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EDITORIAL

When biosafety fails: common errors in research protocols and biomedical articles

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Biosafety has evolved from a concept focused on the containment of highly pathogenic agents to become a comprehensive approach that encompasses risk prevention at all levels of biomedical research[1,2]. Its relevance extends beyond high-containment laboratories, reaching clinical studies, translational research, and even analyses based on minimally invasive biological samples. However, in academic and scientific practice, the biosafety section in research protocols and published articles often presents omissions and errors that debilitate both the reproducibility of the studies and the safety of the individuals involved.

In numerous protocols, it is observed that biosafety is limited to a generic paragraph or, in the worst case, to the answer "does not apply". This practice reduces biosafety to an administrative procedure, ignoring the fact that it constitutes a pillar of responsible research. It is also common to encounter protocols in which the biosafety section is dedicated exclusively to ethical aspects, such as informed consent or data confidentiality. Although essential, they fall within the domain of bioethics, not biosafety. This confusion reflects an incomplete understanding and can make technical and environmental risks invisible.

Biosecurity is usually associated only with highly hazardous agents. However, microorganisms such as *Helicobacter pylori*, *Candida albicans*, or even immortalized cell lines imply risks that must be recognized and managed with appropriate containment measures[3,4].

Protocols often do not contain procedures for emergencies such as spills, sudden injuries, or failures in biosafety equipment. This omission compromises emergency response and reflects deficiencies in risk management. Biohazardous waste or hazardous biological-infectious waste (HBIW, RBPI in Spanish) management is another weak point in protocols and publications. The absence of details on transport, disinfection, segregation, and final disposal of materials compromises occupational and environmental safety[5].

Many protocols or articles ambiguously mention that "international biosafety regulations will be followed or were followed," without specifying which ones. This ambiguity makes it impossible to assess the relevance of the actions implemented. Rigor requires citing specific guidelines from the World Health Organization, Centers for Disease Control and Prevention, National Institutes of Health, or local regulations, such as the Official Mexican Norm (NOM-087-SEMARNAT-SSA1-2002)[1,5,6].

The errors described above reveal a reductionist view of biosecurity. This component can no longer be treated as an accessory requirement, but as a transversal axis of biomedical research. Inadequate attention to biosafety compromises the rigor of scientific work and exposes researchers, participants, and communities to unnecessary risks. The responsibility for correcting these issues falls on researchers, institutional biosafety committees, peer reviewers, and editors of scientific journals. Just as a poor statistical analysis can invalidate a study, a vague or absent biosafety section should be considered grounds for editorial objection. Strengthening the culture of biosafety requires a structural change: including its teaching in university education, reinforcing continuous training, making local and international regulations visible, and demanding their correct integration into scientific publications. Only in this way will safe, ethical, and socially responsible biomedical science be consolidated.

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ORIGINAL ARTICLE

Factors associated with primary caregiver burnout in a tertiary care hospital: a cross-sectional study

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Abstract

Background: *Primary caregiver burnout is a complex phenomenon with physical, emotional, and social implications, especially in hospital settings.* **Objective:** *The objective is to analyze the relationship between sociodemographic and care factors and levels of burnout among primary caregivers of hospitalized patients in a tertiary care hospital in Mexico.* **Methods:** *A quantitative, cross-sectional, analytical study with a convenience sample of 180 caregivers. The Zarit burden test was used.* **Results:** *About 96.1% of the sample did not present burden, while the remainder showed moderate or severe levels. Primary caregivers with partners and a less direct bond with the patient were associated with lower burden scores ($p < 0.05$). Furthermore, the more time spent caring for their patient, the higher the burden scores.* **Conclusion:** *Primary caregiver burden in highly complex hospital settings is determined by an interaction of personal, relational, and healthcare environment factors. Systematically assessing these variables will allow for the implementation of comprehensive intervention strategies that strengthen caregiver adaptation, promote their well-being, and improve the continuity of patient care.*

Keywords: *Caregivers. Caregiver burden. Hospitals. Tertiary. Sociodemographic factors.*

Introduction

According to the World Health Organization, a primary caregiver is a person who assumes primary responsibility for the care of another person who suffers from a chronic illness or condition, generally without receiving remuneration or having specialized training[1]. This figure, often invisible within the healthcare system, plays a fundamental role in the well-being and quality of life of patients, both in the home and hospital settings.

Several studies have documented that the physical, emotional, social, and economic demands of the caregiver role can lead to a phenomenon known as caregiver burden, which is understood as the set of negative consequences that manifest as a result of the sustained effort involved in caring for another person, especially when there is insufficient social support, limited resources, or inadequate training[2-4]. Burden can be expressed objectively through the demand for care tasks, the time spent, and their interference with daily life, or subjectively through emotions of distress, worry, or psychological exhaustion[5,6]. The Zarit burden interview has been widely used since the 1980s to assess the level of burden in informal caregivers. This instrument quantifies the impact of caregiving, interpersonal burden, and self-efficacy expectations, facilitating the identification of caregivers at risk[2,7,8].

Although many studies that have addressed caregiver burden have been conducted in the home or community setting[9-17], the tertiary hospital environment represents a particularly demanding and little-explored scenario. In these hospitals, patients often suffer from complex clinical conditions that require continuous care, difficult decisions, and a high level of involvement from the caregiver, who is usually a close family

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member[18,19]. This situation can increase the burden, especially when the hospital setting does not consider the caregiver's well-being as part of the care process.

The analysis of sociodemographic factors such as sex, age, relationship type, and time spent on caregiving has proven to be relevant in understanding burden. Recent studies have reported that women have higher levels of burden[9,12,13,17], as do caregivers who dedicate more hours per day, those who have a direct filial relationship with the patient, and those who have assumed the role for long periods[6,10,12,14,17]. However, there is little evidence in the hospital setting of addressing these factors systematically.

In this sense, Callista Roy's adaptation model constitutes a relevant theoretical framework for understanding the primary caregiver's response process to stressful stimuli derived from caregiving. This model proposes that individuals, understood as adaptive systems, respond to focal, contextual, and residual stimuli; their adaptive capacity is reflected in their physical, emotional, and social well-being[20,21]. When demands exceed personal and environmental resources, an imbalance occurs that can manifest as burden. The application of this model in nursing allows for identifying needs, planning interventions, and promoting coping and self-care strategies among primary caregivers.

In this context, the present study aims to analyze the relationship between sociodemographic and care factors (such as sex, age, relationship with the patient, complexity of care, and time spent) and the level of burden among primary caregivers of patients hospitalized in a tertiary care hospital in Mexico.

Material and methods

Design

This is a quantitative, cross-sectional study with a descriptive and analytical approach. The research was conducted in a tertiary care hospital in Mexico between January and April 2025.

Population and sample

The target population consisted of primary caregivers of patients hospitalized in medical-surgical areas. The sample size was calculated using the formula for finite populations, assuming a confidence level of 95%, an expected proportion of 50% and a margin of error of 5%, and to compensate for possible losses, it was increased by 10%, resulting in a sample of 180 primary caregivers.

The sampling was stratified by clinical cluster, recruiting 60 caregivers per group. Selection was non-probabilistic and convenience based, inviting those who met the selection criteria and were available during the recruitment period to participate.

Table 1 details the classification of clinical clusters, which was based on medical specialties, the predominant type of care, and the complexity of care.

Inclusion criteria

Primary caregivers over 18 years of age who acted as the primary caregiver for the patient and who provided written informed consent were included in this study.

