opted for a proportion of 12.5% as a middle point for the sample, with an assumption of 95% confidence interval (CI), a 5% margin of error, and a final sample size of 168. The working hypothesis was based on the aforementioned study (Morales et al., 2004) looking for a 17.8% prevalence or lower. The EPDS was used to assess the potential depressive symptoms. If a score of 14 points or higher was reached, the patient was considered as "probable perinatal depression". Any patient reaching said score, was given a results certificate and was referred to the nearest available psychiatry service, while this was not the objective of the study *per se*. Besides, a clinical and demographic questionnaire was applied in order to get information about general medical history, use of tobacco, alcohol consumption and use of illegal drugs, as well as gynecologic-obstetric history. Prior substance abuse disorders were ruled out during the interview.

Data were collected by means of a pretested, face-to-face interviewer-administered structured questionnaire. The questionnaire included three sections: sociodemographic characteristics, gynecological-obstetric, family and social factors. Sociodemographic characteristics included age, educational status, ethnicity, current marital and occupational status. Also, information about past and current domestic violence was examined. As for ethnicity, this was considered a relevant matter, since HIES treats many people of different ethnicities, and, as any minority, they are more exposed to adverse conditions, including violence, which, by itself, produces stress and trauma; although violence is not exclusive to them.

Obstetric factors included number of pregnancies, deliveries, caesarean deliveries, abortions, whether or not the current gestation was planned and/or desired, gestational age, menarche, and number of sexual partners. Personal medical history included systemic arterial hypertension, type 2 diabetes mellitus, hypothyroidism, syphilis, or other diseases. Besides, alcohol, tobacco, and illegal drugs were investigat-

ed during current pregnancy, such as smoking and number of cigarettes per day, alcohol drinking and number of drinks per day, as well as drugs use, type of drugs, and frequency.

Measurements

The EPDS is a screening tool for perinatal depression symptoms but does not give a definitive diagnosis of depression (Cox et al., 1987). It is a simple, free to use tool with a sensitivity and specificity of 84.6% and 77.0% respectively, and a Cronbach's reliability coefficient of .85 (Cox et al., 2014). The EPDS comprehends 10 items, each of which describes a specific symptom of depression with a four-point Likert-scale response option ('most of the time', 'sometimes', 'not often', 'never') scored 0–3, with a total score ranging from 0 to 30. The cut-off value of 14 was used to identify pregnant women with considerable depressive symptoms (Morales et al., 2004; Oquendo-Cortez et al., 2008). The EPDS is the most commonly used screening tool in pregnancy as it does not include the somatic symptoms of pregnancy such as nausea, headache, appetite or weight changes that are all symptoms associated with depression and may result in higher depression scores (Chorwe-Sungani & Chipps, 2017). It is also particularly recommended for low-resource settings for screening for perinatal depression because of its potential to detect common perinatal mental disorders in culturally diverse low-income and lower middle-income countries, since its validity and reliability have been studied in these settings and found to be acceptable (Stewart et al., 2013).

Statistical analyses

Data were coded and exported into Statistical Package for the Social Sciences (SPSS) for recoding, categorization, and statistical analysis. Data were summarized using descriptive statistics such as frequency and percentages for categorical data, and for mean and standard deviation (SD) and range for numerical data. A prevalence of the depressive symptomatology was estimated and its confidence interval was set at 95%. Subsequently, this was adjusted for variables such as: age, marital status, education, occupation, domestic violence, trimester of pregnancy, planned/desired pregnancy, alcohol consumption, use of tobacco and illegal drugs, among other gynecologic-obstetric variables. The SPSS 25.0 (SPSS, Chicago, IL, USA) was used for all statistical analyses.

Ethical considerations

The research was conducted according to the highest ethical standards in accordance with the Declaration of Helsinki, and national ethical and legal requirements. The HIES Institutional Research Ethics Committee authorized the protocol (registry N. 002/21), and also all participants signed an informed consent form prior to inclusion in the study, which could be revoked at any time. Underage participants were required to be accompanied by her guardian, who, apart from the participant herself, signed the informed consent document. The objectives and implications of the study were explained in detail to underage participants, asking them for any questions they had and to paraphrase what was told to them, in order to ensure they fully understood the study.

RESULTS

The sample size was 168 patients. None of them were eliminated from the study, so the expected sample was completed and remained intact. After obtaining the complete sample, patients were classified into three age groups. From 14 to 19 years, from 20 to 29 years and 30 years or older. Thirty-six (21.4%) corresponded to the 14-19 age group; most of them, 100 (59.5%), were in the 20-29 age group; finally, 32 (19.1%) classified in the group of 30 years or older. The important proportion of young people between 14 and 19

Table 1
Sociodemographic characteristics

Variable	N = *168*	*%*
Age (years)		
14-19	36	21.4
20-29	100	59.5
30-40	32	19.1
Marital status		
Married	20	11.9
Single with a partner	21	12.5
Single with no partner	41	24.4
Divorced	3	1.8
Cohabitation	81	48.2
Widowed	2	1.2
Educational level		
None	1	.6
Elementary school	14	8.3
Middle school	88	52.4
High school	57	33.9
Bachelor's degree	8	4.8
Occupation		
Employee	31	18.5
Unemployed	1	.6
Housewife	63	37.5
Retired	0	0
Student	6	3.6
Worked prior to pregnancy	67	39.9
Ethnic group		
None	166	98.8
Triqui / Mayo	2	1.2
Support network (Friends, family, partner living in the same city)		
Yes	167	99.4
None	1	.6

Table 2
Average of clinical characteristics of the sample

Variable	*Mean*	*SD*	*Minimum*	*Maximum*
Age	23.9	5.7	14	40
Gestational age (weeks)	30.3	6.4	13	40
Menarche	12.9	1.6	9	18
Age of first sexual intercourse	16.7	2.4	12	30
EPDS (score)	5.4	5.8	0	27

EPDS = Edinburgh Perinatal Depression Scale. SD = standard deviation.

years of age is worth noting. Sociodemographic characteristics, such as marital status, educational level, ethnic group, support network (whether or not they had social/family support in their city), for the full sample are stated in Table 1. While there is no specific data on their socioeconomic background, it is specified that, those with a partner, said the partner was their provider at home. Regarding single women without a partner, it was the parents who provided.

Regarding the average clinical characteristics of the pregnant women interviewed in this study, the average age was 23.9 years, with a standard deviation (SD) of 5.7, with a minimum of 14 and a maximum of 40 years. The rest of these variables, including the EPDS score, are described in Table 2.

Elaborating on the results of the EPDS, 26 (15.5%) patients obtained a score of zero. Fifty-nine (35.1%) obtained a score of 1-3. 44 (26.2%) patients had a result of 4-7 points. Thirty-nine (23.2%) resulted with 8-27 points. Taking into account the cut-off value established at 14, regarding probable depression / probably without depression, 24 (14.3%) patients obtained a score past this value; while 144 (85.7%) remained below it. Reiterating, a 14.3% prevalence of depressive symptoms (probable depression) was obtained among the women in the study (Table 3).

Subsequently, the prevalence is detailed according to different variables of the patients. The overall prevalence was 14.3%, with a 95% confidence interval (CI) of 9.0 – 19.6, statistically significant with a *P* value of < .001. Regarding these 24 patients above the cut-off value, the sociodemographic variables are established in Table 4.

Table 3
Results of the EPDS

Variable	*n = 168*	*%*
Score		
0	26	15.5
1-3	59	35.1
4-7	44	26.2
8-27	39	23.2
Interpretation		
Probably depressed	24	14.3
Probably not depressed	144	85.7

EPDS = Edinburgh Perinatal Depression Scale.

Apropos to the gynecologic and obstetric variables of the 24 patients, among them, 12 (50%) claimed to have had one or two sexual partners. Seven of them (29.2%), answered three; five claimed having had four or five sexual partners. As for the number of gestations, including the current one, nine (37.5%) were going through their first pregnancy; six (25%) were experiencing their second pregnancy; five (20.8%) were on their third pregnancy; and four, were experiencing their fourth or fifth one. As for previous vaginal deliveries, 15 (62.5%) had had none, five (20.8%) had had one; and four (16.7%) had had two or three. The rest of these variables are described in Table 5.

Concerning the personal history of illness and substance use in these 24 patients: three (12.5%) had a diagnosis of arterial hypertension; three (12.5%) had type 2 diabetes mellitus; two (8.3%) had a history of syphilis, which had been treated; two more patients (28.3%) had a diagnosis of hypothyroidism. As for the current weight of the patients, only seven (29.2%) were in a status of normal weight, according to their body mass index, with 17 (70.8%) overweight or obese (overweight predominating in 58.3%). Regarding the consumption of substances, all of them stated that they did not know about their pregnancy the last time they consumed

Table 4
Sociodemographic variables of the 24 patients above the cut-off value

Variable	*n*	*Prevalence*	*CI 95%*	*P*
Global	24 / 168	14.3	9.0 – 19.6	.000
Age				
14-19	5 / 24	20.9	4.6 – 37.1	.037
20-29	15 / 24	62.5	43.1 – 81.9	.002
30-38	4 / 24	16.7	1.8 – 31.6	.047
Marital status				
Currently, has a partner	13 / 24	54.2	34.2 – 74.1	.003
Currently, has no partner	11 / 24	45.8	25.9 – 65.8	.004
Educational level				
Elementary school	3 / 24	12.5	.0 – 25.7	.120
Middle school	9 / 24	37.5	18.1 – 56.9	.010
High school or above	12 / 24	50.0	30.0 – 70.0	.011
Occupation				
Employee	5 / 24	20.8	4.6 – 37.1	.038
Housewife	5 / 24	20.8	4.6 – 37.1	.038
Student	5 / 24	20.8	4.6 – 37.1	.038
Worked prior to pregnancy	9 / 24	37.5	18.1 – 56.9	.010
History of intimate partner violence				
Yes	13 / 24	54.2	34.2 – 74.1	.008
No	11 / 24	45.8	25.9 – 65.8	.009

* Only one woman with probable depression had no support networks in her city (Hermosillo); *CI* = confidence interval.

Table 5
More gynecologic and obstetric variables of the 24 patients above the cut-off value

Variable	*n*	*Prevalence*	*CI 95%*	*P*
Pregnancy trimester				
Second	8 / 24	33.3	14.5 – 52.2	.008
Third	16 / 24	66.7	47.8 – 85.5	.009
Contemplation of current pregnancy				
Not planned, not desired	8 / 24	33.3	14.5 – 52.2	.007
Not planned, but desired	7 / 24	29.2	11.0 – 47.4	.009
Planned and desired	9 / 24	37.5	18.1 – 56.9	.010
Menarche				
9-10	1 / 24	4.2	.0 – 12.2	.320
11-13	14 / 24	58.3	38.6 – 78.1	.007
14-16	9 / 24	37.5	18.1 – 56.9	.010
Age of first sexual intercourse				
12-14	3 / 24	12.5	.0 – 25.7	.120
15-17	14 / 24	58.4	38.6 – 78.1	.007
18-19	5 / 24	20.8	4.6 – 37.1	.038
20-28	2 / 24	8.3	4.6 – 37.1	.037

them. Thirteen (54.2%) reported alcohol consumption, 10 (41.7%) reported tobacco use, and seven (29.2%) acknowledged to an illegal substance use (marijuana).

DISCUSSION AND CONCLUSION

The objective of this study was to determine the prevalence of depressive symptoms in pregnant women treated at HIES. For this, the EPDS was used, with a cut-off value of 14. When this result was obtained, it was classified as "probable perinatal depression"; this is what, in this study, was considered for the prevalence of depressive symptoms.

The sample size was 168 patients, of which 24 resulted with "probable perinatal depression", that is, 14.3%. It is worth mentioning that Wagner et al. (2012) state that 9.2% of the general population has suffered at least one depressive episode; specifically, existing an underdiagnosis of depression from early stages of pregnancy. The obtained percentage in this study, is clearly higher than the aforementioned data.

Regarding general characteristics of the sample, in partner violence, the majority denied it in current and previous partners. In the study conducted by Aguilera-Ortiz (2022) on intimate partner violence in Sonora, the largest group was 20-24 years old, similar to the age group found in this study, with a history of violence.

The global prevalence was 14.3% (24 patients out of 168). Lartigue et al. (2004), using the same scale, reported a prevalence of approximately 17%, although using a lower cut-off value (12-13). It is important to compare it with that reported by Morales et al. (2004), since it was there that the cut-off value was adjusted to a stricter one, obtaining 17.8%. Compared with the study in Mérida from Rodríguez-Baeza et al. (2017), in which a prevalence of 16.6% was reported, the prevalence in this study was slightly lower.

The prevalence in Sonora was considerably higher than that reported in Quintana Roo by Ceballos-Martínez et al. (2010); that is, 6.4%. The results for Sonora were similar to those reported by Sumano-López and Vargas-Mendoza (2014) in Oaxaca (14%). Gaviria et al. (2019) describe in a similar population regarding age and sociodemographic characteristics, in Colombia, the prevalence of perinatal depression between 14-23%, mentioning that it increases as pregnancy progresses. These differences are possibly related to cultural differences; even in the same country, culture differs vastly. Also, Sonora, being close to the United States, is also influenced by its culture. There is not much information available regarding depression during pregnancy, but Dagher et al. (2021), report its prevalence in the United States as 8.5-11%, which is lower than in Sonora. Although some culture traits might be shared, sociodemographic settings tend to be worse for Mexico. The same authors describe higher perinatal depression rates in Hispanic women living in the United States. Perhaps genetics plays an important role here, though we don't know the context of these Hispanic people. Still, genetics has been and continues to be researched in matters of mental health (Dagher et al., 2021). Moreover, Mitchell et al. (2023) describe that depression is common in low- and middle-income countries, affecting one in four perinatal women, although it remains an understudied field.

Of the 24 patients in question, 54.2% reported having a partner, whether it was cohabitation, marriage, or in a relationship in general. This is consistent with what Rodríguez-Baeza et al. (2017) reported, since they mention that living in cohabitation was identified as a risk factor, and most of the patients in the sample in this study were in said situation. The same authors describe marriage as a protective factor. They also state marriage is considered more of a protective factor than cohabitation, since the commitment in marriage tends to be great than in cohabitation. However, this needs to be taken carefully, since other factors might interfere. For example, a married couple may stay married and together even if they don't want to, anymore, because of legal implications and matrimonial assets, whereas cohabitation could be easier to end, if desired.

Referring to intimate partner violence, 54.2% reported some type of prior partner violence (physical, psychological, etc.); two of them mentioned it with a previous and current partner; Two more patients referred only with current partner. This information is consistent with what was reported by Silva Lima et al. (2020), mentioning that preg-

nant women with depressive symptoms have a higher average level of violence than those who did not present these symptoms.

Regarding the type of violence reported in this study, a specific instrument was not applied to explore it; it was only explored verbally. There was a predominance of psychological violence such as insults during arguments, the prohibition of certain types of clothing or having male friends, looking through mobile phones, social networks, etc.

Rogathi et al. (2017), in their study, noted that exposure to domestic violence at least once increased the risk of postpartum depression more than threefold. In fact, two of the strongest predictors of postpartum depression were prenatal depression and current abuse with an odds ratio of three or higher (Norhayati et al., 2015; Wu et al., 2012 as cited by Hutchens and Kearney, 2020).

Said information could work as a predictor of the prognosis of women who presented domestic violence, being more than half of the 24 patients in question. While local statistics do not describe types of violence and the outcome regarding pregnancy and depression, physical/sexual violence may directly lead to unwanted pregnancies, and psychological violence could increase emotional vulnerability, low self-esteem or malaise in the victims.

Concerning ethnicity, Benítez-Pinto and Puente-Peñaranda (2021) explored postpartum depression, finding that 64% of depressed patients corresponded to mestizo patients, 34% to indigenous patients and 2% to white patients. However, when analyzing each of the groups, they found that, of the 100% sample of indigenous patients, 77% presented postpartum depression compared to 23% without depression; finding a statistically significant relationship $P = .08$ in relation to the indigenous patients. While this does not refer to depression during pregnancy, the fact that about 50% of postpartum major depressive disorders actually begin prior to delivery, needs to be seriously considered (APA, 2022). Dagher et al. (2021) mention racial/ethnic disparities in accessing perinatal depression screening and treatment services as an understudied research area.

Regarding support networks, the only woman in the sample who reported not having friends or family in the city scored for probable depression, which is consistent with the bibliography that describes support networks as a protective factor against depression, described by authors such as Krauskopf and Valenzuela (2020). In Sonora, amicability is rather common, being part of cultural context, which may, in turn, increase patients' support networks.

Turning to educational level, it should be noted that 50% of the 24 patients reported a maximum level of high school studies, which is striking, since the bibliography usually mentions that the lower the level, the greater the probability of scoring above the cutoff, as pointed out by Morales et al. (2004) and Chan-Vázquez (2012). In addition to this, it is not overlooked that a large part of the patients had middle school as top reached level, being an important point described by Contreras-Carreto et al. (2022), who report that this situation is a risk factor with an OR of 5.61, specifically in Mexican population.

As for the trimester of pregnancy, 66.7% of the 24 patients with probable depression corresponded to the third trimester, consistent with Gaviria et al. (2019), who stated perinatal depression increases along with gestation time itself, possibly due to the expectations and qualms about the pregnancy being over and moving forward to the next stage, along with the psychosocial demands Aguilar-Abrego (2008) describes. It is observed that most of the patients with probable depression reported having desired the current pregnancy. This does not correspond to what is usually reported about unwanted pregnancies as a greater risk factor for depressive symptoms, when compared to the desired ones. Rodríguez-Baeza et al. (2017), similarly, describe a fairly similar proportion between whether the pregnancy was planned or not, in women with probable depression, which, apparently, shows that there is no major difference with respect to possible subsequent depression.

In this sample, being primigravida predominated in those with probable depression. However, among those who were not primigravida and had probable depression, the predominance was not having had previous vaginal deliveries.

Ceballos-Martinez et al. (2010) reported the opposite, as a history of previous vaginal deliveries predominated in pregnant women with probable depression. Morales et al. (2004), as well as Contreras-Carreto et al. (2022) describe that the greater the number of gestations, the greater the probability of depression, which was not demonstrated in this study.

Turning to the personal history, out of the five patients with hypothyroidism (of the total sample), two had results of probable depression. The relationship between thyroid function and mood disorders has been described for more than 50 years (Caneo et al., 2020). However, all patients with hypothyroidism were in adequate control, according to their most recent thyroid function tests.

Among the patients with probable depression, 70.8% were overweight or obese, which is transcendental, due to findings that not only speak of an increased risk of depression due to being overweight, but also of consequences for offspring (Cattane et al., 2021). However, these findings should be taken with caution in the present study, since there is no previous information regarding overweight or obesity in patients.