Measurement instrument

A structured questionnaire was applied by the research team to collect relevant information on the sociodemographic characteristics of the participants. This included variables such as age, sex, marital status, occupation, relationship to the patient, and length of time spent providing care (in years, months, and days). Occupation was classified into three categories: unpaid (homemakers, students, and unemployed); informal employment (merchants, construction workers, farmers, hairstylists, among others); and formal employment (contract jobs and professionals).

The Zarit Caregiver Burden Questionnaire was used in its validated version for the Mexican population[2]. This questionnaire consists of 22 items with Likert-type response options, ranging from 0 (never) to 4 (almost always), yielding a total score between 22 and 88 points. The cutoff points for scores are: < 47 points, no burden; 47-55 points, mild burden; and > 55 points, severe burden. The questionnaire has been reported to have high internal consistency, with a reported Cronbach's alpha of 0.92.

Statistical analysis

The data were analyzed with the IBM Statistical Package for the Social Sciences Statistics software version 30[22], R version 4.4.0[23] and RStudio version 2025.05.1 + 513[24]. Descriptive statistics were used to characterize the sample: frequencies and percentages were used for categorical variables, as well as

Table 1. Grouping of services by clinical care cluster

Cluster	Medical specialties included	Predominant type of care	Care complexity	n
1	General surgery, plastic surgery, maxillofacial surgery, angiology, ophthalmology, neurosurgery, oncology, oncologic surgery	Surgical and oncological	High/Medium	60
2	Gastroenterology, geriatrics, rheumatology, infectious disease, orthopedics, urology, toxicology	Specialized clinic (medical or surgical)	High/Medium	60
3	Internal medicine, nephrology, hematology, cardiology	Internal medicine and chronic diseases	High	60

The cluster classification was carried out based on the medical specialty of the service, the predominant nurse-patient ratio (1:5) and the type of interventions required in each area.

measures of central tendency and dispersion for quantitative variables.

The normality of the dependent variable was assessed using the Shapiro-Wilk test, which identified a non-normal distribution. A bivariate analysis was performed between the sociodemographic and clinical characteristics of the caregivers and the presence of burden, using Fisher's exact test.

Subsequently, a multivariate analysis was performed using a multiple linear regression with robust estimation, after checking its linearity, homoscedasticity, and absence of multicollinearity using scatter plots, Levene's test, and condition index (< 30) and variance inflation factors (VIF < 10), respectively.

A statistical significance level of $p < 0.05$ was considered for all tests.

Ethical considerations

This study was conducted in accordance with the ethical principles established in the Declaration of Helsinki[25]. The hospital's research committee approved the protocol. The confidentiality and anonymity of the participants were guaranteed. They were informed about the study objectives and gave their informed consent voluntarily.

Results

Characteristics of primary caregivers

The sample consisted of 180 primary caregivers, with a median age of 43 years (interquartile range [IQR]: 34-52), and a range of 22-74 years old. The female sex predominated (67.2%) and 72.8% reported having a partner. Table 2 presents the distribution of the primary caregivers' sociodemographic characteristics, as well as the differences between variables. Regarding their relationship with the person being cared for, 35.6% were the patient's partner, 55.6% were immediate family members (parents, children, or siblings), and 8.9% were other ties (aunts, uncles, grandparents, or friends). Regarding occupation, 42.2% of participants did not have paid employment (homemakers or students), 52.8% worked in informal jobs or trades, and only 5% reported formal or professional employment. The number of days dedicated to care showed a wide dispersion, with a median of 365 days (IQR: 400), and a range of 18-5,575 days.

Regarding caregiver burden, the score showed a median of 30 points (IQR: 25.75-35.25), with no normal distribution (Shapiro-Wilk, $p \leq 0.001$) (Fig. 1). The majority of participants did not show signs of burden (96.1%), whereas 2.2% presented mild burden and 1.7% severe burden. No significant differences in Zarit scores were observed between male and female caregivers (Fig. 1). The distribution of scores was comparable in both groups, and the Mann–Whitney U test confirmed the absence of sex-related differences in caregiver burden ($p > 0.05$).

Factors associated with caregiver burden

Table 3 presents the multiple linear regression model, which was statistically significant ($F[10, 169] = 2.54$, $p = 0.007$), explaining 7.9% of the variance of the caregiver overload score.

It was observed that caregivers with partners ($B = -5.000$, 95% confidence interval [CI]: −8.494–−1.504, $p = 0.005$) had lower levels of burden. Similarly, the type of relationship they had with the patient showed significant associations. Compared with caregivers who were the patient's partner, those who were immediate family members (parents, children, or siblings) had an

Table 2. Characteristics of primary caregivers (n = 180) adding Zarit scores and if there is statistical significance

Variable	f (%)	Without burden f (%)	With burden f (%)	p*
Caregiver's sex				
Female	121 (67.2)	116 (95.9)	5 (4.1)	1.000[f]
Male	59 (32.8)	57 (96.6)	2 (3.4)	
Caregiver's marital status				
With partner	50 (27.8)	47 (94.0)	3 (6.0)	0.399[f]
Without partner	130 (72.2)	126 (96.9)	4 (3.1)	
Relationship with the patient				
Patient's partner	64 (35.6)	60 (93.8)	4 (6.2)	0.491[f]
Immediate family	100 (55.6)	97 (97.0)	3 (3.0)	
Other ties	16 (8.9)	16 (100.0)	0 (0.0)	
Caregiver's occupation				
Unpaid	76 (42.2)	72 (94.7)	4 (5.3)	0.793[f]
Informal work/trades	95 (52.8)	92 (96.8)	3 (3.2)	
Formal work/professional	9 (5.0)	9 (100.0)	0 (0.0)	
Complexity of care				
Surgical and oncological medicine	60 (33.3)	58 (96.7)	2 (3.3)	0.507[f]
Specialized and surgical clinic	60 (33.3)	59 (98.3)	1 (1.7)	
Internal medicine	60 (33.3)	56 (93.3)	4 (6.7)	

*P value obtained using Fisher's exact test (f), given the presence of expected frequencies < 5.

Table 3. Multiple linear regression model: Sociodemographic and care factors associated with caregiver burden

Variable	B (Confidence interval: 95%)	p	Variance inflation factors
Caregiver's age (years)	0.070 (–0.051 to 0.192)	0.256	1.14
Caregiver's sex (female)	0.936 (–2.423 to 4.296)	0.583	1.37
Caregiver's marital status (with partner)	–5 (–8.494 to –1.504)	0.005	1.32
Relationship with patient: partner	**Reference**		
Relationship with patient: parents, children, siblings	–3.420 (–6.829 to –0.010)	0.049	1.58
Relationship with patient: aunts, uncles, grandparents or friends	–6.130 (–11.390 to –0.971)	0.023	1.23
Occupation: unpaid	**Reference**		
Occupation: informal	–1.386 (–4.714 to 1.942)	0.412	1.52
Occupation: formal	3.578 (–3.277 to 10.433)	0.304	1.23
Type of care: surgical and Oncological	**Reference**		
Type of care: internal medicine	–0.976 (–4.405 to 2.452)	0.576	1.42
Type of care: specialized clinic	–2.153 (–5.578 to 1.273)	0.218	1.42
Care time (days)	0.002 (0.000 a 0.004)	0.023	1.06

Dependent variable: Zarit Burden Scale total score. Adjusted $R^2 = 0.079$; $F(10,169) = 2.54$, $p = 0.007$.

average of 3.42 lower points on the Zarit scale (B = –3.420, 95% CI: –6.829 to –0.010, p = 0.049). Caregivers whose bond with the patient was less close also showed lower levels of burden. This difference was even greater among those with a more distant connection (aunts, uncles, grandparents, or friends), with an average reduction of 6.13 points (B = –6.130, 95% CI: –11.390 to –0.971, p = 0.023).

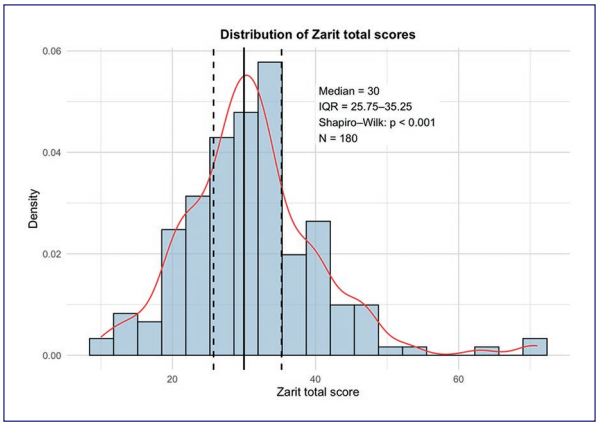

Figure 1. Distribution of Zarit total scores. Histogram with density curve showing the distribution of caregiver burden scores. The solid vertical line indicates the median, while dashed lines represent the interquartile range.

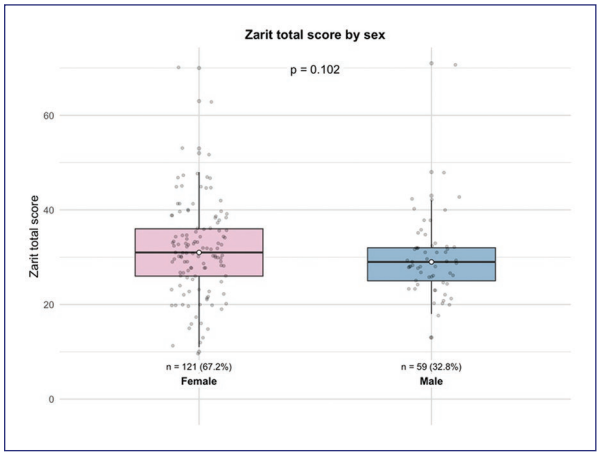

Figure 2. Zarit total score by sex. Boxplots represent interquartile range, white dots indicate the median, and individual points represent each participant. Group sizes (n, %) are shown below each box. The Mann-Whitney U test revelated no statistically significant difference between sexes (p = 0.102).

In addition, it was identified that the number of days dedicated to care was positively associated with overload: the longer the care time, the higher the score on the scale (B = 0.002, 95% CI: 0.000-0.004, p = 0.024).

The remaining variables included in the model (age, sex, occupation, type of care) did not show statistically significant associations. No collinearity was identified between predictors (all VIFs < 1.6). Figure 2 summarizes the estimates of the multiple linear regression model, highlighting the variables significantly associated with caregiver burden. In addition, figure 3 provides a graphical representation (forest plot) of the unstandardized coefficients with their 95% confidence intervals.

Discussion

The age of the primary caregivers in this study coincides with that reported in other research in Latin American contexts, where the predominant age group is between 30 and 64 years[10,11]. Although in our sample, age was not a significant predictor of the level of burden, in Asia, specifically in China, it has been identified that the older the caregiver, the greater the burden[16]. These discrepancies could be explained by cultural and economic factors, as well as by differential access to support networks, suggesting the need for studies that analyze the contextual determinants of care.

Although no association between sex and burden was found in this sample, some studies have reported that male caregivers were more likely to develop depressive symptoms linked to the caregiving role[15,16]. This finding underscores the importance of considering variables beyond gender, such as family environment, support networks, and coping strategies[26]. This is in line with Roy's model, which conceives the human being as an open system, influenced by multiple stimuli that affect its capacity for adaptation[20,21].

Marital status did show a significant association: caregivers with partners reported lower levels of burden. This finding is consistent with previous studies[12,13], suggesting that the presence of a stable relationship may act as a protective resource, possibly by facilitating emotional support, sharing of responsibilities, and greater resilience.

One of the most significant findings was the positive association between the number of days dedicated to caregiving and levels of burden, indicating that prolonged time in the caregiver role increases the risk of physical and emotional exhaustion. This result aligns with studies that link prolonged caregiving with less time for self-care, greater fatigue, and prevalence of depressive symptoms[6,17]. Nevertheless, research in other contexts has documented that time can also facilitate the development of skills and resilience[10]. In our case, the high care load in a tertiary hospital, with a nurse–patient ratio of 1:5, could limit the caregiver's participation in some tasks, but it does not eliminate their exposure to emotional stress.

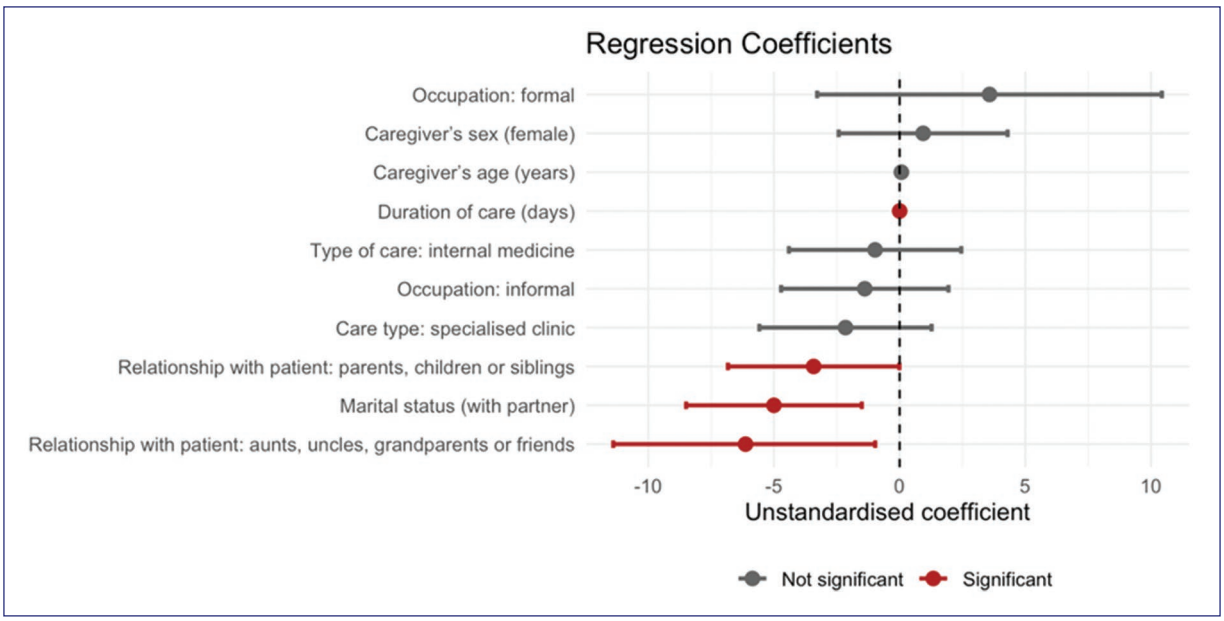

Figure 3. Factors associated with primary caregiver burden. Unstandardized coefficients (B) obtained from the multiple linear regression model for predicting caregiver burden are represented. Horizontal bars indicate 95% confidence intervals for each estimate. Red points correspond to significantly associated variables ($p < 0.05$), while gray points were not significant. The dashed vertical line indicates the null value (B = 0), used as a reference to assess statistical significance.

Regarding the emotional bond with the patient, it was found that caregivers with less close ties (such as aunts and uncles or friends) reported less burden than those who were the patient's partner or immediate family. This observation suggests that emotional closeness increases commitment and expectations for care, intensifying the physical and psychological burden. This dynamic is consistent with the Zarit, Reever, and Bach-Peterson model[2], which suggests that caregiver burden is greater in close emotional relationships due to constant demands, difficulty in setting limits, and a sense of permanent obligation.