Regarding substance use, 54.2% had a history of alcohol use, at least before pregnancy. More than half of the patients in the Rodríguez-Baeza et al. (2017) study had a history of alcohol use. About tobacco consumption, 41.7% referred it, being similar to what was found by Rodríguez-Baeza et al. (2017) and Contreras-Carreto et al. (2022). Finally, 29.2% had a history of use of illegal substances. This shows that

most of the patients with probable depression had a history of some type of substance use. Despite the mention of substance use prior to pregnancy, during the clinical interview, the context in which they came to use the substances was intentionally sought, ruling out criteria for a substance use disorder.

The referred consumption occurred in social situations, denying that it functioned at any time as a negative reinforcer. This type of reinforcer happens when the consumption is sought in order to eliminate or attenuate discomfort, being the consumption that usually occurs in depressive disorders (Wise & Koob, 2014). Although the fact that consumption occurs as a positive reinforcer does not rule out an affective problem, this study did not find a relationship between substance use and a possible previous depressive episode. However, it does not exempt them from complications in the future.

Contreras-Carreto et al. (2022) emphasize several determinants that affect maternal mental health. Among them are minimization of symptoms [by the patient, family and/or health care provider], abandonment of a partner, lack of support networks, a history of any type of abuse, which have been identified in a large part of the 24 patients suspected of depression.

Sociodemographic factors did not predict prevalence of postpartum depression in a cross-national meta-analysis and meta-regression, according to Hahn-Holbrook et al. (2018), whose findings showed that nations with higher wealth inequality, higher risk of maternal or infant mortality and higher percentages of young women working ≥ 40 h a week, were the nations with the highest prevalence of perinatal depression, drawing the attention to macroeconomic and health conditions as important predictors of depression in perinatal period. Mexico's prevalence of perinatal depression in this analysis was in the mean -19%- of all considered nations, which is consistent with our findings.

Regardless of the score, 100% of the pregnant women with probable depression mentioned that they had been told that what was happening to them was "normal" and some even mentioned that they were told that they should "put up with it" sic, because it was "what was expected". This falls within the minimization of symptoms, previously described. Aguilar-Abrego (2008) talks about these expectations and social demands and how they have an important impact.

As Aguilar-Abrego (2008) states, there are different psychosocial demands. One of the expected biological objectives is the birth of a healthy child and as a psychosocial objective, the new mother is expected to grow and mature as a woman, reflecting this by being "unconditionally strong" and not showing any difficulties, even if present. However, each culture has strong beliefs about proper conduct in pregnancy. These expectations must be adopted by the pregnant woman, since society demands and if said woman does not respond, she is usually judged. For this reason, it is not uncommon for women to minimize their own symptoms or try to ignore them, since they have been taught that they must comply with these social demands, sometimes as part of their own worth.

Adlington et al. (2023) talk about loneliness as a central role in the experience of perinatal depression. It is particularly described that issues relating to the interaction between perinatal depression and loneliness included self-isolation and hiding symptoms; this, due to stigma of perinatal depression and fear of judgment as a "bad mother"; a sudden sense of emotional disconnection after birth; and a mismatch between expected and actual support provided by partner, family, and community. They strived to be a "perfect mother". There was a sense that they were expected to be happy and relishing their role as a new mother. Additionally, a double burden of loneliness was identified for women from disadvantaged communities, due to increased stigma and decreased social support. Some of the testimonies said they were told to "just snap out of it" when they were feeling uneasy. A quote from these testimonies was "and my husband would always really try to tell me to be more cheerful, but it would always seem impossible and of course it added to more guilt on my part". Telling pregnant women to "just put up with it" when they're not feeling well is, unfortunately, rather common in many cultures, as was seen in these women in Hermosillo, Sonora.

Lartigue et al. (2008) describe the difficulties that pregnant women go through, with several of them being presented by the patients in this study. Some particular cases reported that part of what increased their symptoms were changes in their autonomy. As can be seen, numerous variables can influence how women feel during pregnancy. Mareckova et al. (2023) assessed a 30-year follow-up of a Czech prenatal birth cohort with a within-participant design neuroimaging component in young adulthood conducted from 1991 to 2022, in the offspring of mothers in context of maternal depression and stressful life events in the past year experienced by the young adult offspring. A gap between estimated neuroanatomical *vs*. chronological age at magnetic resonance imaging (MRI) was identified. This gap was calculated once in participants' early 20s and once in their late 20s, and pace of aging calculated as the differences between brain age gap estimation at the 2 MRI sessions in young adulthood. They state that maternal depression and recent stress may have independent associations with brain age and the pace of aging, respectively, in young adulthood. Thus, they present more evidence that prevention and treatment of depression in pregnant women may have long-term implications for offspring brain development.

All 168 patients were provided with information on affective disorders and what to expect in their pregnancy, in addition to answering any questions they might have had. As a result, 100% of them appreciated feeling listened regarding their pregnancy experience.

It is important to mention that this study focused on detection of pregnant women who had ongoing depressive symptoms, as well as psychoeducation, not actively treating them at the moment. As mentioned before, they were referred to the psychiatry service. Still, it is imperative to state some of the available options for treatment. Numerous patients with mild-moderate depression can respond to psychotherapeutic interventions. Wenzel and Kleiman (2015) have described the usefulness of cognitive-behavioral therapy in pregnancy and postpartum, as has Spinelli (2017) with interpersonal therapy. In moderate-severe depressions that have not responded to psychotherapy or are considered to have a high probability of recurrence, pharmacotherapy is used; the evidence indicates that selective serotonin reuptake inhibitors –preferably avoiding paroxetine– are a good therapeutic option (AILANCYP, 2021).

The working hypothesis was met, since the present study demonstrated a prevalence of depressive symptoms of 14.3%, similar to that described by various authors, also corresponding to other variables such as age group, lack of support networks, marital status, and contrasting with results such as a lower prevalence of depressive symptoms in adolescent pregnancy. In addition to this, the results are consistent with rest of the investigations carried out in Mexico and in other parts of the world, so it could be generalized.

To conclude, as Chin et al., (2022) assert, pregnancy and the first postpartum year is a period of increased access to health care for many, thus implying a greater opportunity for detection and intervention. Universal screening for perinatal depression, along with increased access to mental health services, can reduce adverse outcomes, including suicidal risk.

Taking everything into account, there is a high prevalence of depressive symptoms during pregnancy, going unnoticed for reasons such as insufficient knowledge (patient/health care providers), since there is no routine screening. It is imperative to work on prevention, detection and treatment, since it entails multiple consequences at a binomial, family and social level.

Limitations

Mentioning some limitations, while previous psychiatric history was investigated in the clinical interview and patient records, we have no certain way of knowing about previous undetected depressive episodes. Likewise, HIES/HIMES does not include the population treated in other medical services, such as the private sector. As for women who reached the minimum score of 14, even though they were given a certificate and a referral to the psychiatry service, due to matters of time and infrastructure, follow-up was not conducted by our team as a part of this study, nor full diagnoses confirmation by means of the most frequently employed instruments in our field, since they take, at least, an additional 10-30 minutes to complete and score. To mention a few, these are the Beck Depression Inventory (BDI), Hamilton Depression Rating Scale (HAM-D), and Montgomery-Åsberg Depression Rating Scale (MADRS). However, the database is held by the authors, making it possible to establish a further line of research.

Another possible limitation is that the EPDS, as efficient but plain as it is, might not be fully adjusted regarding various psychosocial factors that could act as mediators or predictors, such as ethnicity, violence, number of deliveries, and comorbidities; especially, violence, since it can potentially lead to developing post-traumatic stress disorder (PTSD) and not just depression. It is certainly an area of opportunity for new lines of research. However, since many of the participants had been exposed to some type of violence, it is imperative to say that, during the clinical interview, no PTSD symptoms were detected.

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Conflict of interest

The authors declare they have no conflicts of interest.

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Postpartum depression in adolescent mothers before and during COVID-19 and the role of self-esteem, maternal self-efficacy, and social support

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ABSTRACT

Introduction. Although the COVID-19 pandemic negatively impacted the mental health of vulnerable populations, such as adolescent mothers, very few studies have documented the prevalence of postpartum depression (PPD) in this population. **Objective.** a) Determine the frequency of PPD (Edinburgh Postnatal Depression Scale [EPDS] ≥ 9) in adolescent mothers before (AM-BP) and during (AM-DP) the pandemic, b) Examine psychosocial factors (self-esteem, maternal efficacy, social support, depression and anxiety in pregnancy, planned and wanted pregnancy) in AM-BP and AM-DP, and c) Determine whether being an AM-DP was a significant factor for experiencing PPD (EPDS ≥ 9). **Method.** Cross sectional study. Subjects: Forty-one AM-BP recruited at Health Centers and interviewed face to face and forty-one AM-DP surveyed online. **Results.** PPD (EPDS ≥ 9) was 42% (p = .001) more frequent in AM-DP. The groups differed significantly in all psychosocial factors, with AM-DP faring worse. Unadjusted regressions showed that being an AM-DP, having lower maternal efficacy and self-esteem, greater dissatisfaction with social support, and depression and/or anxiety in pregnancy increased PPD (EPDS ≥ 9). Adjusted multiple analysis indicated that lower self-esteem was the only factor to maintain its association with PPD (EPDS ≥ 9; p = .017). **Discussion and conclusion.** The pandemic negatively affected PPD (EPDS ≥ 9) and psychosocial factors in AM-DP, as compared to AM-BP, with self-esteem being the main factor associated with PPD (EPDS ≥ 9). In situations of extreme stress as happened in the pandemic, the mental health of adolescent mothers should be prioritized to prevent negative effects such as PPD. PPD preventive and treatment interventions should consider strengthening self-esteem.

Keywords: Adolescents, postpartum depression, maternal self-efficacy, self-esteem, social support, COVID-19.

RESUMEN

Introducción. La pandemia por COVID-19 tuvo un impacto negativo en la salud mental de poblaciones vulnerables, como las madres adolescentes, no obstante, escasos estudios documentaron la prevalencia de depresión posparto (DPP) en esta población. **Objetivo.** a) Conocer la frecuencia de DPP (Escala Edinburgh para la Depresión Postnatal [EPDS] ≥ 9) en madres adolescentes antes de la pandemia (MA-AP) y durante la pandemia (MA-DP), b) Examinar algunos factores psicosociales (autoestima, eficacia materna, apoyo social, depresión y ansiedad en el embarazo, embarazo planeado y deseado) en MA-AP y MA-DP, y, c) Analizar si ser MA-DP, fue un factor significativo para experimentar DPP (EPDS ≥ 9). **Método.** Estudio transversal. Participantes: 41 MA-AP captadas en Centros de Salud y 41 MA-DP encuestadas en línea. **Resultados.** La DPP (EPDS ≥ 9) fue 42% (p = .001) más frecuente en las MA-DP. Los grupos difirieron significativamente en todos los factores psicosociales, en detrimento de las MA-DP. Las regresiones no ajustadas mostraron que ser MA-DP, tener menor eficacia materna y autoestima, mayor insatisfacción con el apoyo social, y depresión y/o ansiedad en el embarazo incrementaron la DPP (EPDS ≥ 9). El análisis múltiple ajustado indicó que una menor autoestima fue el único factor que mantuvo su asociación con DPP (EPDS ≥ 9; p = .017). **Discusión y conclusión.** La pandemia tuvo un efecto negativo en la DPP (EPDS ≥ 9) y en factores psicosociales en MA-DP; la autoestima fue el principal factor asociado a la misma. Ante situaciones de estrés extremo, la salud mental de madres adolescentes debería ser prioritaria para prevenir efectos negativos como la DPP. Intervenciones preventivas y de tratamiento de DPP deben fortalecer la autoestima.

Palabras clave: Adolescentes, depresión posparto, eficacia materna, autoestima, apoyo social, COVID-19.

INTRODUCTION

The pandemic intensified a range of social and health problems (WHO, 2022; Edward & Mobarak, 2022), particularly affecting women (Burki, 2020). According to experts, unmet needs for contraceptives and safe abortion, lack of reproductive health programs, domestic sexual violence, poverty, and school dropout rates rose during the pandemic (NU - ECLAC, 2020; Borg Xuereb et al., 2023), contributing to the increase in the adolescent fertility rate (NU - ECLAC, 2020), which rose by 30% in Mexico (UNFPA, 2023).

Adolescents who experienced pregnancy and motherhood during the pandemic were forced to cope with adversity and intense emotions; fear of having loved ones with COVID-19, stress due to unemployment and financial difficulties (Astle et al., 2021; Smiley et al., 2021; Merriman et al., 2023), and uncertainty due to changes in their prenatal care and birth plans (Astle et al., 2021; Moltrecht et al., 2022). Many reported feeling unprepared to stimulate their children's development because they had been unable to take advantage of prenatal classes and contact with adults who would otherwise have provided guidance (Moltrecht et al., 2022).

Some adolescents reported feeling depressed due to the strict lockdown they observed out of fear of the unknown consequences of COVID-19 on pre-existing medical conditions, their pregnancy, or their newborns. Conversely, those who interrupted social distancing to receive support from their families reported experiencing anxiety and guilt (Moltrecht et al., 2022; Merriman et al., 2023). Adolescent mothers who parented their babies without support from their extended families and or partners—who were usually the providers—experienced constant frustration (Merriman et al., 2023). Those who continued their studies during the pandemic found it overwhelming to balance them with motherhood. Many were forced to interrupt or drop out of their studies because they lacked support to care for their children (Smiley et al., 2021).

In 2020, the adversities and intense emotions caused by the pandemic were expected to contribute to mental health problems (Shigemura et al., 2020), and a recent meta-review showed that depression and anxiety increased in adolescents, pregnant and postpartum women and people hospitalized with COVID-19 (Bower et al., 2023). Three research projects were found on the mental health of adolescent mothers during the pandemic. The first reported lower parental stress and postpartum depression (PPD) during the pandemic than before it started, attributed to a life skills program (LSP) and continuous school contact (Astle et al., 2021). The second research project reported a low level of PPD associated with good family support in two groups of adolescent mothers: under lockdown *vs*. not under lockdown (Matei et al., 2021), while the third found a higher proportion of PPD and lower social support among adolescent than adult mothers in the group (Sangsawang & Sangsawang, 2023).

These research projects during the pandemic coincide with studies prior to this one showing that adolescent and adult mothers who receive adequate postpartum support are less likely to experience PPD and that the protective effect is greater for adolescents (deCastro et al., 2011; Kim et al., 2014).

Self-esteem and confidence in one's ability to solve problems—associated with parenting or otherwise—increases the use of effective coping strategies, maintaining hope and commitment under challenging circumstances (Bandura, 1994; Lazarus & Folkman, 1987). These characteristics can play an important role in coping with the stressors of motherhood, the pandemic, or both. Research on adolescent mothers reports that low self-esteem (Birkeland et al., 2005; Ramos-Marcuse et al., 2009) and a negative perception of their own abilities to foster the development of infants and overcome parenting difficulties—low perception of maternal efficacy —are associated with PPD (Lara et al., 2017; Léniz-Maturana et al., 2022). Sangsawang & Sangsawang (2023) observed that the maternal efficacy of adolescent girls decreased due to social distancing, which was associated with PPD. Before the pandemic, children of adolescent mothers with lower maternal efficacy were found to have lower emotional self-regulation (Léniz-Maturana et al., 2022).

In addition to the difficulties associated with COVID-19, even under normal circumstances, adolescent mothers are more likely to have obstetric complications, and premature babies (< 37 weeks of gestation or gw) with low birth weight (< 2500g; Ganchimeg et al., 2014). In some contexts, adolescent mothers are stigmatized, especially if they do not have a partner, which reduces social support (Merriman et al., 2023; Moltrecht et al., 2022), except from their mothers, who tend to support them (Alvarez-Nieto et al., 2014). Moreover, many fail to overcome the cycle of poverty due to educational lag (UNFPA, 2020). The disadvantages of adolescent mothers contribute to depression, which can affect their parenting and increase the risk of behavioral problems in their children (Hodgkinson et al., 2014). In Mexico, between 16.05% (deCastro et al., 2011) and 33.3% (Patiño, 2016) of adolescents have been found to have PPD.

In short, previous studies focused on the challenges and emotions faced by adolescent mothers during the pandemic, tending to overlook the detection and analysis of factors associated with PPD and other mental health problems in this population. Only one gathered data on PPD before the pandemic and during the first months of lockdown (Astle et al., 2021). No studies were conducted in Mexico. The data available in this country show that, during the COVID-19 health crisis, pregnant adults suffered stress (32%) and depression (17.5%; Medina-Jimenez et al., 2022), greater stress was associated with higher levels of depression and

social support was associated with less depression (Rivera-Rivera et al., 2021). Likewise, it was observed that experiencing pregnancy and postpartum during the pandemic was overwhelming due to the intense fear of contagion and the multiple demanding situations (Lara et al., 2023). Having data on the effects of the COVID-19 pandemic on the mental health and well-being of postpartum adolescent mothers will fill a gap in research, both in Mexico and in other countries, and serve as the basis for PPD prevention and management in this population in future crises.

Objectives

a) Determine the frequency of PPD (EPDS ≥ 9) in adolescent mothers before (AM-BP) and during the pandemic (AM-DP), b) Examine certain psychosocial factors (self-esteem, maternal efficacy, social support, depression and pregnancy anxiety, planned and desired pregnancy) in AM-BP and AM-DP, and c) Analyze whether belonging to the AM-DP group was a significant factor for experiencing PPD (EPDS ≥ 9) when adjusting for other sociodemographic, obstetric, and psychosocial factors.

METHOD

Design of the study/Places

A cross-sectional, comparative, correlational study was conducted with two groups of adolescent mothers. The first was surveyed from July 2019 to March 2020 at two Primary Health Care Centers (HC) in Mexico City (CDMX): adolescent mothers before the pandemic (AM-BP). Recruitment at HC was halted due to lockdown. The second group was surveyed online from March 8 to July 8, 2021: adolescent mothers during the pandemic (AM-DP).

Participants

The inclusion criteria were being a first-time mother, aged 14 to 19, with a baby aged two to nine months and living in Mexico City. In addition, AM-DPs were required to have an email address so they could access the online questionnaire. The exclusion criterion was for the mother to have reported having one of the following situations: 1) health problems during childbirth or postpartum requiring hospitalization for a week or longer or that caused pain and made it difficult for her to perform her everyday activities, 2) health problems in the past month unrelated to childbirth or postpartum causing hospitalization, 3) having a baby with health problems requiring hospitalization, or 4) having had very low birth weight (≤ 1.5 kg) or being born before 32 weeks' gestation.