Although variables such as age, sex, occupation, and type of care did not show statistically significant associations with caregiver burden, their inclusion in the analysis is relevant from a theoretical and practical perspective. For example, age has been identified as an important factor in international studies, particularly in older age groups, where caregiver frailty can exacerbate the impact of the caregiving role[16]. In our sample, age showed a positive, although non-significant, trend, suggesting that studies with greater statistical power could detect clinically relevant effects.

Regarding gender, although no differences were identified in levels of burden, this finding may reflect increasing equity in the distribution of the caregiving role or the presence of modulating factors such as family support or prior experience. Employment, for its part, also showed no direct association, but it should be noted that informal or unpaid work may entail burdens that are not visible from a traditional employment perspective, such as double shifts or exclusion from formal support networks.

Finally, the type of care or complexity of the clinical service was not significant, which could be because in hospital settings with a more established care structure, the primary caregiver does not directly assume complex tasks. Nonetheless, this does not exclude their exposure to emotional stress, which suggests that future research should explore not only the clinical complexity but also the perception of the caregiver's role in relation to the care provided.

Limitations

This study has several limitations that should be considered when interpreting the results. First, the cross-sectional design prevents establishing causal relationships between the factors analyzed and caregiver burden. Second, although the sample

was homogeneous and representative of the hospital, the results cannot be generalized to other contexts. Organizational specificities, such as the structure of services, the nurse-patient ratio, and the dynamics of care delivery, could differ from those of other tertiary hospital settings, affecting external comparability.

Conclusion

The findings of this study show that primary caregiver burden is a multifactorial phenomenon, involving personal, relational, and contextual variables. While prolonged caregiving time increases the perceived burden, factors such as the caregiver's marital status, the type of relationship with the patient, and the organizational dynamics of the hospital setting also play a role. Identifying these variables can help nursing staff recognize risk profiles and guide caregiver-centered preventive interventions. It is necessary to move toward multicenter, longitudinal studies that deepen our understanding of the adaptive care process in different healthcare settings, to develop comprehensive strategies that promote caregiver well-being and strengthen their role in the care process.

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The authors declare that this work was carried out with the authors' own resources.

Conflicts of interest

The authors declare that they have no conflicts of interest.

Ethical considerations

Protection of humans and animals. The authors declare that no experiments involving humans or animals were conducted for this research.

Confidentiality, informed consent, and ethical approval. The authors have followed their institution's confidentiality protocols, obtained informed consent from patients, and received approval from the Ethics Committee. The SAGER guidelines were followed according to the nature of the study.

Declaration on the use of artificial intelligence. The authors declare that no generative artificial intelligence was used in the writing of this manuscript.

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ORIGINAL ARTICLE

Frequency of obesity in infertile women among patients at the Hospital Juárez de México

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Abstract

Background: *Infertility is a significant health issue for women of reproductive age, and obesity is a global health epidemic. This study aimed to determine the frequency of infertility in women with overweight or obesity and highlight the reproductive implications of obesity.* **Objective:** *Determine the frequency of obesity in infertile women attending the Human Reproduction Biology consultation at Hospital Juárez in Mexico.* **Methods:** *This retrospective and cross-sectional study included women diagnosed with infertility at the Juárez Hospital in Mexico between 2022 and 2023, excluding those who did not meet the diagnostic criteria and had complete records.* **Results:** *A total of 390 records of women from Juárez Hospital in Mexico were analyzed, including 179 patients aged 21-47 years. 44.1% were overweight, 39.1% were obese, and 40.8% completed high school. The majority lived in Gustavo A. Madero and Ecatepec, and 58.7% were homemakers. 60.9% had primary infertility and 39.1% had secondary infertility; 60.3% had never been pregnant.* **Conclusion:** *The study found that age, poverty, and low education were risk factors for infertility in women. 59.8% had infertility, with 44.1% overweight and 25.1% obese, emphasizing the need for multidisciplinary strategies to improve treatments and public health.*

Keywords: *Infertility. Obesity. Body mass index. Primary infertility. Secondary infertility.*

Introduction

Obesity is considered a public health issue that continues to increase over the years, affecting men and women. However, it has a greater impact on female sex due to the hormonal alterations that women suffer as a result of constant metabolic changes. This makes women a vulnerable population, as body weight has a profound effect from the onset of puberty in girls, fertility during the reproductive years, and throughout the peri-, pre-, and post-menopausal[1,2].

Infertility is also considered a global health issue and is experiencing a growing trend, as it is currently estimated to affect about 10%-20% of couples, or between 60 and 80 million people worldwide. The American Society for Reproductive Medicine defines infertility as the inability to conceive after 12 months or more in women under 35 years old, and after 6 months in women over 35 years old[3,4].

There are two types of infertility: primary infertility, which is defined as the inability to conceive from the onset of unprotected intercourse, and secondary infertility, which refers to the inability to conceive after a previous pregnancy.

A recent study conducted in 2021 showed that the risk factors associated with infertility include a woman's age, pelvic inflammatory disease, sexually transmitted infections, obesity, low weight, drug addiction, with overweight being the most representative factor[5].

It is important not to lose sight of the fact that the participation of multiple environmental factors and lifestyle plays a crucial role in predisposing to infertility, with overweight and obesity standing out.

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Women with a body mass index (BMI) > 32 kg/m^2 have a lower probability of achieving a spontaneous pregnancy, as excess weight is associated with anovulatory cycles. Polycystic ovary syndrome is the primary cause of oligo/anovulation. However, obesity can have multiple implications, such as changes in sexual desire, ovulatory disorders, or endometrial abnormalities that hinder fertilization. In this way, infertility is strongly linked to obesity[6-8].

Objectives

Determine the frequency of obesity in women with infertility in patients attending the Human Reproduction Biology service at the Hospital Juárez de México to identify the frequency of infertility, in turn, characterized by age group, educational level, place of residence, and occupation, in order to describe the risk factors associated with infertility.

Methods

Study design and population

This study was designed following the Preferred Reporting Items for Cross-Sectional Studies of STORBE Statement. This is an observational, cross-sectional, retrospective study with a selected population of all patients diagnosed with infertility at the Hospital Juárez de México between 2022 and 2023, by collecting data from.

Inclusion and exclusion criteria

The inclusion criteria were defined to include female patients who went to Human Reproduction Biology consultation from January 01, 2022 to December 31, 2023 with diagnosis of infertility, whereas the criteria of non-inclusion and elimination were established for those who do not have a diagnosis of infertility and who have an incomplete or illegible record and who do not have somatometry.

Variables

The variables used in this study were four quantitative variables (age, BMI, number of pregnancies, and time of diagnosis: that is, the time the woman has been trying to get pregnant), and five qualitative variables (education level, place of residence, occupation, alcoholism, and smoking).

Statistical methods

The variables previously mentioned were recorded in a database, and statistical analysis was then performed using the Statistical Package for the Social Sciences. The data were expressed in frequency (n) and percentages (%) and measures of central tendency (mean, mode, and median), and finally, made into graphics.

Results

A total of 390 medical records of women who attended the Human Reproduction Biology service at the Juárez Hospital in Mexico were analyzed, of which 212 were excluded for not meeting the inclusion criteria. The final sample consisted of 179 patients, aged between 21 and 47 years, with an average age of 32.9 years. Patients aged between 31 and 32 years represented 9.5% (n = 17) of the studied population, making it the most frequent age group. The study analyzed BMI, education level, place of residence, and occupation. It was found that 44.1% of the population is overweight, 16.8% have a normal BMI, 25.1% have obesity grade I, 8.4% have obesity grade II, and 5.6% have obesity grade III (Figs. 1 and 2).

Among 40.8% of the population who completed high school, 19.6% have a bachelor's degree, and 0.6% have a postgraduate degree. 1.1% did not attend school, 5.6% finished elementary school, 24% completed middle school, 3.4% have incomplete high school, 0.6% started a bachelor's degree but did not finish it, and 2.8% studied a technical career.

The place of residence was analyzed. In Mexico City (CDMX), the boroughs with the highest representation were Gustavo A. Madero (20.7%), Iztapalapa (5.6%), and Venustiano Carranza (3.4%). Other boroughs with lower representation included Cuauhtémoc, Iztacalco, and Miguel Hidalgo, among others. In the State of Mexico, the municipalities with the highest representation were Ecatepec (9.5%), Nezahualcóyotl (7.8%), and Tlalnepantla (6.7%), followed by several other municipalities with lower representation. The majority of the studied population is dedicated to household work (58.7%), followed by merchants (13.4%) and employees (9.5%). Other occupations include stylists and saleswomen (2.2%), with lower representation of lawyers, seamstresses, and caregivers (1.7% each). 1.1% consists of domestic workers, nurses, students, bakers, and teachers. Other occupations, such as advisor, beautician, laboratory technician, makeup artist, receptionist, and secretary, each represented 0.6%. The

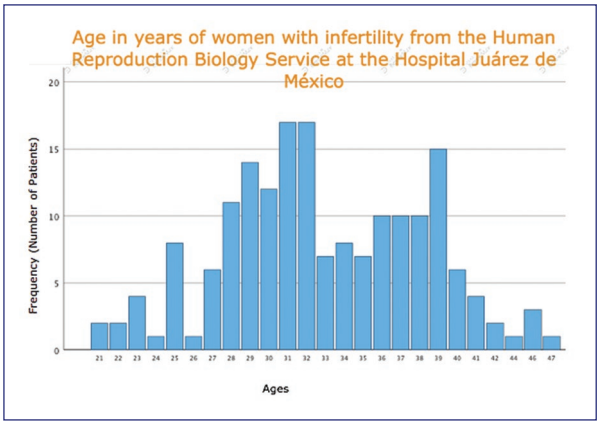

Figure 1. Age in years.

analysis of religious beliefs showed that 79.3% of the patients are Catholic, 9.5% are Christian, 9.5% do not practice any religion, 1.1% are Jehovah's Witnesses, and 0.6% practice the Yoruba religion.

The alcohol consumption and smoking habits were analyzed in patients diagnosed with infertility, where it was observed that 55.3% do not consume alcohol, compared to 44.7% who admitted to consuming alcohol. Meanwhile, only 31.3% of the studied population smokes, with the majority, 68.7%, not smoking.

About 60.9% of the studied population had a diagnosis of primary infertility, and 39.1% were diagnosed with secondary infertility. This means that 60.3% (n = 108) have never been pregnant, 21.2% (n = 38) have had only one pregnancy, 8.9% (n = 16) have been pregnant twice, and 9.5% (n = 17) have had three pregnancies in their lifetime. The majority of patients have been diagnosed with infertility within the last 1-5 years, with 16.8% diagnosed for 1 year, 14.5% for 2 years, and 12.3% for 3 years. Smaller percentages have had the diagnosis for 6-20 years, with a few cases dating back as far as 20 years (Figs. 3-5).

Discussion

Infertility is a significant health issue affecting women of reproductive age. In this study, we found that at the Hospital Juárez de México alone, 176 patients sought care at the Human Reproductive Biology Service due to difficulties achieving pregnancy. These findings highlight the importance of contextualizing our results within the framework of recent research to better understand the associated factors.

The age group with the highest prevalence of infertility among women attending the clinic was between 29 and 39 years, consistent with previous studies indicating that infertility increases with age. This is primarily due to biological factors such as decreased ovarian reserve and functional alterations in the reproductive cycle. Our findings are aligned with those of Esquivel-González et al.[2], who reported that the majority of women experiencing infertility were over 30 years old. However, nearly 20% were between the ages of 21 and 28. This pattern is also supported by the ENSANUT 2021 survey, which found that Mexican women are increasingly delaying motherhood, thereby raising the risk of age-related infertility. A 2022 U.S. study further supports this trend, reporting that women over 35 are almost twice as likely to experience infertility.

BMI analysis revealed that 69.2% of patients had elevated BMI, with most classified as overweight or having obesity class I. This finding is similar to a 2008-2009 study that reported 66.93% of patients had a BMI > 25. Reyes-Tápanes et al. also found a direct association between a BMI over 25 and infertility. Similarly, a 2021 study conducted in Mexico reported that 46% of women with infertility were overweight.

Educational attainment has been identified as a risk factor for infertility. Our results also support those of Meneses-Sierra et al., underscoring the influence of educational level on access to reproductive health information, health-seeking behavior, and the tendency to postpone motherhood. Understanding how social determinants affect perceptions and management of infertility is essential for developing effective interventions.

A considerable proportion of the patients in our study came from urban areas, particularly boroughs with high levels of poverty and marginalization, such as Gustavo A. Madero and Ecatepec. Previous studies suggest that women from low-income areas may face limited access to specialized services or experience additional stressors and unhealthy lifestyle factors. Ruipérez-Pacheco et al. documented that women from lower socioeconomic backgrounds encounter greater challenges in accessing specialized care. These results emphasize the importance of developing tailored health-care strategies that take into account the patients' sociodemographic context.

The finding that 58.7% of women diagnosed with infertility were homemakers raises questions about the social and psychological influences on infertility. Being dedicated solely to household work may expose women to psychosocial stress, which can contribute to hormonal imbalances that negatively impact fertility.

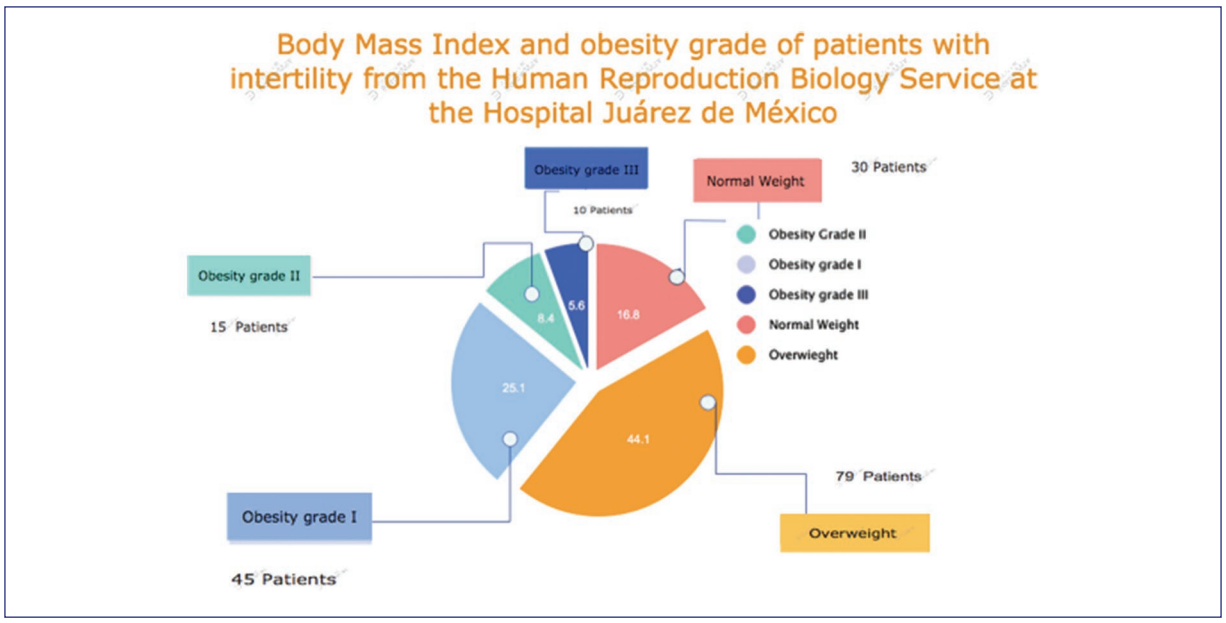

Figure 2. Body mass index and obesity grade.