The sample of 82 teenage mothers was non-probabilistic and included 41 AM-BP and 41 AM-DP. The groups were matched by mother and baby ages to ensure representativeness of ages. They were also matched by whether the adolescents were in a relationship with the baby's father, because the majority of the AM-BP had a relationship with the fathers of their babies (n = 31, 75.6%).

Measurements

Sociodemographic data: age of the mother (years) and baby (months), educational attainment, whether the mother attended school during pregnancy and postpartum, whether she worked postpartum, marital status, whether she had a relationship with the baby's father postpartum. Socioeconomic status (SES) was evaluated using the Mexican Association of Market Intelligence and Opinion Agencies Index (AMAI, 2020), comprising seven levels: A/B high (≥ 205 points), C+ or upper-middle (166-204 points), C or middle (136-165 points), C- or lower-middle (112-135 points), D+ low (90-111 points), D poverty (48-89 points), and E extreme poverty (0-47 points; AMAI, 2020; López-Romo, 2020).

Obstetric data: Birthweight (in grams) and number of weeks of gestation at the time of delivery.

The Edinburgh Postnatal Depression Scale (EPDS; Cox et al., 1987) was used to identify mothers with a high probability of PPD rather than to establish a clinical diagnosis. It consists of ten statements with a Likert-type response (0 to 3), with the total score being calculated by adding the scores of each item. The higher the score, the greater the likelihood of PPD. Although research on the optimal cut-off point of the EPDS to identify adolescents with a high probability of depression during pregnancy and postpartum is incipient, it has been recommended to use the score ≥ 9 (Barassi & Grealish, 2022). In the validation of the instrument with low-income Mexican pregnant adolescents the optimal cut-off point (8/9), adequate sensitivity (70.4%), and specificity (84.9%; Alvarado-Esquivel et al., 2014) were obtained. With primiparous adolescent mothers in postpartum, the cut-off point ≥ 9 had a sensitivity and specificity of 90% (Venkatesh et al., 2014), which is why this cut-off point was used in this study.

The Postpartum Depression Predictors Inventory (PDPI-R; Beck, 2001; Records et al., 2007), was validated in Mexico (Ibarra-Yruegas et al., 2016) and administered to adolescent mothers (Lara et al., 2017; Patiño, 2016). Several features from the inventory were used to evaluate the psychosocial factors described below. Social support: This scale comprises twelve questions evaluating whether a woman has adequate support (from family, partner, and friends). Questions are answered with yes (0) or no (1). The total score is the sum of each item: the higher the score, the greater the participant's dissatisfaction with the support she received. Reliability of the social support scale in this study was higher than α = .70 in AM-BP and AM-DP. 2) Depres-

sion and anxiety in pregnancy. One item was used to evaluate the perception of depression and another to evaluate the perception of anxiety during pregnancy, both of which are a retrospective measurement. The response options for each item are yes (1) or no (0). 3) Planned and desired pregnancy. One item was used to determine whether the pregnancy was planned and another to determine whether it was wanted. The response options for both questions are yes (0) or no (1).

Maternal self-esteem and efficacy were evaluated using the Rosenberg Self-Esteem Scale (1965) and the Parental Evaluation Scale (PES; Farkas-Klein, 2008). The Rosenberg scale comprises 10 statements with Likert-type responses (1 to 4). The total score is the sum of the items; the more the total score increases, the higher the level of self-esteem. Reliability is α = .86 (Ramos-Marcuse et al., 2009). The PES, designed to evaluate overall self-perception of maternal efficacy, has 10 statements answered from 0 to 10. As the total score increases, the perception of maternal efficacy rises. Reliability is α = .77 (Léniz-Maturana et al., 2022).

Procedure

a. AM-BP. Those who attended the immunization appointment with their babies at the HC were invited to answer the survey. The survey was administered if they met the selection criteria and signed the informed consent form (IC). Any doubts the participants had were clarified before they signed the IC. The author and two trained psychology interns administered the surveys.
b. AM-DP. These adolescent mothers were recruited through an online survey developed with the Google forms tool. The survey was published on the Facebook page "Help for Depression" (Administered by a research project of the Ramón de la Fuente Muñiz National Institute of Psychiatry) [INPRFM]. Paid advertising was used to disseminate the survey on Facebook among the population of interest for the study, and the scope criteria were defined by sex, age, topics of interest, and location (women ages 14 to 19, with an interest in motherhood issues, postpartum and health and residing in Mexico City). In the first part of the survey, the justification and objectives of the study were presented. Those interested registered their email to see the IC and those who accepted the research conditions accessed the filter questions (selection criteria). One hundred and fourteen responses were received and 41 were finally included (Figure 1).

Statistical analyses

Descriptive statistics were obtained, and comparison analyses conducted of the groups (AM-BP and AM-DP) for sociodemographic, obstetric, psychosocial, and PPD variables (EPDS ≥ 9). X^2 (categorical variables), Student's t for independent samples (quantitative variables meeting the assumptions of normality and homogeneity of variances), and Mann-Whitney U (quantitative variables that did not meet the assumption of normality) tests were performed. The assumptions of normality and homogeneity were evaluated using the Kolmogorov-Smirnov and Levene tests. Differences between the groups of paired variables were not analyzed.

The following analyses were conducted to determine whether there was a greater probability of PPD (EPDS ≥ 9) (dependent variable) among AM-DP than in AM-BP when adjusting for other sociodemographic, obstetric, and psychosocial factors (independent variables): simple logistic regression models to evaluate the association between the groups (AM-BP *vs*. AM-DP) and sociodemographic, obstetric and psychosocial factors (independent variables), and PPD (EPDS ≥ 9; dependent variable). A multiple logistic regression model (adjusted) was built using significant variables from previous regressions.

A significance of $p < .05$ was used for the difference and association tests. Analyses were performed using SPSS Version 25 (International Business Machines [IBM], 2017).

Ethical considerations

This research was approved by the INPRFM Research Ethics Committee (Initial CEI/C/096/2018. Addendum CEI/C/005/2021). All participants gave their consent prior to their inclusion in the study. In return for their participation, they were given a pamphlet on PPD and a directory of psychological, legal, and sexual health advice.

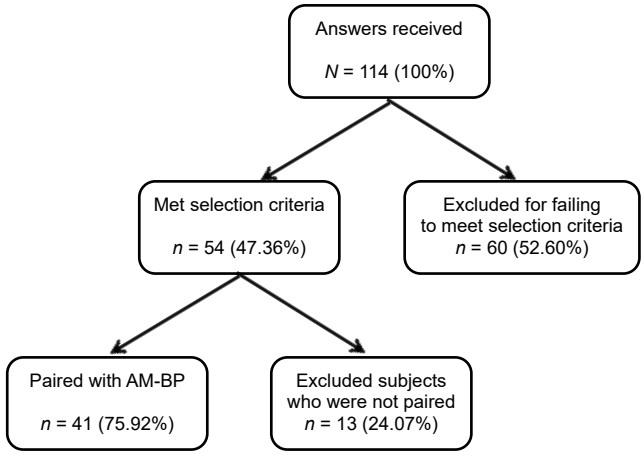

Figure 1. Diagram of adolescent mothers recruited during the pandemic (AM-DP) who answered the online survey.

RESULTS

Sociodemographic and obstetric factors

As can be seen from Table 1, the average age of mothers was 17.7 years (*SD* = 1.3) and the average age of babies 4.7 months (*SD* = 2.2), with 45.1% having middle/lower middle SES and 50% having completed their basic education. There were no differences between groups in regard to sociodemographic or obstetric factors.

PPD (EPDS ≥ 9) and psychosocial factors

As shown in Table 2, 26.8% of AM-BP reported PPD (EPDS ≥ 9) compared to 68.35% of AM-DP, in other words, PPD (EPDS ≥ 9) was 42% higher in MA-DP (p = .001). In regard to psychosocial factors, it was found that AM-DP had significantly lower scores in maternal efficacy (p = .001) and self-esteem (p = .008), as well as greater dissatisfaction with their overall social support (p = .030) and support from their families (p =.022) than AM-BP. Furthermore, AM-DPs reported feeling depressed (82.9%; p = .001) and/or anxious (70.7%; p = .014) during pregnancy more frequently than AM-BPs. No differences were found between the groups in terms of wanted and planned pregnancies.

Association between groups (AM-BP *vs* AM-DP), sociodemographic, obstetric, and psychosocial factors and PPD (EPDS ≥ 9)

Table 3 shows the logistic regression models (simple) used to analyze the association between the groups (AM-BP *vs*. AM-DP) and sociodemographic, obstetric, and psychosocial factors and PPD (EPDS ≥ 9). The results show that belonging to the AM-DP group (p = .001), having lower maternal efficacy (p = .001), lower self-esteem (p = .001), and greater dissatisfaction with overall social support (p = .001)), their partners (p = .006) and family (p = .013), and presenting with depression (p = .001) and anxiety (p = .013) during pregnancy increased the probability of PPD (EPDS ≥ 9). Table 4 shows the multiple logistic regression model, adjusted for factors such as the group to which the

Table 1
Descriptive analyses and comparison of sociodemographic and obstetric factors

	AM-BP (n = 41)	*AM-DP (n = 41)*	*Total (N = 82)*	*p*
Sociodemographic data				
Mother's age (years)	17.7 (*SD* = 1.3)	17.7 (*SD* = 1.3)	17.7 (*SD* = 1.3)	NA
Baby's age (months)	4.7 (*SD* = 2.2)	4.7 (*SD* = 2.2)	4.7 (*SD* = 2.2)	NA
SES				
A/B and C+ (High /upper middle)	10 (24.4%)	8 (19.5%)	18 (22.0%)	
C and C - (Middle/lower-middle)	21 (51.2%)	16 (39.0%)	37 (45.1%)	.258[a]
D+ D and E (Low level/poverty)	10 (24.4%)	17 (41.5%)	27 (32.9%)	
Educational Attainment				
Basic	21 (51.2%)	20 (48.8%)	41 (50%)	.825[a]
Middle school	20 (48.8%)	21 (51.2%)	41 (50%)	
Attended school at the time they became pregnant				
Yes	16 (39.0%)	19 (46.3%)	35 (42.7%)	.503[a]
No	25 (61.0%)	22 (53.7%)	47 (57.3%)	
Attended school postpartum				
Yes	9 (22.9%)	13 (31.7%)	22 (26.8%)	.319[a]
No	32 (78.0%)	28 (68.3%)	60 (73.2%)	
Marital status				
Married/Living together	28 (68.3%)	29 (70.7%)	57 (69.5%)	.810[a]
Single/Separated	13 (31.7%)	12 (29.3)	25 (30.5%)	
In a relationship with the baby's father				
Yes	31 (75.6%)	31 (75.6%)	62 (75.6%)	NA
No	10 (24.4%)	10 (24.4%)	20 (24.4%)	
Work (at the time of the survey)				
Yes	6 (14.6%)	5 (12.2%)	11 (13.4%)	.746[a]
No	35 (85.4%)	36 (87.8%)	71 (86.6%)	
Obstetrics				
Gestation weeks at delivery	39.1 (*SD* = 1.4)	38.6 (*SD* = 1.7)	38.8 (*SD* = 1.6)	.343[b]
Birthweight (g)	2984.7 (*SD* = 456.2)	2961.2 (*SD* = 402.1)	2972.9 (*SD* = 427.5)	.805[c]

Notes: AM-BP = Adolescent mothers before the pandemic; AM-DP = Adolescent mothers during the pandemic; SES = Socioeconomic Status; GW = Gestation weeks at delivery.
Test performed: [a] X^2; [b] U Mann Whitney; [c] *t* test.

Table 2
Descriptive analyses and group comparison: PPD (EPDS ≥ 9) and psychosocial factors

	AM-BP (n = 41)	*AM-DP (n = 41)*	*Total (N = 82)*	*p*
PPD				
Yes (EPDS ≥ 9)	11 (26.8%)	28 (68.35%)	39 (47.6%)	.001[a]
No (EPDS < 9)	30 (73.2%)	13 (31.7%)	43 (52.4%)	
Maternal efficacy R [0-10]	7.6 (*SD* 1.6)	6.2 (*SD* 1.8)	6.9 (*SD* 1.8)	.001[c]
Self-esteem R [10-40]	32.0 (*SD* 4.8)	28.7 (*SD* 6.1)	30.4 (*SD* 5.7)	.008[b]
Dissatisfaction with overall social support and by type of source				
Overall or total[†] R [0-12]	3.8 (*SD* = 2.4)	5.1 (*SD* = 2.7)	4.4 (*SD* = 2.6)	.030[b]
Partner R [0-4]	1.2 (*SD* = 1.7)	1.6 (*SD* = 1.5)	1.4 (*SD* = 1.6)	.189[b]
Family R [0-4]	.34 (*SD* = .79)	1.0 (*SD* = 1.3)	.6 (*SD* = 1.1)	.022[b]
Friends R [0-4]	2.2 (*SD* = 1.6)	2.5 (*SD* = 1.6)	2.4 (*SD* = 1.6)	.321[b]
Depression during pregnancy				
Yes	13 (31.7%)	34 (82.9%)	47 (57.4%)	.001[a]
No	28 (68.3%)	7 (17.1%)	34 (42.7%)	
Anxiety during pregnancy				
Yes	18 (43.9%)	29 (70.7%)	47 (53.3%)	.014[a]
No	23 (56.1%)	12 (29.3%)	35 (42.7%)	
Planned pregnancy				
Yes	9 (22.2%)	14 (34.1%)	23 (28.0%)	.219[a]
No	32 (78.0%)	27 (65.9%)	59 (72.0%)	
Wanted pregnancy				
Yes	28 (68.3%)	28 (68.3%)	56 (68.3%)	1.00[a]
No	13 (31.7%)	13 (31.7%)	26 (31.7%)	

Notes: AM-BP = Adolescent mothers before the pandemic; AM-DP = Adolescent mothers during the pandemic; R = Response range.
Test performed: [a] X^2; [b] U Mann Whitney; [c] *t* test.
[†] The higher the score, the greater the dissatisfaction with social support.

mother belongs (AM-BP and AM-DP), maternal efficacy, self-esteem, dissatisfaction with overall social support, depression, and anxiety during pregnancy. The results indicate that the AM-DP group was no longer significant for PPD (EPDS ≥ 9) when other factors were adjusted for. In this model, self-esteem was the only prevailing factor associated with PPD (EPDS ≥ 9; $p = .017$). The data fit well with the multiple logistic regression model ($\chi^2 = 55.995$; $p = .001$).

DISCUSSION AND CONCLUSION

The first objective of the study was to determine the frequency of PPD (EPDS ≥ 9) in AM-BP and AM-DP. The results show that PPD (EPDS ≥ 9) was 41.5% more frequent in AM-DP than in AM-BP, which was significant given that the groups had similar sociodemographic and obstetric features. This increase may reflect the stressful situations young mothers faced: fear of having loved ones with COVID-19, financial problems, and fear of interacting with other people (Astle et al., 2021; Smiley et al., 2021; Merriman et al., 2023).

A comparison of the PPD (EPDS ≥ 9) of the AM-DP (68.35%, EPDS ≥ 9) with similar research showed that it was higher than that of other adolescent mothers who also experienced their postpartum during the pandemic (36%, EPDS ≥ 13; Sangsawang & Sangsawang, 2023). These differences can be attributed to the use of different cut-off points, the fact that this study was based on an online survey, and the context and risk factors to which Mexican adolescent mothers were exposed. In regard to context, data in Sangsawang & Sangsawang (2023) were gathered during lockdown, whereas those for this article were collected between March 8 and July 8, 2021, following a spike in infections and deaths due to the pandemic in Mexico. During this period, it was confirmed that although the country had exceeded the worst-case scenario threefold, compulsory lockdown was not restored (Sánchez-Tanquer et al., 2021).

The analysis of sociodemographic, obstetric, and psychosocial factors before and during the pandemic showed differences in all psychosocial factors, with AM-DP displaying lower self-esteem, lower maternal efficacy, greater dissatisfaction with overall social and family support and a history of anxiety and depression during pregnancy. These results coincide with previous research reporting that, the greater the perception of stress due to the pandemic, the lower the parenting effectiveness-in adults (Xue et al., 2021; Gniewosz, 2022) and the lower the self-esteem of adolescents (Goto et al., 2022). They are also consistent with research showing a lack of support from the partners and families of adolescents during the pandemic (Moltrecht

Table 3
Simple logistic regression model for total sample (N = 82): Association between group to which the mother belongs, sociodemographic, obstetric, and psychosocial factors and PPD (EPDS ≥ 9)

	OR	*p*	*95 CI*
Teenage mother group			
AM-BP	Ref.	-	-
AM-DP	5.874	.001	2.263-15.348
Sociodemographic data			
Age of teenage mother	.756	.113	.535-1.068
Socioeconomic status			
A/B and C+ (High / upper-middle)	Ref.	-	-
C and C - (Middle/lower-middle)	1.071	.907	.338-3.393
D+ D and E (Low level/poverty)	2.671	.117	.782-9.122
Educational attainment			
Basic (elementary and junior high school)	1.635	.270	.683
Middle school (senior high school)	Ref.	-	-
Attended school during pregnancy			
Yes	Ref.	-	-
No	1.138	.773	.473-2.736
Attended school postpartum			
Yes	Ref.	-	-
No	1.444	.466	.537-3.884
Marital status			
Single/Separated	1.629	.313	.632-4.201
Married/Cohabiting	Ref.	-	-
In a relationship with the baby's father			
Yes	Ref.	-	-
No	1.484	.445	.539-4.087
Work (at the time of the survey)			
Yes	Ref.	-	-
No	.469	.259	.126-1.745
Obstetrics			
GW at delivery	.959	.759	.733-1.254
Birthweight (grs)	1.00	.937	.999-1.001
Psychosocial			
Maternal efficacy	.414	.001	.281-.608
Self-esteem	.753	.001	.666-.850
Dissatisfaction with social support			
Overall or total[†]	1.483	.001	1.197-1.838
Partner	1.489	.006	1.119-1.981
Family	1.785	.013	1.130-2.822
Friends	1.294	.070	.979-1.711
Depression in pregnancy			
Yes	11.393	.001	3.874-33.503
No	Ref.	-	-
Anxiety during pregnancy			
Yes	3.215	.013	1.280-8.078
No	Ref.	-	-
Planned pregnancy			
Yes	Ref.	-	-
No	1.257	.644	.477-3.314
Wanted pregnancy			
Yes	Ref.	-	-
No	1.818	.213	.710-4.659

Notes: OR = (odds ratio/odds ratio); CI = Confidence interval; AM-BP = Teenage mothers before the pandemic; AM-DP = Teenage mothers during the pandemic; GW = Gestation weeks at time of delivery.
[†] The higher the score, the greater the dissatisfaction with the social support received.

Table 4
Multiple logistic regression model for the total sample (N = 82): Association of group to which mother belongs and psychosocial factors with PPD (EPDS ≥ 9)

	OR-A	*p*	*95 CI*
Group to which the teenage mother belongs			
AM-BP	Ref.	-	-
AM-DP	1.474	.613	.328 - 6.625
Psychosocial aspects			
Maternal efficacy	.663	.103	.405 - 1.087
Self-esteem	.826	.017	.737 - .971
Dissatisfaction with social support	1.430	.073	.967 - 2.13
Depression in pregnancy			
Yes	4.059	.082	.836 - 19.713
No	Ref.	-	-
Anxiety during pregnancy			
Yes	2.478	.219	.584 - 10.517
No	Ref.	-	-

Notes: OR-A = (adjusted odds ratio); CI = Confidence interval; AM-BP = Adolescent mothers before the pandemic; AM-DP = Adolescent mothers during the pandemic.
Model $X^2 = 55.995$; $p = 0.001$.

et al., 2022; Merriman et al., 2023), which impacted their perception of maternal efficacy due to their feeling that they lacked sufficient practical support and information to promote their babies' development (Moltrecht et al., 2022).

Evidence was found of higher percentages of perceived depression (82.9%) and anxiety (70%) during pregnancy among AM-DP than AM-BP. Among the former, percentages were also higher than among other groups of pregnant adolescents who experienced the pandemic: depression = 43% (Tele et al., 2022) and anxiety = 45.5% (Chamdimba et al., 2022). The perception of depression and anxiety in pregnancy of AM-DP may be overestimated since they were retrospectively evaluated with single items rather than with conventional scales as in the comparison studies (Tele et al., 2022; Chamdimba et al., 2022). It should be noted, however, that these measurements have proved effective in identifying depression and anxiety symptoms in pregnancy and postpartum (Lara et al., 2017; Patiño, 2016; Marcos-Nájera et al., 2021).

In regard to the third objective, determining whether belonging to the AM-DP group was a significant factor in experiencing PPD (EPDS ≥ 9), simple association analyses showed that being an AM-DP, presenting with lower levels of self-esteem, greater dissatisfaction with overall social support, from their partners and families, as well as experiencing depression and anxiety during pregnancy were associated with PPD (EPDS ≥ 9). As in previous studies, these data confirm the association between low maternal efficacy (Lara et al., 2017; Léniz-Maturana et al., 2022), low self-esteem (Birkeland et al., 2005; Ramos-Marcuse et al., 2009), dissatisfaction with social support (deCastro et al., 2011; Kim et al., 2014), having depression or anxiety during pregnancy (Patiño, 2016), and becoming a mother during the pandemic (Bower et al., 2023) and PPD (EPDS ≥ 9).

A key finding was that, when controlling for the previous factors in a multiple analysis, the only significant factor for presenting with PPD (EPDS ≥ 9) was having lower self-esteem. These data place self-esteem at the center of the relationship between psychosocial factors and PPD. There are two possible explanations for this result. First, adolescence sees a decline in self-esteem—particularly in girls—attributable to changes in body image, the emerging ability to think abstractly about oneself and the future, and to experiencing more challenging situations than in childhood (Robins & Trzesniewski, 2005). Second, being a mother can influence how adolescents perceive themselves (Mora-Guerrero et al., 2021). It can contribute to their self-esteem and identity if they regard it as an opportunity to mature and give meaning to their life, but if they regard it more as an event entailing unwanted responsibilities, it can have negative effects on their self-esteem and identity (Melgar, 2015; Patiño, 2016; Mora-Guerrero et al., 2021). The continuous discrepancy between the ideal and the real self leads to negative thoughts and feelings (Escalante, 2004), a central factor in depression (Abdel-Khalek, 2016).

This suggests that, under normal circumstances and particularly in emergencies, self-esteem should be regarded as a key element in programs to prevent PPD that can begin during pregnancy and continue in the first year postpartum. Likewise, self-esteem should be considered in interventions to treat those who have already been identified with depression in their pregnancy and postpartum. It has already been noted that social support has positive effects on the self-esteem of adolescents and their motherhood: respectful sup-

port makes it easier for them to acquire confidence in their abilities and make more appropriate decisions about their life and parenting (Mora-Guerrero et al., 2021).

Strengths: To the best of our knowledge, this is the first study in Mexico to provide information on the psychosocial and mental health factors of adolescent mothers during the pandemic and include a comparison group prior to the health crisis. In general, there is a dearth of research exploring the mental health of adolescents during pregnancy and the postpartum period compared to those of adult mothers. In this respect, this study contributes to lending visibility to the problem. On the other hand, it is relevant that the most widely recognized self-report scale (EPDS) was used to identify those with a high probability of presenting PPD. In addition, a cut-off point was selected that has shown adequate sensitivity and specificity in primiparous and postpartum adolescent mothers (Venkatesh et al., 2014). It should be noted, however, that the EPDS is not a clinical diagnosis.

Limitations: The study is cross-sectional, which only enables levels of association to be established between variables. At the same time, the data correspond to adolescent mothers living in Mexico City, who use primary care health centers (AM-BP) and Facebook (AM-DP). These circumstances limit their generalization to other groups of adolescent mothers who do not share these characteristics. The level of commitment of participants and the social desirability bias (Singh & Sagar, 2021) may differ due to the two methods of administering the survey, although it is not known how this may be reflected. Moreover, both groups primarily comprise people interested in obtaining mental health information and support for themselves, which could be particularly true of AM-DP who answered the online survey a year after the start of the health crisis. Another limitation was that since adolescent mothers were not asked about adverse events they had experienced during the pandemic, we do not know how they may have influenced PPD (EPDS ≥ 9).

In conclusion, AM-DP experienced more PPD (EPDS ≥ 9) than AM-BP. The crisis impacted various psychosocial factors associated with PPD (EPDS ≥ 9). The role of self-esteem in PPD (EPDS ≥ 9) prevails over other factors. These data show how major crises can affect this already vulnerable population and suggests elements to be considered when implementing mental health prevention and treatment measures in this population, such as boosting self-esteem.

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Conflict of interest

The authors declare that they have no conflicts of interest.

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Psychosocial profiles of women who legally terminated a pregnancy in Mexico City

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ABSTRACT

Introduction. Reproductive autonomy enables a person to freely decide their life plan, including sexual and reproductive health. However, its exercise can be constrained by health determinants and other structural conditions. Knowing the background of women who undergo a Legal Interruption of Pregnancy (LIP) helps identify patterns of inequality and their impact on the exercise of reproductive autonomy. **Objective.** To analyze the profile of women who legally terminate a pregnancy in Mexico City. **Method.** Latent class analysis, with the participation of 274 women who terminated a first trimester pregnancy at a public facility. **Results.** Model of two latent classes: adult (68.34%) and young women (31.65%). Stigma was the predictor variable for class; the higher the score, the lower the probability of belonging to the adult group (p = .019). Adult women were characterized by having lower educational attainment, engaging in unpaid activities, having at least one child, and having had previous abortions, having experienced intimate partner violence in the past twelve months and reporting that their partners did not agree with the interruption of their pregnancy. Young women were students, partnered and reported that their partners had agreed with them to request an abortion. **Discussion and conclusion.** Despite the legal changes effected, stigma is still present in the abortion demand and access, particularly for women with certain characteristics. It would be useful to include interventions to reduce stigma in counseling, using an approach based on previous experience.

Keywords: Induced abortion, stigma, autonomy, reproductive health, gender violence.

RESUMEN

Introducción. El ejercicio de la autonomía reproductiva permite tomar decisiones libres sobre el plan de vida incluyendo la salud sexual y reproductiva. Las determinantes de la salud y otros condicionantes estructurales pueden obstaculizar su ejercicio. Conocer los antecedentes de las mujeres que realizan una Interrupción Legal del Embarazo contribuye a determinar patrones de desigualdad y su impacto sobre el ejercicio de la autonomía reproductiva. **Objetivo.** Analizar el perfil de mujeres que interrumpen legalmente un embarazo en la Ciudad de México. **Método.** Análisis de clases latentes, participaron 274 mujeres que interrumpieron un embarazo de primer trimestre en un servicio público. **Resultados.** Modelo de dos clases latentes: adultas (68.34%) y jóvenes (31.65%). El estigma fue la variable predictora de la clase; a mayor puntaje menor probabilidad de pertenecer al grupo de adultas (p = .019). Para las adultas se caracterizaron por tener menor escolaridad, actividades no remuneradas, tener al menos un hijo y abortos previos, experimentaron violencia de pareja en los últimos doce meses y reportaron que su pareja no estuvo de acuerdo con la interrupción. Las jóvenes eran estudiantes, tenían pareja y reportaron que habían acordado con ella solicitar el aborto. **Discusión y conclusión.** A pesar de los cambios legales, el estigma está presente en la demanda y el acceso a los servicios de aborto y resulta particularmente relevante en mujeres con ciertas características. Sería oportuno incluir en la consejería intervenciones para disminuirlo buscando un enfoque centrado en las experiencias previas.

Palabras clave: Aborto inducido, estigma, autonomía, salud reproductiva, violencia de género.

INTRODUCTION

Between 2015 and 2019, 112 to 131 million unintended pregnancies occurred worldwide, with six out of ten ending in abortion. The global abortion rate fluctuates between 36 and 44 abortions per thousand women aged between 15 and 49 (Bearak et al., 2020). In Mexico, this rate is estimated to be 34 per 1,000 women (Singh et al., 2010) The Health Information System shows that the national mortality rate is 40.3 deaths per 100,000 population, ranging from 7.9 in Baja California Sur to 83.3 in Chiapas (Schiavon & Troncoso, 2020).

Although the Total Fertility Rate in Mexico is 2.07 children per woman, it ranges from 1.34 in Mexico City to 2.80 in Chiapas. Among women who have only completed elementary school, it is 2.82, whereas among those who have completed secondary and higher education it is 1.75 (ENADID, 2018). Adolescent women reported that one in two pregnancies was unwanted or unplanned, regardless of whether they already had children. One in five women with fewer children than they considered ideal stated that they had not had more children due to lack of money or for health reasons, whether they lived in a rural or urban setting (ENADID, 2018).

Variability in the epidemiology of abortion and other sexual and reproductive health indicators accounts for the disparities in access to health. The evidence shows that gender, age, ethnicity, social class, and their intersections influence decisions throughout a person's sexual and reproductive life (Cleeve et al., 2017). The power to freely and responsibly decide about issues that concern one is one of the characteristics of empowerment, known as agency. Empowerment is multidimensional and refers to the expansion of women's ability to make strategic decisions about their lives, in areas where these decisions were previously limited (Upadhyay et al., 2014).

These limitations are also associated with legal frameworks. The law was changed in Mexico City in 2007 and Legal Interruption of Pregnancy [LIP] (Secretaría de Salud de la Ciudad de México [SEDESA], 2022) services began to be provided. Since 2019, nine states have incorporated changes to make it possible to request an abortion on demand in the first trimester. For the remaining health needs, the legislation varies enormously (Centro Nacional de Equidad de Género y Salud Reproductiva, 2022).

In 2021, the Mexican Supreme Court of Justice set a historic, nationwide precedent, recognizing reproductive autonomy as a right protected by the Constitution and defining it as "All the choices that give meaning to the life project of people as free beings, within the scope of a morally plural, secular state," including "the choice of and free access to all forms of contraception, assisted reproduction techniques and the possible interruption of pregnancy" (Suprema Corte de Justicia de la Nación, 2022). The Court argued that health determinants and other structural conditions could obstruct the elements required to prevent an unwanted pregnancy and concluded by indicating the need for health services to exist to exercise the right to decide.

In Mexico, seeking a LIP service has been associated with sociodemographic characteristics such as being a student, having a job, and having other children (Figueroa-Lara et al., 2012). Qualitative reports indicate that worrying about having another child is associated with having more caregiving tasks and distributing them among family members, as well as having to share the household income with another member of the family nucleus. Caregiving and parenting tasks are perceived as a barrier to professional development (Helfferich et al., 2014).

In Mexico City, from April 2007 to May 2023, among those attended at LIP facilities, the highest proportion (45%) were between 18 and 24 years old; 43% had completed high school, 70% had at least one child, one in two (54%) was single, 29% were living with their partners and 11% were married. One in three (30%) were homemakers, 24% were students and 29% were employees (SEDESA, 2022).

This study explores how the determinants of sexual and reproductive health influence the control women have over their behaviors and how experiences of power dynamics significantly influence reproductive outcomes. Accordingly, this study considers that the presence of adverse economic, reproductive, and psychosocial experiences can make it difficult for women legally terminating a pregnancy to exercise reproductive autonomy.

METHOD

Design of the study

Cross-sectional study that is the baseline of a prospective, longitudinal study designed to determine the prevalence of a probable major depressive episode in women who legally interrupted a pregnancy and received medication at a public facility in Mexico City.

Participants

Two hundred and seventy-four women who met the following criteria: being over 15, resident in Mexico City, who had attended their discharge/follow-up appointments and agreed to participate in the interview. Exclusion criteria included having had an abortion by manual vacuum aspiration, having a serious intellectual or motor disability that prevented them from answering, and having requested the LIP for other legal reasons (rape, danger to the woman's life, genetic malformation).

Measurements

Semi-structured interviews based on a questionnaire that included ad hoc questions and a battery.

Table 1
Characteristics of women who terminated a pregnancy at a Mexico City hospital

Sociodemographic Characteristics		
Age (years)	Frequency	%
15-19	55	20.07
20-29	158	57.66
30 and over	61	22.26
Educational Attainment	Frequency	%
Elementary education	76	27.74
Secondary education	138	50.36
Higher education	60	21.89
Occupation	Frequency	%
Paid Activity	137	50.40
Unpaid Activity	80	29.40
Student	55	20.20
Socioeconomic level*	Frequency	%
Very low	93	33.94
Low	152	55.47
Medium/High	29	10.58
Currently partnered	214	78.10
Reproductive characteristics		
Age at first pregnancy		
Mean (SD)		19.4
Median (Q1-Q3)		18 (16 – 20.5)
Min-Max		14 – 35
	Frequency	%
Has children	150	54.74
Previous induced abortions	65	23.72
Agreement with partner		
Partner agreed	152	57.36
Partner didn't agree or wasn't sure	43	25.29
Partner didn't know or didn't take part in the decision	46	17.36
Psychosocial characteristics	Frequency	%
Current depressive symptoms	47	17.28
Self-reported depression in the past 12 months	108	39.41
Perception of mother's depression	174	63.50
Intimate partner violence in the past 12 months	128	46.71
Child sexual abuse	87	31.75
Stigma		
Mean (SD)		2.40 (.67)
Median (Q1-Q3)		2.38 (1.92-2.87)
Min-Max		1.04-4.15
Concern about being judged		2.15 (.85)
Self-judgment		2.50 (1.07)
Isolation		1.92 (.82)
Community Condemnation		3.01 (1.33)

Note: * Evaluated by the social worker of the LIP service using the Medical Administration and Hospital Information System (SAMIH).

Table 2
Latent class models

Models	*Log likelihood*	*n*	*p*	*df*	*AIC*	*BIC*	*LL*
1	-2,870.281	274	-	17	6,292.27	6,360.92	-3,127.14
2	-3,043.524	274	< .001	39	6,165.16	6,306.07	-3,043.55
3	-2,988.402	274	.776	56	6,105.72	6,311.67	-2,988.35

Notes: AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; LL = Statistical Index of Best Fit of Model.

Sociodemographic characteristics. Age (open), educational attainment and occupation (closed multiple choice), socioeconomic level (assigned by the Medical Administration and Hospital Information System), current relationship (dichotomous).

Reproductive characteristics. Age at first pregnancy, number of children (open), previous induced abortions and whether they had agreed with their partners to undergo the LIP (closed multiple choice).

Psychosocial characteristics. For current depressive symptoms, the 35-item version of the Center for Epidemiological Studies Depression Scale, (González-Forteza et al., 2011) was used. Designed by Radloff in 1977, it was validated among the Mexican pregnant adolescent population (Lara et al., 2006), and adapted to the DSM-IV criteria using 35 items that explore the nine symptoms and their presence in the past two weeks (Ramos-Lira et al., 2001) and women who had terminated their pregnancies (α = .93; Ramos-Lira et al., 2023). Response options ranged from "0 days" to "8 to 14 days." At the end, subjects were asked "In the past twelve months, have you had symptoms like those I just mentioned and for so long and with such intensity that you would say you were depressed?" with dichotomous response options. A question about the perception of their mother's depression was also included from the adaptation de Lara et al. (2006): "Has your mother been or was she depressed? This means that she has shown symptoms such as feeling lonely, sad, or not wanting to do anything with such intensity and for so long that you would think she was depressed," with dichotomous response options.

Intimate partner violence in the past twelve months was evaluated with four dichotomous items (Ramos-Lira & Saltijeral Méndez, 2008). For this analysis, a single variable was created, considering the presence of at least one (α = .72). For sexual violence in childhood, subjects were asked, "Before you turned 15, did anyone –whether or not they were a member of your family– ever touch you, or touch or caress any part of your body;" "Did they touch any part of your body or have sexual relations with you when you were very young or against your will?" (Ramos-Lira et al., 2023). Response options were dichotomous.

The Individual Abortion Stigma Scale (Cockrill et al., 2013) was also included, focusing on women who have had an abortion, and validated in clinics in the United States in its 20-item version (α = .88) in four subscales: Worries (α = .94), Isolation (α = .83), Self-criticism (α = .84), and Community rejection (α = .78). The score is continuous, with a potential range of 1 to 4.35, meaning that the higher the score, the greater the stigma. It has been tested in Nigeria, Germany, Uruguay, Kenya, and Mexico to evaluate interventions, services, and public policies (Wollum et al., 2021).

Procedure

Data were collected at a hospital affiliated to the Mexico City Ministry of Health between November 2018 and December 2019. Interviews, conducted during the follow-up appointment, two weeks after the abortion, lasted from 40 to 60 minutes. The interviewers and the social worker assigned to the LIP facility invited subjects to participate. After accepting, they were taken to a cubicle where the informed consent form was read to them.

Statistical analysis

Stata 16.0 was used for the Latent Class Analysis (LCA), which estimates conditional probabilities of belonging to a population segment, given that each person has specific behavior. Regression models evaluate the contributions of each observed variable based on membership of this segment (Monroy Cazorla et al., 2009), which is particularly useful in small samples (Reyna & Brussino, 2011; Strunin et al., 2015; Cordero-Oropeza et al., 2021).

Three models were evaluated through the Bayesian Information Criteria (BIC), weighting the goodness of fit of the model through the maximum likelihood (ML) value. Parsimony was evaluated using the Akaike information criteria (Monroy Cazorla et al., 2009). Finally, a regression analysis was performed using the stigma score as the dependent variable.