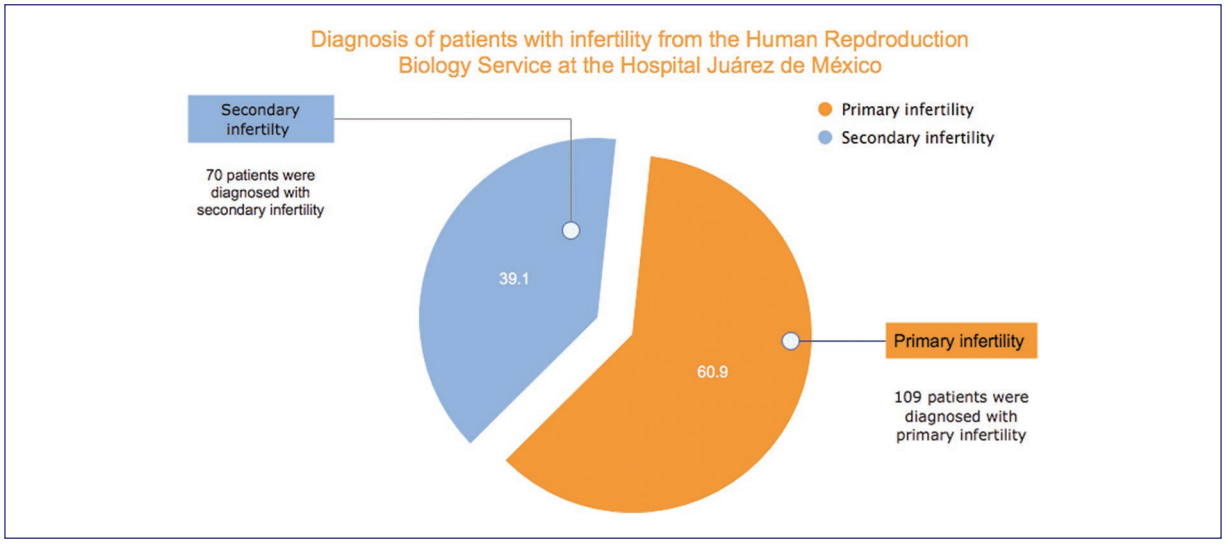

Figure 3. Diagnosis.

Furthermore, this condition is often associated with lower socioeconomic status and limited access to reproductive health care, as well as potential psychological implications. These results reinforce the importance of approaching infertility with a biopsychosocial perspective.

Infertility also has a profound emotional and psychological impact, and religion plays a key role in how women experience and cope with their condition. In our study, Catholicism was the predominant religion. Religious teachings that frame motherhood as a divine purpose can increase emotional and social pressure for women struggling with infertility. Other religious affiliations, such as Jehovah's Witnesses, may limit access to certain reproductive treatments due to doctrinal restrictions.

Although the Yoruba religion was reported by only a small number of patients, it is worth highlighting that its belief system includes spiritual practices related to

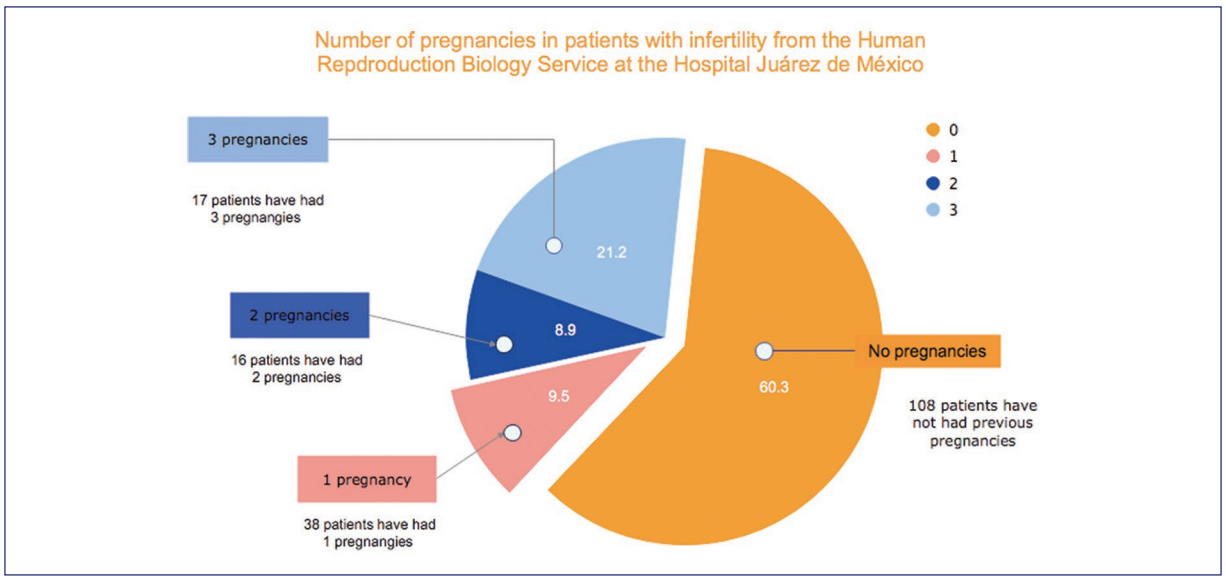

Figure 4. Number of pregnancies.

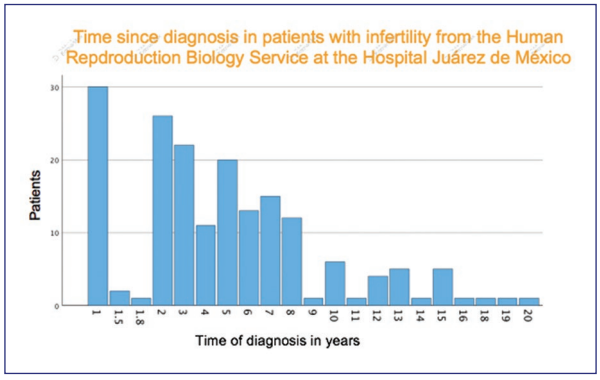

Figure 5. Time since diagnosis.

infertility, which can influence how patients integrate traditional rituals with medical treatments. The high prevalence of religious beliefs among participants underscores the need to incorporate religious and cultural sensitivity into medical care. Ortega-González et al. conducted a study in Latin America demonstrating how religious doctrine may limit access to fertility treatments.

Analyzing the type of infertility offers valuable insights into differences in etiology and the psychosocial factors involved in primary versus secondary infertility. This understanding is essential for designing more accurate diagnostic and therapeutic strategies.

In our study, most patients (60.9%) were diagnosed with primary infertility–meaning they had never been pregnant–whereas 39.1% had secondary infertility, with most of these women being over the age of 29. Among those with secondary infertility, the majority (21.2%) had experienced only one pregnancy, and smaller percentages had two or three prior pregnancies.

Furthermore, 85% of patients had been attempting to conceive for 1-8 years without success. This underscores the urgent need to identify and address barriers to accessing specialized care to ensure timely diagnosis and improve treatment success rates.