Ethical considerations

Ethical approval was obtained from the Research Ethics Committee of the Ramón de la Fuente Muñiz National Institute of Psychiatry, on June 4, 2018: CEI/C/037/2018.

Table 3
Profile of women who terminate their pregnancies

	Class 1 / Adults (n = 184)			*Class 2 / Youth (n = 90)*		
	Mean (%)	*95 CI*		*Mean (%)*	*95 CI*	
Total by	68.34%	.61	.75	31.65%	.25	.39
Age						
15-19 years	6.93%	.04	.12	48.44%	.37	.60
20-29 years	60.49%	.53	.67	51.55%	.40	.63
30 or over	32.57%	.26	.40	.86%	.00	.99
Educational Attainment						
Elementary education	34.02%	.27	.41	14.15%	.08	.24
Secondary education	47.21%	.40	.55	57.17%	.45	.68
Higher education	18.76%	.13	.26	28.66%	.19	.40
Occupation						
Paid Activity	55.81%	.48	.63	38.51%	.27	.52
Unpaid Activity	42.93%	.36	.51	.05%	.00	1.00
Student	1.25%	.00	.07	61.48%	.48	.73
Socioeconomic level*						
Very low	38.81%	.32	.46	23.42%	.15	.38
Low	51.64%	.44	.59	62.58%	.51	.73
Medium/High	9.53%	.06	.15	13.99%	.08	.24
Currently partnered	82.58%	.76	.88	68.43%	.57	.78
Has children	76.50%	.68	.83	8.68%	.04	.20
Age at first pregnancy (mean)	19.592	18.88	20.29	17.855	15.87	19.84
Previous induced abortions	28.96%	.23	.36	16.21%	.09	.27
Agreement with partner regarding LIP						
Partner agreed	53.65%	.46	.61	65.46%	.54	.76
Partner didn't agree or wasn't sure	28.22%	.22	.35	18.84%	.11	.30
Partner did not take part in the decision	18.12%	.13	.25	15.68%	.09	.26
Current depression symptoms	18.43%	.13	.25	14.76%	.08	.25
Self-reported depression in past 12 months	35.30%	.28	.43	49.86%	.38	.61
Perception of mother's depression	70.43%	.63	.77	66.91%	.55	.77
Intimate partner violence in past 12 months	54.65%	.47	.62	30.52%	.21	.42
Child sexual abuse	32.53%	.26	.40	31.17%	.22	.42

Note: * Evaluated by the social worker of the LIP service using the Medical Administration and Hospital Information System (SAMIH).

RESULTS

Table 1 shows the characteristics of the subjects. The two-class model was chosen because it provided the best fit, was the most parsimonious, and showed statistically significant differences (Table 2).

Table 3 shows two classes. The first comprises 68.34% of the women while the second contains 31.65% ($p < .01$). The profile for the first group included a larger proportion of adult women, with a higher proportion of those who had completed basic education (34% *vs*. 14.1%). Eight out of ten had stable partners, 76.5% had at least one child, had had their first pregnancy at an average age of 19.5 and over half their partners had agreed for them to undergo a LIP (53.65%). The majority displayed severe depressive symptoms at the time of the interview (18.4% *vs*. 14.8%) and had perceived their mothers as being depressed at some point in their lives (70.4 *vs*. 66.9%), while 54.6% had experienced intimate partner violence in the previous 12 months.

Conversely, the group of young women were high school or university students (57.2% and 28.7% respectively) and less likely to report being partnered, 8.7% had children and 16.2% had had at least one induced abortion. Their first pregnancy at been at the age of 17.8 years. A total of

4.8% of those with partners reported that they had agreed to the interruption of their pregnancy. Although young women were more likely than adult women to have perceived themselves as being more frequently depressed in the past twelve months (49.9% *vs*. 35.3%), after the abortion they reported high symptoms of depression less frequently (14.8%). They had experienced comparatively less violence from their partners in the past year (30.5%; Table 3).

In regression, the stigma score was inversely associated in young women ($f[x] = -.5056$, $p = .02$). In other words, young women who had terminated their pregnancies were less likely to perceive themselves as stigmatized. Table 4 also shows that experiences prior to abortion differ between the two classes. In the case of young women, having children, having had induced abortions, disagreeing with their partners, or having partners who had not taken part in the decision, having experienced intimate partner violence in the past twelve months and/or having been a survivor of childhood sexual abuse, were inversely related to the probability of having high stigma scores. Conversely, among adult women, being aged between 20 and 29 years old, having a partner and having become pregnant for the first time before turning 20, was associated with the probability of presenting greater stigma (Table 4).

Table 4
Logistic regression with stigma as a predictor variable

	Class 1 / Adults (n = 184)			*Class 2 / Youth (n = 90)*		
Total by class	*OR*	*95% CI*		*OR*	*95 CI*	
Age						
15-19	1.00			1.00		
20-29	2.164	1.541	2.787	.084	-.39	.557
30 and over	1.553	.907	2.200	-17.563	-5641.064	5605.938
Educational attainment						
Elementary education	1.00			1.00		
Secondary education	.344	.013	.676	1.38	.695	2.064
Higher education	-0.592	-1.04	-.144	.729	-.031	1.49
Occupation						
Paid activity	1.00			1.00		
Unpaid activity	-.261	-.568	.046	-15.284	-2225.155	2194.586
Student	-3.791	-5.613	-1.969	.464	-.67	.994
Socioeconomic level*						
Very low	1.00			1.00		
Low	.285	-.031	.600	.958	.400	1.517
Medium/High	-1.41	-1.947	-.874	-.599	-1.376	.179
Currently partnered	1.55	1.153	1.947	.811	.318	1.303
Has children	1.186	.786	1.585	-2.366	-3.305	-1.427
Age at first pregnancy (mean)	2.976	2.94	3.012	2.884	2.771	2.996
Previous induced abortions	-.894	-1.225	-.562	-1.655	-2.317	-0.992
Agreement with partner regarding LIP						
Partner agreed	1.00			1.00		
Partner didn't agree or wasn't sure	-.631	-.981	-.282	-1.317	-1.954	-.679
Partner did not take part in the decision	-1.084	-1.496	-.673	-1.407	-2.059	-.755
Current depressive symptoms	-1.47	-1.849	-1.092	-1.797	-2.443	-1.151
Self-reported depression in the past 12 months	-.604	-.916	-.292	-.01	-.479	.459
Perception of mother's depression	.872	.533	1.21	.697	.201	1.193
Intimate partner violence in the past 12 months	.193	-.111	.497	-.836	-1.355	-.338
Child sexual abuse	-.724	-1.042	-.407	-.803	-1.293	-.313

Note: * Evaluated by the social worker of the LIP service using the Medical Administration and Hospital Information System (SAMIH).

DISCUSSION AND CONCLUSION

Latent class analysis identified different behavioral patterns in women who terminate their pregnancies. Stigmatization remains a central element in the barriers to obtaining an abortion, access to which is constructed as shameful, immoral, and deviant (Cullen & Korolczuk, 2019). The scale used showed adequate psychometric properties (α = .88 - α = .98) coinciding with previous reports on the Mexican population (Ramos-Lira et al., 2023; Belfrague et al., 2020).

As in Table 1, in the study by Cockrill et al., (2013), self-criticism and community condemnation obtained the highest scores. In a systematic review by Hanschmidt et al., (2016), self-criticism is classified as internalized stigma (what women think about themselves) and social condemnation as perceived stigma (the anticipation of negative judgment from others regarding their decision, which could be loved ones, healthcare providers, or people in general). In the case of healthcare providers, stigma has been described in dimensions such as discrimination, management disclosure, and resilience (Martin et al., 2018).

In findings about women who had had an abortion, the total scale score was significantly and inversely associated with age, as in the present study. Moreover, it was positively associated with religiosity, particularly with the social condemnation subscale (Cockrill et al., 2013). This agrees with studies in non-Western countries reporting high community rejection of older or married women or those who already have children (Makleff et al., 2019), which would appear to be linked to the idealization of motherhood and religiosity (Orihuela-Cortés et al., 2023; Sorhaindo et al., 2014). However, it may also be associated with experience, since abusive practices exercised by providers towards women seeking service have been documented (Collado Miranda & Mora-Ríos, 2020).

Reproductive experience also proved relevant. Having had a previously induced abortion decreases the probability of high stigma, whereas having had a first pregnancy at age 19 increases it. A study conducted with Catholic women who had had abortions shows that they defended "selective motherhood" against absolutist Catholic discourse by having a contextual moral approach, anchored in everyday circumstances such as a precarious financial situation, maternal work, and unstable interpersonal conditions (Singer, 2018).

The contents of Table 4 could support the hypothesis of Norris et al. (2011) that women find a number of reasons to have an abortion, with some reasons being more socially sanctioned and therefore eliciting a less harsh judgment. Situations such as living in adverse circumstances such as being depressed, disagreeing with their partners, or having experienced violence are situations associated with unwanted pregnancy (Steinberg, 2016). The decision to have an abortion is therefore a means of eliminating the stress associated with an unwanted pregnancy and may create a sense of relief rather than a negative experience (Major et al., 2009).

Among adults, being aged between 20 and 29 years old, having higher education, being a student and having a medium/high socioeconomic level was inversely associated with the probability of greater stigma (Table 4), which coincides with what found by Figueroa-Lara et al. (2012), who document that in Mexico, seeking LIP services is associated with years of schooling, being a student, and being engaged in paid employment. A qualitative study in Germany showed that younger women regarded having a child as barrier to gaining financial independence, completing their education and improving their social status (Helfferich et al., 2014). A five-year longitudinal study conducted in the United States showed that women with the greatest financial difficulties are those who seek an abortion and when they do not obtain one and continue an unintended pregnancy, they are also those who face the greatest risk of unemployment, poverty and assuming the responsibility of raising a child without a partner (Biggs et al., 2013; Finer et al., 2005; Kirkman et al., 2009).

Being partnered was associated with the risk of having higher levels of stigma in adults (Table 4), although not in young women, who reported a higher proportion of agreement (Table 3). Making the decision independently of their partners decreased the probability of high stigma scores in both classes. This coincides with the result of a study of German women, which found that the stability of a relationship was associated with the common, consensual decision of whether or not to have children. (Helfferich et al., 2014). In this respect, Chibber et al. (2014), report that 26% of women declared that their partner could not or did not want to help them have a baby, because they were not physically close enough to be able to support then, were not financially capable of providing, "were not ready to become fathers" or were not "responsible enough" to parent, or did not help the woman raise her existing children.

Adult women may make the decision to abort without consulting their partners and for financial reasons that discourage them from having more children. Conversely, young women do so because they regard having a child as constraining their life project or likely to cause family problems because they are single (Chibber et al., 2014). In this respect, it would appear that when a woman has a stable partner, reproductive autonomy, conceptualized as a personal decision-making capacity, is associated with better communication skills and less disparity (Upadhyay et al., 2014).

Experiences of violence were associated with the lowest probability of high stigma, which is consistent with what was reported by Stockman et al. (2013) that violence could impact women's ability to decide about their sexuality and reproduction. In a meta-analysis of reproductive coercion (Grace & Anderson, 2016), one of the consistent conclu-

sions is that unintended pregnancy is higher among those being coerced by their current partners.

It is striking that the proportion of child sexual abuse among the adult and young women in this study is higher (32.53% and 31.17% respectively) than that reported by other studies in Mexico, which hovers around the 10% mark (INEGI, 2022; Valdez-Santiago et al., 2020) and that in both groups, it is inversely proportional to stigma. A greater presence of adversities in childhood is associated with having multiple abortions (Steinberg et al., 2016) and subsequently experiencing intimate partner violence or sexual victimization (Stockman et al., 2013).

Stigma has been described as the most significant predictor of depression both internationally (Biggs et al., 2020; Major et al., 2000; O'Donnell et al., 2018; Steinberg et al., 2016) and nationally (Moreno López et al., 2019; Ramos-Lira et al., 2023). However, the results of this study coincide with the results of a qualitative study on women who underwent an LIP in Mexico City. Subjects, particularly young women, mentioned that although abortion was a difficult situation, it constituted a source of satisfaction since they had managed to solve a serious problem in their lives and their decision meant they had prioritized their health and well-being (Sorhaindo et al., 2016). The high percentage of perceived maternal depression is striking in view of the existing evidence on the intergenerational transmission of depression, a phenomenon that requires further study in terms of its mechanisms and protective factors (Goodman, 2020).

The main limitation of this study is the intentional selection of the sample, which only includes women who used medication and were cared for by highly specialized personnel exclusively dedicated to performing these procedures.

The results underline the significance of the stigma attached to abortion in reproductive decision-making, even in contexts of legality and standard procedures. Stigma mechanisms do not appear to be reproduced in the same way among the generations of women interviewed. Providing counseling focused on demystifying erroneous or distorted ideas about abortion, within the context of the connection with experiences in the individual sexual and reproductive trajectory, should be a priority for public policy in this sphere.

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Conflict of interest

The authors declare they have no conflicts of interest.

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REVIEW ARTICLE
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Bibliometric analysis of peer-reviewed literature on perinatal depression in Mexico

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ABSTRACT

Background. Perinatal depression (PND) is a clinical disease developed in any stage during the pregnancy and postpartum period with serious health and economic implications. **Objective.** The aim of this work was to analyze via bibliometrics indicators Mexico's production on PND to provide a view of the academic landscape and a comprehensive reference for subsequent research in the country. **Method.** The Scopus and Web of Science (WoS) databases were used to perform a search for peer reviewed papers related to PND in México. The search was made following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). The extracted data were processed with VOS Viewer to examine link strength and clusters associations of diverse bibliometrics variables. **Results.** A total of 132 records were retrieved and we included 70 studies in the bibliometric analysis after application of the exclusion criteria. The authors with more papers were Navarrete L., and Asunción Lara M. The institutions with more papers were the National Institute of Perinatology, Ramón de la Fuente National Institute of Psychiatry, and National Institute of Public Health of Mexico. A diminution of the research considered in PND is observed in the last two years. Four keyword clusters were identified related to PND: symptoms, prevalence, pregnancy. **Discussion and conclusion.** The scarce literature concerning PND in Mexico compared with other countries could be due the limited collaboration between the health institutes. An urgent need to increase research on PND in Mexico is evident to be applicable in the management of resources in the healthcare system.

Keywords: Perinatal depression, postpartum depression, México, bibliometric, VOS Viewer, Scopus, Web of Science.

RESUMEN

Antecedentes. La depresión perinatal (PND) es una enfermedad clínica que se desarrolla en cualquier etapa del embarazo y posparto con graves implicaciones sanitarias y económicas. **Objetivo.** El objetivo de este trabajo fue analizar a través de indicadores bibliométricos la producción de México sobre PND, para brindar una visión del panorama académico y un referente integral para investigaciones posteriores en el país. **Método.** Se utilizaron las bases de datos Scopus y Web of Science (WoS) para realizar una búsqueda de artículos revisados por pares relacionados con la PND en México. La búsqueda se realizó siguiendo los elementos de informes preferidos para revisiones sistemáticas y metaanálisis (PRISMA). Los datos extraídos se procesaron con VOS Viewer para examinar la fuerza de los enlaces y las asociaciones de grupos de diversas variables bibliométricas. **Resultados.** Se recuperaron un total de 132 registros y se incluyeron 70 estudios en el análisis bibliométrico después de la aplicación de los criterios de exclusión. Los autores con más artículos fueron Navarrete L. y Asunción Lara M. Las instituciones con más artículos fueron el Instituto Nacional de Perinatología, el Instituto Nacional de Psiquiatría Ramón de la Fuente y el Instituto Nacional de Salud Pública de México. Se observa una disminución de las investigaciones consideradas en el PND en los últimos dos años. Se identificaron cuatro grupos de palabras clave relacionadas con la PND: síntomas, prevalencia y embarazo. **Discusión y conclusión.** La escasa literatura sobre PND en México en comparación con otros países podría deberse a la limitada colaboración entre los institutos de salud. Se evidencia una necesidad urgente de realizar más investigaciones sobre PND en México que sean aplicables y útiles en la gestión de recursos en el sistema de salud.

Palabras clave: Depresión postparto, México, bibliométrico, VOS Viewer, Scopus, Web of Science.

BACKGROUND

Perinatal depression (PND) is a mood disorder at any stage during pregnancy or in the 4 weeks following delivery (About 50% of postpartum major depressive disorders begin prior to delivery; American Psychiatric Association, 2022). The symptoms of this disease can be associated with signs of depression, desperation, sadness, change in sleep and eating habits, decreased libido, irritability, diminished interest, isolation, thoughts of hurting oneself or the infant, or even suicidal thoughts (Galea & Frokjaer, 2019; Wang et al., 2021).

There are several proposed etiological mechanisms for postpartum depression, such as fluctuations in steroid hormones; neurobiological changes particularly in the hippocampus, prefrontal cortex, and amygdala (Brummelte & Galea, 2016). Little is known about genetic factors, but there has been some reported association between PND and serotonin transporter linked polymorphism, catechol-O. methyltransferase and brain-derived neurotrophic factor, oxytocin receptors, and estrogen receptors. However, their role is still unclear as they tend to show associations only during the second and third trimesters and for those who begin during the postpartum period (in particular, four weeks after delivery; Figueiredo et al., 2015; Lancaster et al., 2022; McEvoy et al., 2017; Mehta et al., 2021). It has also been proposed that the identification of genetic variants associated with risk for major depressive disorders that might be used as a polygenic risk approach to identify women at risk (Rantalainen et al., 2020).

Diverse psychosocial risk factors are associated with PND, such as life stress, lack of social support, family income, marital dissatisfaction, violence, child male gender family preference, unplanned pregnancy, previous psychopathology (the strongest predictor factor is prenatal depression), woman's occupation, being afraid or delivery, gestational diabetes, age $\geq$ 40 years, hospitalization during pregnancy woman's education level, and breastfeeding (Contreras-Carreto et al., 2022; Hutchens & Kearney, 2020; Shidhaye & Giri, 2014).

At least 10-30% of women experience this underdiagnosed complication that is more common in low-middle-income countries such as Mexico, where the prevalence is estimated at 13.9-30.7% (Contreras-Carreto et al., 2022; Santiago et al., 2023). The puerperium is the stage with the most prevalence of this disorder (60-80%; Brummelte & Galea, 2016; Krauskopf & Valenzuela, 2020; Wisner et al., 2013). Despite the availability of screening tools for detecting antenatal, the prevailing social stigma around mental health discourages women from seeking help and active treatment, leaving up to 60% without a clinical diagnosis. Among those diagnosed, less than 50% receive adequate treatment. It is reported that 25% of untreated women will develop a chronic illness, and 15% of those who do not treat their depression will attempt suicide (Bonari et al., 2004).

PND has been associated with poor birth outcomes such as low birth weight, preterm labor, preeclampsia, admission to Neonatal Intensive Care Unit, pregnancy outcome (stillborn *vs*. live birth), spontaneous abortion, long hospital stays, higher risk for cesarean section or vaginal instrumental, and lower Apgar scores (Dowse et al., 2020). Concerning the mother, it is associated with higher rates of substance use, poor attendance to antenatal clinics, more pain during labor and, therefore, a more frequent need for epidural analgesia (Bonari et al., 2004). It is also associated with reduced maternal care, such as more negative and disengaged behaviors toward children, fewer interactions with consequent delays in children's neurobiological development, infant undernutrition, and early cessation of breastfeeding (Brummelte & Galea, 2016; Rahman et al., 2016).

The above makes indispensable the constant training and actualization of the health care personnel of the first level and obstetric to identify the risk factors in early stages from preconception to prenatal (Santiago et al., 2023). However, most primary care personnel are unaware of this public health problem that needs to be considered by policymakers and directors of the centers (Navarrete et al., 2022). The estimated costs of PND are between 32300 and 94000 USD, with the higher expenditures due to reduced economic productivity, more preterm births, and increased health expenses. However, the impact is not limited to the perinatal period; it impacts even in the adulthood of children with total lifetime costs of up to 4.86 billion USD (Bauer et al., 2014; Bonari et al., 2004; Dowse et al., 2020; Luca et al., 2020). These data suggest an urgent need and cost-effectiveness for prevention, diagnostic, and treatment approaches (Bauer et al., 2022).

Bibliometric analysis is a helpful tool that allows us to know and predict the trends (past, present and future) in the research of a specific field using diverse bibliometric indicators such as authors, citations, co-citations, institutions, or words shared between articles to construct networks of publications through time (Nakagawa et al., 2019). The above allows researchers to obtain a more detailed framework to identify gaps in the topic that interests them and establish whether it made substantial contributions (Gan et al., 2022; Manoj Kumar et al., 2022). The utility of bibliometrics is not limited to the scientific field but also represents a bridge between researchers and policy decision-makers, government, and the health system (Kajikawa, 2022). In the last one, the decisions should consider diverse stakeholders such as the patients, their families, health care workers, and associations (Bowen & Zwi, 2005; Elwyn et al., 2015).

As far as we know, only one bibliometric analysis has been made on the topic (Dol et al., 2023), while just one previous bibliometric analysis on antenatal depression was found (Zhu et al., 2023); two other were identified on

postpartum depression: the first one from 2000 to 2020 (Bai et al., 2021) and the second one over a period of five years from 2017 to 2021 Wang & Shan, 2022), finally one on perinatal mental health also was identified (Ali et al., 2022). However, all of them only used one database. More important the academic panorama of the current scientific production in Mexico of the PND is unknown since no research has been made about this topic; we aimed to analyze the scientific production concerning the PND and provide a comprehensive reference for further research in Mexico through bibliometric indicators.

METHOD

Databases

The databases Scopus (Elsevier) and Web of Science (WoS; Clarivate Analytics) were employed as sources of the bibliographic data on the topic selected since it is widely accepted that numerous papers in the field of medicine can be retrieved using them (Ellegaard & Wallin, 2015). Access to the databases was provided by the National Autonomous University of Mexico. The searches were made in July 2023, we considered all the years of publication until 2023.

Search strategy

The search string was optimized with a previous search performed on the WoS database. The terms to refer to the pregnancy were combined with the word depression and Mexico until the best performance was achieved by the first and fourth authors. The following search string considering the topic was employed in WoS: (postpartum OR postnatal OR puerperal OR perinatal depression OR peripartum OR maternal OR pregnancy) AND (depression) AND (mexico). In the case of scopus the search string was: TITLE-ABS-KEY (postpartum OR postnatal OR puerperal OR perinatal AND depression OR peripartum OR maternal OR pregnancy) AND (depression) AND (mexico). The search was limited to articles to ensure a peer review process in the information obtained. Only English terms were included in the searches and from the returned documents.

Inclusion criteria

We included original articles related to the PND in Mexico retrieved in WoS and Scopus. We excluded pre-proofs, book chapters, meeting abstracts, conference presentations. The search was performed following the flow diagram established by the PRISMA statements for systematic reviews (Page et al., 2021). In the first stage, the articles were retrieved by searching in the Scopus and WoS databases with the optimized search strings (screening included title, abstract and keywords). The second stage consisted of a complete reading of the title and abstract. In the third stage the full text was read to ensure the locality of the population studied and the diagnosis of PND all of this was made manually by the first and second authors both of them work at a specialized mental health center.

Bibliometric analysis

Data from WoS was exported to Microsoft Excel and plain text to obtain the full record of bibliometric indicators for each paper by the first, third, and fourth authors. The documents generated included annual growth of publications, types of documents, languages, countries, authors, institutions, journals, citations, and funding agencies. The retrieved data was used in the free access VOSviewer program to create network visualization maps. These maps identify the strength of associations between authors, publications, their citations, keywords, institutions, and journals. The strength of the clusters was presented as Total Link Strength which is automatically given by VOSviewer upon mapping research data. The strength of the link is represented by a line, where thicker lines indicate a stronger link.

RESULTS

The search query retrieved 132 documents on perinatal depression in Mexico- related literature of which we only

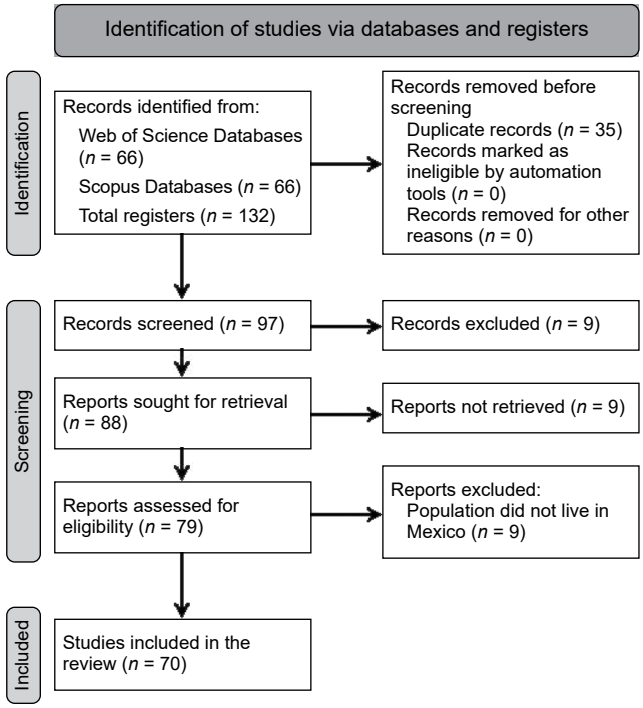

Figure 1. PRISMA flow diagram showing the search strategy and documents retrieved.

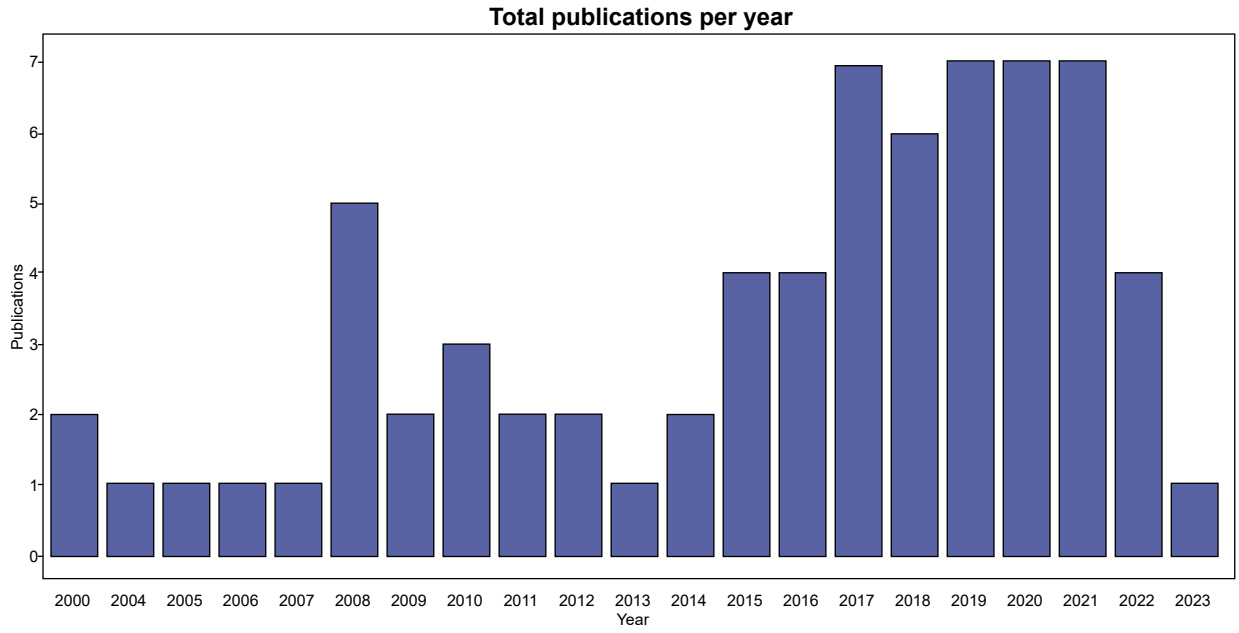

Figure 2. Total publications per year from 2000 to 2023.

used 70 articles after eliminating duplicates, added unrecovered documents in the search string, and determining that they corresponded to the theme selected for the synthesis (Figure 1).

Output and temporal publication and trends

The annual growth of publications in the PND in Mexico-related literature was low in the 2000 to 2014 period (except in 2008) but showed a step increase after 2015 (Figure 2). In recent years there has been a decrease in the study of this subject (the number of publications for the year 2023 may be underestimated due to the month in which the mapping was carried out), most of these papers are published at the journal "Salud mental" and "Archives of women's health" (eFigure 1 in Supplement 1).

Analysis of leading institutions and collaboration between countries

The six institutions who that had the greatest number of publications in the area were: National Institute of Perinatology (Mexico City, Mexico), Ramón de la Fuente Muñiz National Institute of Psychiatry (Mexico City, Mexico), and National Institute of Public Health of Mexico (Morelos, Mexico), these three institutes belong to a network of public institutions whose main objectives are to conduct scientific research and to train qualified personnel to conduct these investigations and also to act as healthcare professionals on their respective fields; it should be noted the other three were from the United States: George Washington University (Washington D.C., USA), Ball State University (Indiana, USA), and the Icahn School of Medicine at Mount Sinai (New York, USA; Figure

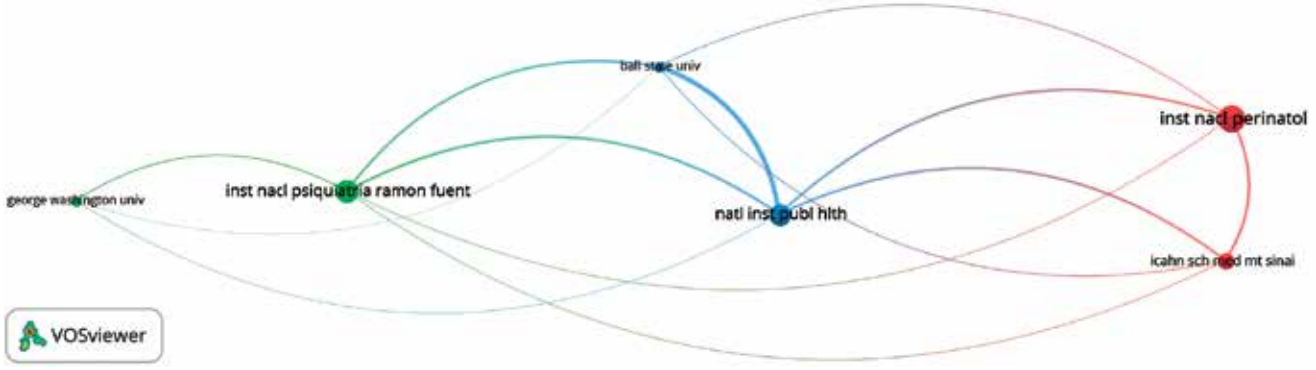

Figure 3. Institutions with the largest number of publications on perinatal depression in Mexico-related literature.

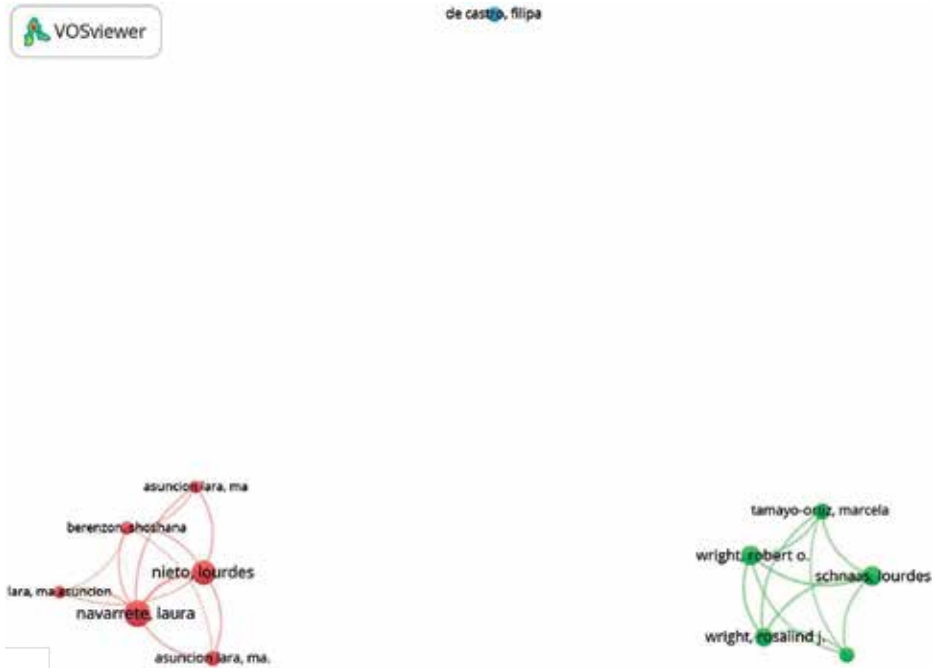

Figure 4. Authors with the largest number of publications linked to the study on perinatal depression in Mexico-related literature.

3); the countries who tend to collaborate more are Mexico and USA, however there exists collaboration with Spain and England (eFigure 2 in Supplement 1).

Analysis of authors and co-citation

The two authors with the most work in the area were Navarrete L., and Asunción Lara M. (Figure 4), within these authors, collaborations have been established with other researchers such as Nieto L., and Berenzon S.; all of them being part of a first collaboration group localized in Mexico. The second group in turn is characterized by Wright R., Schnaas L., Tellez R., and Tamayo-Ortiz M.; all of them located at the United States, with low collaboration between this groups, that is not visualized through the bibliometric mapping, when co-citation is considered this two groups are still well differentiated, but links between them are noticeable (eFigure 3 in Supplement 1).

Analysis of keywords

Mapping the most frequent terms in title/abstract fields of documents in the PND in Mexico-related literature gave 29 terms distributed in four clusters representing the main research themes (Figure 5). The first cluster (red) included keywords related to PND: risk factors, Mexico, health, stress, maternal depression, and PND predictors. The second cluster (blue and purple) included terms related to pregnancy: depression, mental health, anxiety, exposure, women risk, mental disorder, predictors, mental disorders, intervention, and risk factors. The third cluster (purple) included words that alluded PND and symptoms: risk, mental disorder, predictors, mental disorders, intervention, and risk factors. The fourth cluster (green) included terms related to: mothers, mental health, scale, outcomes, disorders, social support, and prenatal depression.

DISCUSSION AND CONCLUSION

This study aimed to analyze the scientific production through bibliometric indicators in the PND and provide a comprehensive reference for further research in Mexico. According to the Health and Nutrition National Survey (ENSANUT), from 2018 to 2019, 17.9% of the population met the criteria for moderate to severe depression being more common in women (1.8 times) and 19.9% more common in the urban areas of Mexico (Shamah-Levy et al., 2020). The numbers increase if it is considered PND, a mood disorder developed at any stage during the pregnancy and postpartum period (twelve months after delivery; Bennett et al., 2004). The symptoms of this disease are desperation, sadness, change in sleep and eating habits, decreased libido, irritability, diminished interest, isolation, thoughts of hurting oneself or the infant, or even suicidal thoughts (Galea & Frokjaer, 2019; Wang et al., 2021).