Conclusion

This study identified key risk factors for infertility–such as advanced maternal age, low educational level, obesity, and residence in marginalized areas–among women treated at the Reproductive Biology Service of Hospital Juárez de México. A high prevalence of overweight and obesity was observed, highlighting the need for comprehensive care strategies. Integrating nutritional, metabolic, and psychological support into fertility treatment could improve outcomes and reduce public health burdens. Addressing these factors is essential for developing more effective and equitable fertility care.

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The authors declare that this work was carried out with the authors' resources.

Conflicts of interest

The authors declare that they have no conflicts of interest.

Ethical considerations

Protection of humans and animals. The authors declare that no experiments involving humans or animals were conducted for this research.

Confidentiality, informed consent, and ethical approval. The authors have obtained approval from the Ethics Committee for the analysis of routinely obtained and anonymized clinical data, so informed consent was not necessary. Relevant guidelines were followed.

Declaration on the use of artificial intelligence. The authors declare that no generative artificial intelligence was used in the writing of this manuscript.

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RESEARCH LETTER

Nontuberculous mycobacteria mimicking cerebral toxoplasmosis in a human immunodeficiency virus-infected patient: a case report

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Abstract

Nontuberculous mycobacterial (NTM) central nervous system (CNS) infections are rare, with neuroimaging showing diffuse ring-enhancing lesions. In this case report, we describe a case of a human immunodeficiency virus (HIV)-infected patient who presented with a subacute onset of headache and altered mental status, with neuroimages highly suggestive of cerebral toxoplasmosis, but with no response to treatment, and later identification of a disseminated NTM infection. Presumptive diagnosis of an NTM CNS infection was based on extra-cerebral cultures and the favorable response to treatment. This report highlights the diagnostic challenge of intracerebral lesions in HIV-infected patients, especially when molecular testing and tissue sampling are unavailable. NTM infection of the CNS shall be considered in HIV patients presenting with lung, skin, or lymph node affection by NTM and altered mental status.

Keywords: *Nontuberculous mycobacterial infection. Ring-enhancing lesions. Human immunodeficiency virus-infection. Central nervous system infection.*

Background

Nontuberculous mycobacterial (NTM) infections of the central nervous system (CNS) are rare, with few cases reported in literature[1]. This raises diagnostic challenges, with cerebrospinal fluid (CSF) analysis being insufficiently sensitive and requiring a tissue sample in most cases[2]. Here, we describe a case of a patient with human immunodeficiency virus (HIV)-infection who presented with a subacute onset of headache and altered mental status with radiological images highly suggestive of cerebral toxoplasmosis, but with no response to treatment, and later identification of a disseminated NTM infection.

Case presentation

A 41-year-old male patient was diagnosed 1 month before admission with HIV infection. His relative referred a 6-month history of weight loss of 15 kg, intermittent nocturnal fever episodes, oppressive intermittent bilateral headache, and was diagnosed in an external clinic with a left basal pneumonia, where antibiotics and antiretroviral therapy were initiated. Two weeks later, he began with altered mental status, inattention, and tendency to stupor and was admitted to our emergency department. At admission, vital signs were blood pressure 90/60 mmHg, heart rate 110 bpm, respiratory rate 22 bpm, temperature (T°) 37.0 °C, and oxygen saturation per pulse oximeter 92% ambient air. Physical examination revealed bilateral crackles in lung auscultation and a palpable, non-painful left inguinal adenopathy. No focal neurological deficit was evident. A chest and head computed tomography (CT) scan was ordered, identifying a diffuse tree-in-bud pattern in the former. The head CT scan revealed multiple bilateral

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hypodense lesions, predominantly in the basal ganglia. Laboratory findings were remarkable for a normocytic normochromic anemia (Hemoglobin [Hb] 7.24 g/dL, mean corpuscular volume 90 fL, mean corpuscular Hb 29.2 pg), leukopenia (white blood cell 2.06 K/uL, lymphocytes 0.42 K/uL), and a hypovolemic hypoosmolar hyponatremia (Na^+ 125.8 mmol/L, Cl^- 95.0 mmol/L). A lumbar puncture was performed, resulting in 0 cells, a negative Gram stain, proteins 60 mg/dL, glucose 122 mg/dL, and lactate 1.6 mmol/L. Serum venereal disease research laboratory, *Toxoplasma gondii* serology, cryptococcal antigen, CD4+ cell count, and viral load were ordered, resulting in negative immunoglobulin G/immunoglobulin M for *T. gondii*. CD4+ cell count reported 22 cells/mm^3 and viral load 117,000 copies.

A bronchoscopy was performed, obtaining a positive acid-fast bacilli stain in bronchoalveolar lavage. Cultures were sent to the infectious disease department, and treatment for pulmonary tuberculosis was initiated. Furthermore, a brain magnetic resonance imaging (MRI) was performed, identifying ring-enhancing oval lesions localized in the head of the right caudate nucleus, right cerebral peduncle, left globus pallidus and thalamus (Fig. 1). As cerebral toxoplasmosis is the most common cause of brain mass lesions in HIV-infected patients[3], we decided to empirically initiate trimethoprim 5 mg/kg + sulfamethoxazole 25 mg/kg intravenous twice daily. The general surgery service performed an excisional left inguinal lymph node biopsy, revealing lymphatic hyperplasia, and cultures were sent. After 2 weeks, no improvement in mental status was documented, and a new brain MRI was ordered, with no changes compared to the previous. By this time, bronchoalveolar lavage culture revealed *Mycobacterium kansaii,* whereas lymph node biopsy culture revealed *Mycobacterium intracellulare* subspecies *chimaera.* Considering the brain lesions were also manifestations of a disseminated NTM infection, we added clarithromycin 500 mg every 12 h to the anti-tuberculous regimen. We performed *T. gondii* polymerase chain reaction (PCR) on CSF, with a negative result. We de-escalated trimethoprim/sulfamethoxazole to a prophylaxis dose. We repeated a brain MRI 2 weeks later, showing the previous lesions had decreased in size (Fig. 1). Clinically, the patient's mental status improved, and antiretroviral therapy was then initiated. After improvement in mental status, we decided to discharge the patient with the previous anti-tuberculous regimen and continue follow-up in the outpatient infectious diseases clinic. Unfortunately, the patient was lost to follow-up.

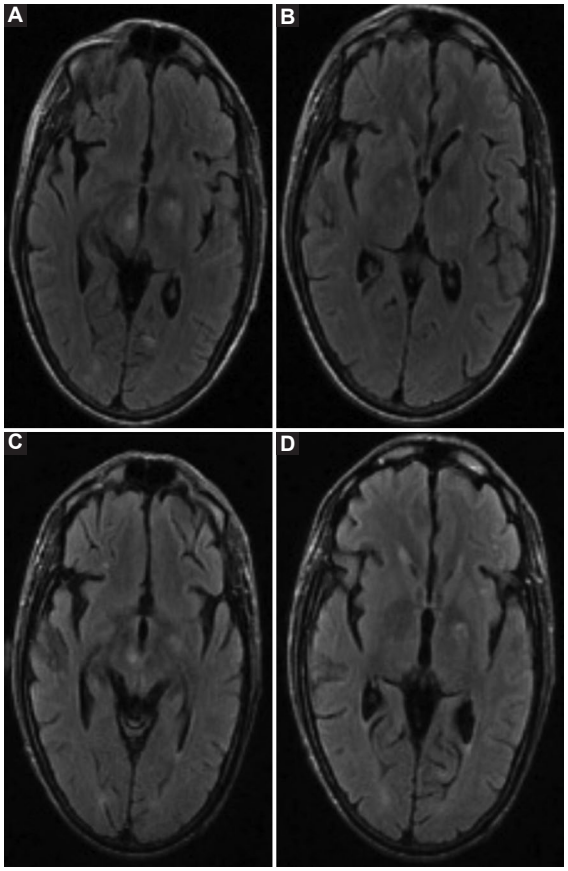

Figure 1. **A** and **B**: magnetic resonance images showing oval lesions localized bilaterally in basal ganglia and in left thalamus in fluid-attenuated inversion recovery T2 sequence. **C** and **D**: show the same patient 2 weeks after initiating anti-tuberculous regimen including clarithromycin.