PND is a common and severe mental health problem associated with several consequences for the number of publications in Mexico from 2000 to 2014. The annual growth

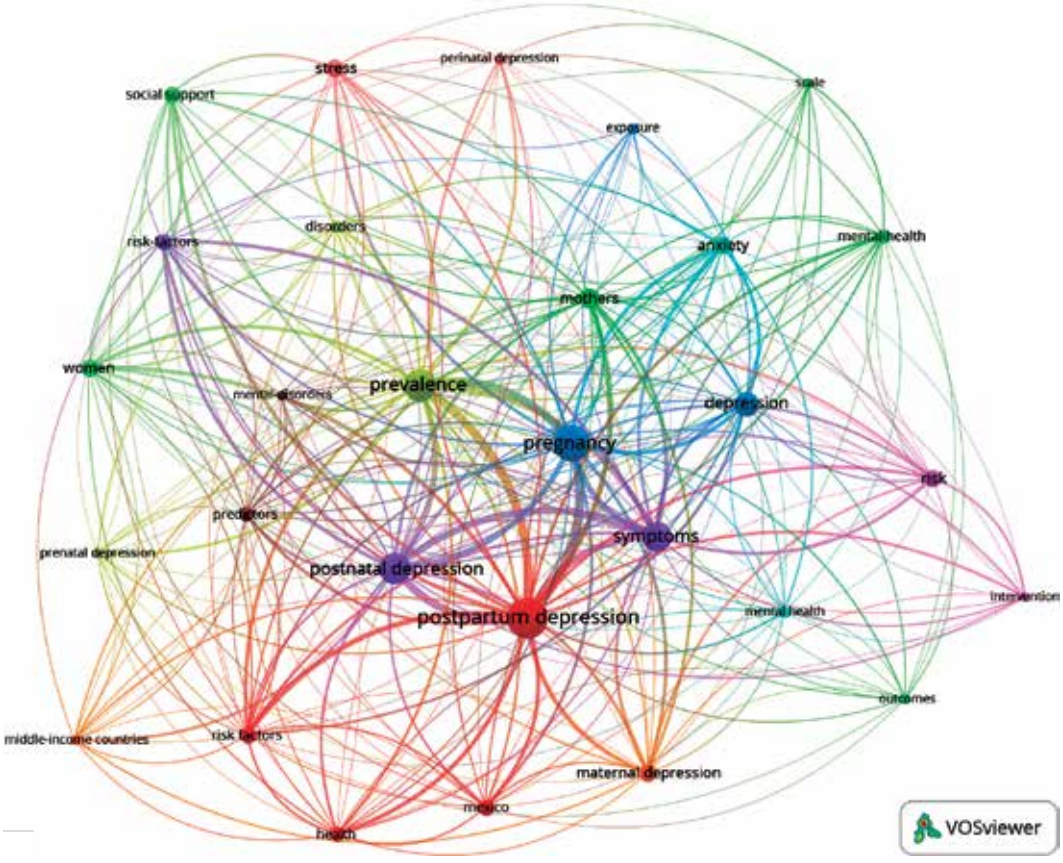

Figure 5. Terms most used in the reviewed studies depending on their occurrence in different citations.

of publications was low and increased after 2015; however, since 2022, the number of publications has decreased, which could be partly explained by a reduction in Gross domestic Expenditure in Research and experimental Development (GERD) passing from 5.80 billion USD in 2011 to 4.06 billion USD in 2022. The latter being the lowest in the last ten years, with government investment being the most important source of income: 76.7% of the investment came from government funds, 18.2% from private funds and, 5.1 from others (higher education institutions and non-profit organizations), but also the one with the most notable decrease (CONACYT, 2021). All of these might be explained in part by a new development model with a focus on social programmes and a gradual reduction to the sectoral funds programme; for example, in 2019 and 2020, the Humanities Sciences and Technologies National Council (CONAHCYT) did not issue any calls for project proposals meaning that only projects that received funding in previous years remain operational; due the reduction in GDP, funding by shift to social programs and COVID-19 response impact on projects (CONACYT, 2021; Schneegans et al., 2021). Another possible explanation could be that while institutions or universities conduct research on PND, they might not publish in indexed journals. It requires researchers to increase their presence in these journals and keep in mind the gray literature to encompass more relevant studies and present a comprehensive view of evidence. However, there's limited information on search methods (Mahood et al., 2014).

According to the analysis of publishing institutions, only three of the six institutions with the most publications in the area were from Mexico. The other resides in the United States, which might reflect the fact that there is a lack of perinatal mental health research (particularly in low- and middle-income countries such as Mexico) and policies (Dol et al., 2023). We believe the reason is the higher priority given to preventing pregnancy-related deaths (Fisher et al., 2012). In addition, the three most important research institutions on PND reside in Mexico City, where the majority of human resources in science and technology are centralized (CONACYT, 2021). In Mexico, 34.26% of the economically active population works in research and development (R&D), with Mexico City hosting the highest proportion of economically active individuals participating in R&D activities (55%; CONACYT, 2021; Schneegans et al., 2021). Research topics and publication numbers often mirror a country's awareness of prevalent issues. Therefore, it's reasonable to find that healthcare personnel are attentive to or prepared to detect and treat PND (Navarrete et

al., 2022). Mexico and the United States demonstrate a predominant tendency for collaboration, possibly attributed to their geographical proximity, Nonetheless, it is imperative to capitalize on these collaborative efforts to optimize the utilization of available resources.

The two most prolific authors in this field were Navarrete L., and Asunción Lara M. They often collaborate, being part of the same institution alongside Nieto L., and Berenzon S. Notably, their collaboration is limited with the group from the USA, represented by Wright R., Schnaas L., Tellez R., and Tamayo-Ortiz M. Enhancing collaboration among authors and institutions is crucial for fortifying resources and optimizing efforts toward a better understanding of PND in Mexico. The absence of new researcher groups persists despite a substantial rise in the pool of R&D human resources (from 11.2 million in 2016 to 18.5 million in 2020; CONACYT, 2021), with many of them possibly unemployed or involved in non-R&D pursuits. There is a scarcity of jobs, with a minimal increase from 6.2 million in 2016 to 6.7 million in 2020 (CONACYT, 2021; Schneegans et al., 2021) accompanied by a lack of resources to tap into the potential of innovative minds. This situation risks a 'brain drain' phenomenon, impeding Mexico's development (Arroyo & Castañeda, 2016).

The first cluster focused on identifying PND risk factors in Mexico. It's crucial for policymakers and healthcare professionals to note that depression is more prevalent in urban settings. Despite various proposed neurobiological mechanisms, most risk factors point to psychosocial factors (Contreras-Carreto et al., 2022; Hutchens & Kearney, 2020; Shidhaye & Giri, 2014), meaning the need for research and policies to address these social determinants of health. Doing so can mitigate disparities in health outcomes, making them viable targets for policy interventions (WHO, n.d.).

The second research cluster focused on predictors, interventions, and related risk factors. Maternal and child care standards include PND, with recommendations at first and second-level health facilities to consult a mental health professional. However, the Edinburgh Postnatal Depression Scale (EPDS), validated in Mexico, indicates a total score of > 10 points as depressive illness risk (75% sensitivity and 93% specificity). Upon identification, women must submit to diagnoses and begin psychoeducation and psychotherapy (such as cognitive-behavioral or interpersonal therapy). If deemed insufficient, it suggests a pharmacological approach (Curry et al., 2019; Genchi-Gallardo et al., 2021; Secretaría de Salud, 2021; Santiago et al., 2023; SSA, 2016).

The third group emphasizes birth outcomes and social support. Acknowledging that PND heightens the risk of adverse maternal and infant outcomes beyond the perinatal period, these repercussions span beyond mortality, impacting society significantly (Bauer et al., 2014; Bonari et al., 2004; Dowse et al., 2020; Luca et al., 2020). The inherent bias within published literature introduces complexity in assessing their genuine influence, given that the volume of articles does not consistently correspond to their dissemination. This discrepancy may lead to an underestimation of the impact associated with PND.

The scarcity of studies on the neurobiology of PND highlights the field's potential for development in Mexico. Despite an 11% increase in publications within "Psychiatry and Psychology" since 2019, these contributions represent merely 1.44% of Mexico's overall scholarly output. These call on government, universities, and society to be more aware of mental health and the importance of research and policy (CONACYT, 2021), and particularly in the PND, it may be due to inadequate collaboration between health institutes.

Our study marks the first bibliometric analysis of PND scientific production in Mexico, conducting a comprehensive survey for quantitative and qualitative analysis of publications. However, limitations include a relatively small article count and the potential underestimation of 2023 publications due to the timing of data compilation. The exclusive reliance on WoS and Scopus led to the omission of 'gray literature,' potentially excluding publications from academic institutions and certain hospitals, thereby introducing a bias into the analysis. Future research should consider exploring this unaccounted literature for more comprehensive insights.

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Conflict of interest

The authors declare they have no conflicts of interest.

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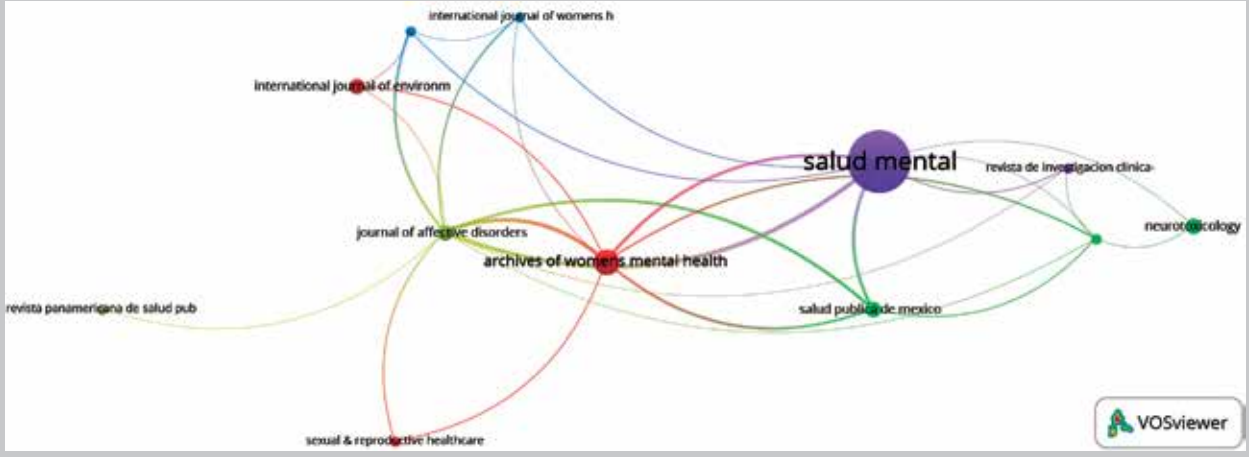
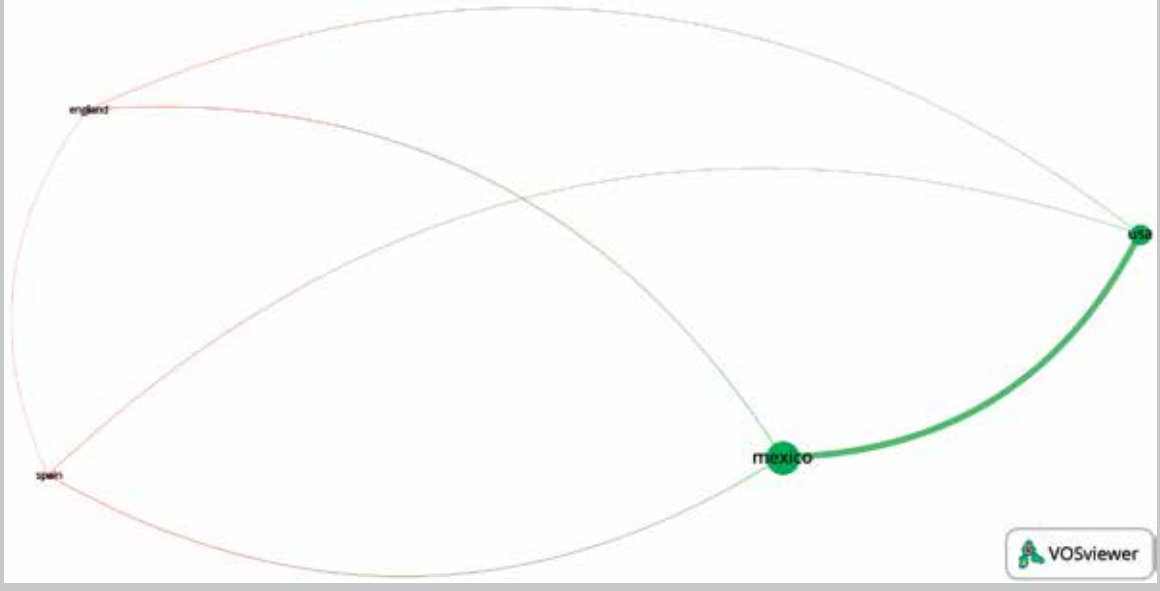
Supplement 1

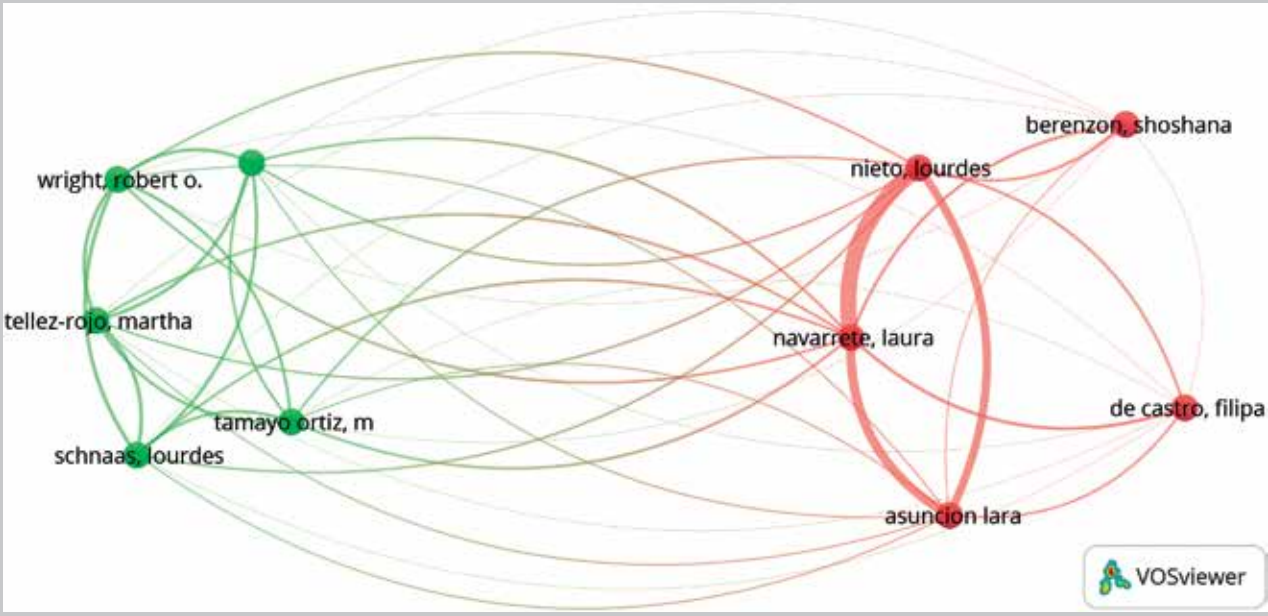


eFigure 1. Network map journals.



eFigure 2. Network map of co-autorship between countries with the more publications.

Supplement 1 (continued)



eFigure 3. Network map of co-citation analysis of references.

GUÍA PARA LOS AUTORES

La revista Salud Mental publica artículos originales sobre psiquiatría, psicología, neurociencias y disciplinas afines de acuerdo con los siguientes formatos:

1. **Editoriales**
   Se escriben por invitación del Director-Editor de la revista. Deben expresar opiniones autorizadas sobre temas específicos de interés para la comunidad científica y para el área de la salud mental. Su objetivo es estimular el debate y promover nuevas líneas de investigación. *Extensión máxima: 1000 palabras*.
2. **Artículos originales (sección revisada por pares)**
   Presentan resultados de investigaciones no publicados en otras revistas. Pueden desarrollarse a partir de las siguientes metodologías:
   - **Metodología cuantitativa:** Incluye resultados primarios y secundarios de estudios transversales, ensayos clínicos, casos y controles, cohortes y estudios cuasi experimentales. *Extensión máxima: 3500 palabras*.
     De acuerdo con el tipo de estudio, los manuscritos deben cumplir con las guías:
     • Los ensayos clínicos aleatorizados deben adecuarse a las guías *CONSORT* (http://www.consort-statement.org).
     • Los estudios con diseños no experimentales, a las guías *TREND* (http://www.trend-statement.org).
     • Los estudios transversales, de cohorte, y de casos y controles, a la guía *STROBE* (http://www.strobe-statement.org).
   - **Metodología cualitativa:** Incluye reportes de grupos focales, entrevistas a profundidad, redes semánticas y análisis de contenido. *Extensión máxima: 5000 palabras*.
     Deben cumplir con la guía *COREQ* (https://academic.oup.com/intqhc/article/19/6/349/1791966/Consolidated-criteria-for-reporting-qualitative).
3. **Artículos de revisión (sección revisada por pares)**
   - **Revisiones narrativas:** Comprenden revisiones narrativas basadas en la bibliografía nacional e internacional, (Máximo 50, todas ellas de reciente publicación). *Extensión máxima: 5000 palabras.*
   - **Revisiones sistemáticas:** Preferentemente deben incluir un metaanálisis. *Extensión máxima: 4000 palabras*.
4. **Casos clínicos (sección revisada por pares)**
   Incluye reportes de efectos de un método diagnóstico o terapéutico que sea útil o relevante en el ámbito médico, académico o científico. *Extensión máxima: 2000 palabras.*
   Deben cumplir con la guía *CASE REPORT* (https://www.care-statement.org/checklist)

*Nota***:** El conteo de palabras para cada una de estas secciones excluye el título, los resúmenes y las palabras clave, así como los apartados de financiamiento, conflictos de interés y agradecimientos; tampoco se consideran las palabras incluidas en tablas, figuras y referencias.

IDIOMAS
Salud Mental recibe y publica únicamente manuscritos en inglés.

ASPECTOS ÉTICOS EN LA PUBLICACIÓN
Vea los Lineamientos éticos en el sitio web de Salud Mental (www.revistasaludmental.mx).

AUTORÍA
El número de autores dependerá del tipo de manuscrito enviado. Para artículos originales y artículos de revisión el número máximo de autores será de ocho. Solo cuando se trate de estudios multicéntricos el número máximo de autores será de doce, siempre y cuando se justifique de acuerdo con el alcance del estudio.

En caso de autoría colectiva, se incluirá el nombre de los redactores o responsables del trabajo seguido de «*y el grupo...» c*uando todos los miembros del grupo se consideren coautores del trabajo. Si se desea incluir el nombre del grupo, aunque no todos sus miembros sean considerados coautores, se mencionarán a los autores responsables seguido de *«en nombre del grupo...»* o *«por el grupo...»*. En cualquier caso, los nombres e instituciones de los miembros del grupo se incluirán en un anexo al final del manuscrito.

LINEAMIENTOS EDITORIALES
Es muy importante que los autores consideren los siguientes puntos antes de enviar sus manuscritos:

1. Los manuscritos deben redactarse de forma clara y concisa, sin errores de ortografía ni de sintaxis.
2. El texto debe estar escrito en formato Word, en fuente Times New Roman de 12 puntos, a doble espacio, con márgenes de 2.5 cm. y en tamaño carta.
3. Las páginas se numeran consecutivamente, empezando por la página del título y con el número escrito en la esquina superior derecha.
4. La primera página (donde se encuentra el título) debe contener los siguientes apartados en el orden que aquí se menciona:
   - **Título del trabajo en español y en inglés.** El título debe ser descriptivo e indicar los resultados principales del estudio. *Extensión máxima: 25 palabras*
   - **Título corto en español y en inglés.** *Extensión máxima: 6 palabras*.
   - **Nombre completo del autor y de los coautores.** Los autores deberán colocarse en listado; luego, en superíndice, deberá colocarse un número arábigo que indique la institución de adscripción.
   - **Número ORCID de los autores.** Es requisito que cada uno de los autores cuente con su número de identificación ORCID, el cual se puede conseguir en https://orcid.org/register
   - **Adscripción de los autores.** Se debe indicar con números arábigos y en superíndice. Las adscripciones se colocan inmediatamente después de los nombres de los autores (no como notas en pie de página). Es necesario que la adscripción especifique: departamento, área, institución, ciudad y país de cada autor. No es necesario indicar la dirección postal. Las instituciones deben escribirse en su idioma original, sin traducción. Si los autores añaden siglas, éstas deben pertenecer al nombre oficial. No se deben escribir cargos ni grados de los autores (doctor, residente, investigador, etc.).

     Ejemplo:
     Juan José García-Urbina,[1]
     Héctor Valentín Esquivias Zavala[2]

[1] Dirección de Investigaciones Epidemiológicas y Psicosociales, Instituto Nacional de Psiquiatría Ramón de la Fuente Muñiz, Ciudad de México, México.
[2] Departamento de Publicaciones, Instituto Nacional de Psiquiatría Ramón de la Fuente Muñiz, Ciudad de México, México.

- Al final de la primera página, en el apartado ***"Correspondencia"***, se proporcionarán los datos de contacto del autor corresponsal (dirección postal completa, teléfono, correo electrónico). Es con quien Salud Mental se comunicará durante todo el proceso editorial.

  Ejemplo:

  Correspondencia:
  Juan José García-Urbina
  Dirección de Investigaciones Epidemiológicas y Psicosociales, Instituto Nacional de Psiquiatría Ramón de la Fuente Muñiz.
  Calz. México-Xochimilco 101, San Lorenzo Huipulco, Tlalpan, 14370, Ciudad de México, México.
  Tel: 55 4152-3624
  E-mail: jurb@imp.edu.mx

5. La segunda página debe contener los resúmenes del trabajo presentado en inglés y español. *Extensión máxima: 250 palabras.*

- ***Artículos originales y Revisiones sistemáticas.*** Los resúmenes deben estar conformados por: Introducción, Objetivo, Método, Resultados y Discusión y conclusión.
- ***Revisiones narrativas.*** La estructura del resumen es la siguiente: Antecedentes, Objetivo, Método (bases de datos consultadas), Resultados y Discusión y conclusión.
- ***Casos Clínicos.*** Los resúmenes deben estar conformados por: Introducción, Objetivo, Principales hallazgos, Intervenciones y resultados y Discusión y conclusión.
- ***Palabras clave.*** Al final de cada resumen se incluirá un mínimo de cuatro y un máximo de seis palabras clave, separadas por comas y en minúsculas. Las palabras clave deben ser las mismas en inglés y en español. Éstas suelen emplearse para la indexación de los artículos, por lo cual tres de ellas deben encontrarse en el MeSH (*Medical Subject Headings*) que se puede consultar en: *http://www.nlm.nih.gov/mesh/MBrowser.html*.

6. A partir de la tercera página comienza el cuerpo del manuscrito, el cual deberá conservar la estructura señalada en el resumen.

- ***Introducción (o Antecedentes en el caso de las Revisiones narrativas).*** El último párrafo de este apartado debe incluir de forma clara los objetivos del trabajo y, si se cree necesario, las hipótesis.
- ***Método.*** Es preciso que cuente con las siguientes secciones:
  - Diseño del estudio
  - Participantes/descripción de la muestra
  - Sedes
  - Mediciones
  - Procedimientos
  - Análisis estadísticos
  - Lineamientos éticos.

Nota: En caso de los artículos de revisión y casos clínicos, estas secciones pueden ser modificadas de acuerdo con la guía PRISMA (revisiones sistemáticas o la guía CASE REPORT (casos clínicos).

- **Resultados.** Se presentarán en una secuencia lógica dentro del texto. Pueden apoyarse con tablas, gráficas y figuras.
- **Discusión y conclusión.** En esta sección se destacarán los aspectos nuevos e importantes del estudio y las conclusiones que derivan del mismo, así como las posibles implicaciones de sus hallazgos y sus limitaciones.

7. Después del apartado de Discusión y conclusión, es preciso agregar las declaraciones de los autores en el siguiente orden:

- ***Financiamiento.*** En este apartado se debe declarar si el estudio o la preparación del manuscrito recibió algún tipo de financiamiento, indicando el nombre de la entidad que proporcionó los fondos.

  Ejemplo:

  Este estudio fue financiado en parte por el CONSEJO NACIONAL DE CIENCIA Y TECNOLOGÍA. (No. XXXXXXX).

  Si no se recibió ningún apoyo financiero, los autores deben declararlo también.

  Ejemplo:

  Ninguno.

- ***Conflicto de intereses.*** En esta sección, los autores deberán declarar si tienen conflictos de intereses relacionados con su actividad científica. Tener un conflicto de interés no supone necesariamente un impedimento para la publicación del manuscrito. Si no existe conflicto de interés se debe insertar la siguiente frase: *"Los autores declaran no tener algún conflicto de intereses"*.
- ***Agradecimientos.*** Cuando se considere necesario, se mencionarán después de las declaraciones anteriores los agradecimientos a personas, centros o entidades que hayan colaborado o apoyado en la investigación.

8. Referencias. Las referencias se colocan después de las declaraciones del autor (Financiamiento, Conflicto de intereses y Agradecimientos), y ***deben seguir exclusivamente las normas de publicación de la American Psychological Association (APA), en su última edición*** (https://normas-apa.org).

9. Tablas y figuras. Salud Mental establece un máximo de cinco elementos gráficos en total. ***El estándar solicitado para la elaboración de tablas y figuras es el de la American Psychological Association (APA), última edición*** (https://normas-apa.org)***.*** Éstas se colocarán al finaldel manuscrito después de las referencias:

- Las tablas deben contener título y, en la parte inferior, una nota con el desglose de las siglas.
- Las figuras deben enviarse en un formato de alta resolución (mínimo 300 dpi).
- Los títulos de las tablas y los pies de las figuras deben ser claros, breves y llevar siempre el número correspondiente que los identifique. Dentro del texto, el autor debe indicar entre paréntesis y con mayúsculas en qué parte del texto sugiere insertar los elementos gráficos.

  Ejemplo:

  Se cambiaron las definiciones de algunos patrones conductuales (Tabla 3) de manera que fueran más comprensibles en el idioma español y se redefinieron las categorías que agrupan dichos patrones con base en la literatura especializada. (INSERTAR AQUÍ TABLA 3)

ARCHIVOS COMPLEMENTARIOS

1. ***Carta de autorización de uso de la obra*.** Debe estar firmada por todos los autores y enviarse en formato PDF que se puede descargar en http://revistasaludmental.mx/public/Carta-autorizacion-para-publicacion.pdf.
2. ***Carta de presentación.*** El autor debe exponer las fortalezas de su aportación científica, resaltando el alcance, la originalidad y la importancia de su contribución al campo de la salud mental. Debe cargarse en formato PDF.

ÉNFASIS Y PUNTUACIÓN

1. Es importante que los manuscritos eviten en general las notas a pie de página, aunque se pueden considerar si son claramente necesarias.
2. Las cursivas deben utilizarse para:
   - Destacar palabras extranjeras.
   - Enfatizar expresiones populares.
   - Mencionar títulos de libros, documentos ya publicados y publicaciones periódicas.
3. Las cursivas pueden emplearse para:
   - Resaltar términos significativos o importantes cuando se mencionan por primera vez.
   - Destacar una palabra u oración dentro de una cita.
4. Las comillas dobles deben usarse solamente para:
   - Citar párrafos de otros autores dentro del texto.
   - Citar textualmente fragmentos del discurso de los sujetos de estudio.
5. Evite el uso de paréntesis doble, es decir, un paréntesis dentro de otro. En su lugar utilice corchetes.
6. Puede emplearse guiones largos para indicar oraciones parentéticas.
7. Deben utilizarse de forma correcta todos los signos de puntuación. Por ejemplo, si emplea signos de interrogación en un texto en español, deben colocarse los de apertura y cierre correspondientes; se procede de igual manera con las comillas.

FÓRMULAS MATEMÁTICAS Y ESTADÍSTICAS

Para presentar los resultados se deben considerar las siguientes indicaciones:

1. Escribir con letra las cifras de cero a nueve y con números las cifras de 10 en adelante.
2. Utilizar números cuando se trate de fechas, muestras, etcétera.
3. Incluir en los datos estadísticos los intervalos de confianza.
4. Los símbolos estadísticos se escriben en cursivas (por ejemplo, *M, SD, n, p)*.
5. Expresar la probabilidad exacta con dos o tres decimales (por ejemplo, p = .04; p = .002) sin el cero adelante del punto decimal. En caso de ser menor a .001 indicarlo con un < .001.
6. Dejar un espacio antes y después de cada signo (a + b = c en lugar de a+b=c).
7. Emplear puntos en lugar de comas para indicar decimales.

VERIFIQUE LO SIGUIENTE ANTES DE SOMETER SU MANUSCRITO

Antes de enviar su manuscrito, cerciórese de adjuntar la documentación solicitada. A los autores, se les devolverá aquellos envíos que no cumplan con los lineamientos editoriales.

1. Manuscrito en formato en WORD.
2. Carta de presentación en formato PDF.
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Salud Mental publishes original articles on psychiatry, psychology, neurosciences and other related fields in the following formats:

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   Written at invitation of the Director Editor, editorials express authoritative opinions on specific topics of interest to the scientific community and the area of mental health. They are designed to foster debate and promote new lines of research. *Maximum extension: 1000 words*.
2. **Original articles (peer-reviewed section)**
   These articles present research results unpublished in other journals, and can be written using the following methodologies:
   - *Quantitative methodology.* This methodology includes primary and secondary results from cross-sectional studies, clinical trials, cases and controls, cohorts, and quasi-experimental studies. *Maximum extension: 3500 words*.
     Depending on the type of study, manuscripts should adhere to the following guidelines:
     - Randomized clinical trials should adhere to the *CONSORT guidelines* (http://www.consort-statement.org).
     - Studies with non-experimental designs should adhere to the *TREND guidelines* (http://www.trend-statement.org).
     - Cross-sectional, cohort, and case-control studies should adhere to the *STROBE guidelines* (http://www.strobe-statement.org).
   - *Qualitative methodology.* This methodology includes focus group reports, in-depth interviews, semantic networks, and content analysis. *Maximum extension: 5000 words*.
     Articles using this type of methodology should comply with the *COREQ guidelines* (https://academic.oup.com/intqhc/article/19/6/349/1791966/Consolidated-criteria-for-reporting-qualitative).
3. **Review articles (peer-reviewed section)**
   - **Narrative reviews.** Reviews based on recently published national and international bibliography (no more of 50 references reviewed). *Maximum extension: 5000 words.*
   - **Systematic reviews.** These reviews should preferably include a meta-analysis. *Maximum extension: 4000 words*.
4. **Case reports**
   They include reports on the effects of a diagnostic or therapeutic method that is useful or relevant in the medical, academic, or scientific field. *Maximum length: 2000 words.*
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Note. The word count for each of these sections excludes the title, abstracts, and keywords, as well as the funding, conflicts of interest and acknowledgments sections. Words included in tables, figures and references are not considered either.

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Salud Mental receives and publishes only manuscripts in English.

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The number of authors will depend on the type of manuscript submitted. The maximum number of authors for original or review articles is eight. Only in the case of multicenter studies will the maximum number of authors be increased to twelve, provided this is justified by the scope of the study.

In the event of collective authorship, the name of the editors or those responsible for the article will be included followed by “and the group...” when all members of the group consider themselves co-authors of the work. If the name of the group is to be included, even if not all its members are considered co-authors, the authors responsible will be mentioned followed by “on behalf of the ...group or “by the...group.” In any case, the names and institutions to which members of the group are affiliated should be included in an appendix at the end of the manuscript.

EDITORIAL GUIDELINES

It is of the utmost importance for authors to consider the following before sending their manuscript:

1. Manuscripts should be written clearly and concisely, with no spelling or grammatical errors.
2. The text should be written in Word format, Times New Roman font, size 12, with double-spacing and 2.5 cm margins on letter size sheets.
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4. The first page (showing the title) should contain the following sections in the order mentioned here:
   - *Title of article in Spanish and English*. The title should be descriptive and indicate the main results of the study. *Maximum extension: 25 words.*
   - *Short title in Spanish and English*. *Maximum extension: 6 words.*
   - *Full name of author and co-authors*. The authors must be listed and then an Arabic number must be placed in superscript, indicating the institution to which they are affiliated.
   - *Author ORCID number.* It is a requirement that all authors have their ORCID identification number, which can be obtained at https://orcid.org/register
   - *Author affiliation*. This should be indicated with Arabic numerals and in superscript. Affiliations should be placed immediately after authors’ names (not as footnotes). Affiliations should specify the department, area, institution, city, and country of each author. It is not necessary to indicate the postal address. Institutions must be written in their original language, without translation. If the authors add acronyms, these must be included in the official name. No positions or degrees of the authors (such as doctor, resident, or researcher) should be written.

   . For example:
   Juan José García-Urbina,[1] Héctor Valentín Esquivias Zavala[2]

[1] Dirección de Investigaciones Epidemiológicas y Psicosociales, Instituto Nacional de Psiquiatría Ramón de la Fuente Muñiz, Ciudad de México, México.
[2] Departamento de Publicaciones, Instituto Nacional de Psiquiatría Ramón de la Fuente Muñiz, Ciudad de México, México.

- The **"Correspondence"** section should be placed at the end of the first page, indicating the corresponding author with their postal address, phone and email address. This will be the only author Salud Mental will contact during the process.

  For example:

  Correspondence:
  Juan José García-Urbina
  Dirección de Investigaciones Epidemiológicas y Psicosociales, Instituto Nacional de Psiquiatría Ramón de la Fuente Muñiz.
  Calz. México-Xochimilco 101, San Lorenzo Huipulco, Tlalpan, 14370, Ciudad de México, México.
  Phone: 55 4152-3624
  E-mail: jurb@imp.edu.mx

5. The second page should contain abstracts of the article in English and Spanish. Each abstract should contain a maximum of 250 words.
   - **Abstracts of original articles and systematic reviews** should comprise the following: Introduction, Objective, Method, Results, and Discussion and Conclusion.
   - **In the case of Narrative Reviews**, the structure of the abstract should be as follows: Background, Objective, Method (databases consulted), Results, and Discussion and Conclusion.
   - **Abstracts of Clinical Cases** should comprise Introduction, Objective, Main findings, Interventions, Results, and Discussion and Conclusion.
   - **Keywords.** At the end of each abstract, a minimum of four and a maximum of six keywords should be included, separated by commas and in lower case. Keywords must be the same in English and Spanish. These are used for indexing articles, which is why three of them must be found in the *MeSH (Medical Subject Headings)* (http://www.nlm.nih.gov/mesh/MBrowser.html).
6. The body of the manuscript begins on the third page, which should follow the structure indicated in the abstract:
   - **Introduction (or Background for Narrative Reviews)**. The last paragraph of this section should clearly include the objectives of the review and, if necessary, the hypotheses.
   - **Method.** This should contain the following sections:
     - Study design
     - Subjects/sample description
     - Sites
     - Measurements
     - Procedure
     - Statistical analysis
     - Ethical considerations (See ethical guidelines for publication. Add link)

     In the case of review articles and clinical cases, these sections may be modified in keeping with the PRISMA guideline (systematic reviews) or the CASE REPORT guideline (clinical cases).
   - **Results.** These should be presented in a logical sequence within the text. They can be supported with tables, graphs, and figures.
   - **Discussion and Conclusion**. This section will highlight new and relevant aspects of the study and the conclusions derived from it, as well as the possible implications of its findings and its limitations.
7. After the Discussion and Conclusion section, author statements should be added in the following order:
   - **Funding**. In this section, authors should declare whether the study or the preparation of the manuscript received any type of funding, indicating the name of the entity that provided the funds.

     For example:

     This study was partially funded by CONSEJO NACIONAL DE CIENCIA Y TECNOLOGÍA (No. XXXXXXX).

     If no financial support was received, authors must state it was well.

     For example:

     None.
   - **Conflict of interest.** In this section, authors must declare whether they have conflicts of interest related to their scientific activity. Having a conflict of interest will not necessarily prevent publication of the manuscript. If there is no conflict of interest, the following phrase must be inserted: "The authors declare that they have no conflicts of interest."
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8. **References.** Are placed after the authors' declarations (Funding, Conflicts of interest, and Acknowledgements), and must adhere to the ***Publication Guidelines of the American Psychological Association (APA), last edition*** (https://normas-apa.org).
9. **Tables and figures.** *Salud Mental* establishes a maximum total of five graphic elements. The standard requested for tables and figures adheres to the ***Guidelines of the American Psychological Association (APA), last edition*** (https://normas-apa.org). These will be placed in the same document as the manuscript after the references.
   - Tables must contain a title and a note with an explanation of the acronyms used at the bottom.
   - Figures must be submitted in a high resolution format (minimum image size 300 dpi).
   - Titles of the tables and figure captions must be clear, brief, and always have an identifying number. Within the text, the author must indicate in parentheses and capital letters where the graphic elements should be inserted.

     For example:

     The definition of some behavioral patterns was changed (Table 3) so that they were more comprehensible in Spanish and the categories that group such patterns were redefined based on specialized literature.
     (INSERT TABLE 3 HERE)

COMPLEMENTARY FILES

1. **Authorization letter for Publication**. This should be signed by all the authors and submitted in PDF format.

Download the form at http://revistasaludmental.mx/public/Authorization-letter-for-publication.pdf.

2. **Cover letter**. The author should describe the strengths of their scientific contribution, highlighting the scope, originality, and importance of their contribution to the field of mental health. This must be uploaded in PDF.

EMPHASIS AND PUNCTUATION

1. Manuscripts should generally avoid footnotes, although they may be considered if essential.
2. Italics should be used to:
   - Highlight foreign words
   - Emphasize popular expressions
   - Mention titles of books, published documents and periodicals
3. Italics can be used to:
   - Highlight significant or important terms when they are first mentioned
   - Highlight a word or sentence within a quote
4. Double quotes should only be used for:
   - Citing paragraphs from other authors within the text
   - Quoting verbatim fragments of the study subjects' words
5. Avoid using double parentheses, in other words, one parenthesis inside another, and use square brackets instead.
6. Long dashes can be used to indicate parenthetical sentences.
7. All punctuation marks must be used correctly. For example, if question marks are used in a Spanish text, the corresponding opening and closing signs must be included together with quotation marks.

MATHEMATICAL AND STATISTICAL FORMULAE

The following points must be considered when results are presented:

1. Write figures from zero to nine in letters and use numbers for figures from 10 onwards.
2. Use numbers with dates and samples, etc.
3. Include confidence intervals in statistical data.
4. Statistical symbols are written in italics (M, SD).
5. Express exact probability to two or three decimal places (for example, p = 0.04; p = 0.002), *with no zero in front of the decimal point.* If it is less than .001, it should be written as follows < 0.001.
6. Leave a space before and after each sign (a + b = c instead of a+b=c).
7. Use periods instead of commas to indicate decimals.

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