Discussion

Neuroimaging findings of patients presenting with NTM CNS infection may vary. A recent systematic review of 112 patients with NTM CNS reported single or multiple space-occupying lesions (mass, abscess, ring-enhancing lesion) as the most common radiological finding (36.6%), followed by leptomeningeal enhancement (28%)[4]. No specific predominance of lesions' localization was reported in this review. A recent case series showed a diffuse distribution of nodular and ring-enhancing lesions, particularly in the left frontal lobe, bilateral occipito-parietal lobes, and brainstem[2]. Basal ganglia affection was reported in only one patient of this series. In our case, the affection of both the thalamus and basal ganglia prompted us to first consider toxoplasmosis in our

differential diagnosis, as their lesions have a predominance for these localizations. Furthermore, clinical manifestations, including fever, headache, and altered mental status, are shared between both diseases, making the diagnosis challenging. Regarding mortality rate and prognosis, 37.5% of the 112 patients in the systematic review and 33.3% of patients in the case series died[2,4], with male gender and HIV seropositivity as prognostic factors for mortality.

Tuberculosis is highly prevalent in HIV patients. Nonetheless, most cases of NTM infection in this population primarily involve the lung, skin, or lymphatic tissue[5]. In most reported cases of CNS involvement where patients were seropositive, disseminated NTM infection was present[1], as in our case, where lung and lymphatic tissue were affected. A limitation of the present case report was the lack of a definitive diagnosis through the identification of the mycobacterial species in the culture of cerebral tissue or CSF. In the previously mentioned case series, diagnosis could only be made by tissue sampling. The literature review conducted by authors showed that in 30% of cases tissue-based diagnosis was necessary, especially for slow growing mycobacteria, where acid-fast bacillus-stain was rarely positive in CSF[2]. Moreover, a study evaluating the performance of real time PCR for NTM in CSF exhibited a sensitivity of 33.3%[6]. In this manner, the insufficient sensitivity of molecular testing or acid-fast testing in CSF makes a therapeutic trial in the context of presumptive diagnosis of NTM CNS infection reasonable.

Conclusion

When affection of other organs by nontuberculous mycobacteria is present, especially in the context of immunosuppression, dissemination to CNS and diagnosis through a therapeutic trial must be considered even when CSF analysis is inconclusive.

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The authors declare that this work was carried out with the authors' own resources.

Conflicts of interest

The authors declare that they have no conflicts of interest.

Ethical considerations

Protection of humans and animals. The authors declare that the procedures followed complied with the ethical standards of the responsible human experimentation committee and adhered to the World Medical Association and the Declaration of Helsinki. The procedures were approved by the institutional ethics committee.

Confidentiality, informed consent, and ethical approval. The authors have followed their institution's confidentiality protocols, obtained informed consent from patients, and received approval from the Ethics Committee. The SAGER guidelines were followed according to the nature of the study.

Declaration on the use of artificial intelligence. The authors declare that no generative artificial intelligence was used in the writing of this manuscript.

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SYSTEMATIC REVIEW

Psychological variables affecting antiretroviral treatment adherence in Latin American women living with HIV: a scoping review

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Abstract

Background: *Adherence to antiretroviral treatment (ART) is crucial for effective human immunodeficiency virus (HIV) management. However, women in vulnerable contexts in Latin America face some structural barriers which can precipitate, worsen, or maintain psychological factors that hinder consistent adherence.* **Objective:** *The objective of this study was to identify psychological variables linked to ART adherence among Latin American women living with HIV and highlight areas for intervention development.* **Methods:** *A scoping review across PubMed, PsycINFO, and Cochrane Library focused on studies involving cisgender Latin American women and reporting psychological variables linked to ART adherence.* **Results:** *From 29 initial records, nine studies met eligibility criteria. Key barriers to adherence included depression, substance use, internalized stigma, domestic violence, and parenting-related stress. Facilitators included social support, self-efficacy, and maternal motivation.* **Conclusion:** *Adherence among Latin American women living with HIV is shaped by emotional, cognitive, behavioral, and interpersonal factors. Stress, depression, and stigma consistently emerge as barriers, while self-efficacy and social support act as key facilitators. These findings highlight that adherence cannot be addressed in isolation from the broader psychological context. Interventions may integrate mental health care with adherence counselling to strengthen self-efficacy, reduce stigma, and provide comprehensive support in this population. Such integrative approaches are essential to improve treatment outcomes and quality of life in this population.*

Keywords: *Human immunodeficiency virus. Antiretroviral adherence. Women. Psychological factors. Latin America.*

Introduction

In 2023, approximately 53% of people living with human immunodeficiency virus (HIV) worldwide were women and girls, including 1.9 million adolescent girls and young women aged 15-24 living with HIV. That same year, 44% of new HIV infections occurred in women and girls of all ages[1].

The effectiveness of antiretroviral therapy (ART) in controlling the progression of HIV depends primarily on high levels of treatment adherence. Sustained adherence enables viral suppression to undetectable levels, thereby prolonging life expectancy and significantly reducing the risk of HIV transmission. However, achieving and maintaining optimal adherence remains a significant challenge, particularly for Latin American women living with HIV, who face unique social and structural barriers that may contribute to psychological distress. Structural barriers such as absent programs to prevent vertical (mother-to-child) transmission of HIV in several countries across the region.

In addition, more than 2 million people have fled growing poverty and unrest in Central America, many without access to HIV prevention or testing services[2]. Moreover, in many Latin American countries, cisgender women are

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not considered a key population for HIV surveillance and prevention efforts, as they account for fewer than 20% of new HIV cases, for instance, 16% in Chile, 17% in Costa Rica, and 15% in Mexico[3]. This exclusion may hinder timely diagnosis, limiting the possibility of mitigating negative health and psychological consequences.

The World Health Organization defines adherence as "the extent to which a person's behavior (taking medication, following a diet, and/or implementing lifestyle changes), corresponds with agreed recommendations from a healthcare provider"[4]. This definition underscores that adherence is not merely a pharmacological act but also a voluntary and sustained behavioral process rooted in the individual's capacity to engage with and commit to medical care. Numerous studies have identified factors associated with adherence and non-adherence to ART, including treatment complexity, side effects, healthcare accessibility, patient-provider communication, and sociodemographic conditions[5]. Psychological variables such as depression, anxiety, substance use, and lack of social support consistently associate with lower adherence[6].

In this context, there is a pressing need to identify and better understand the psychological variables influencing adherence among women living with HIV in the subcontinent, to inform the development of tailored, culturally relevant interventions.

Given the multidimensional nature of ART adherence and the diversity of contexts in which Latin American women live, a scoping review is an appropriate methodological approach. Scoping reviews are beneficial for exploring broad and complex topics, mapping the extent and nature of existing evidence, and identifying knowledge gaps to guide future research or intervention design.

Accordingly, the objective of this scoping review is to synthesize and map existing evidence regarding psychological variables linked with adherence to antiretroviral therapy among Latin American women living with HIV.
The following population, concept, and context (PCC) framework-guided this review:

- Population: women living with HIV.
- Concept: psychological variables associated with ART adherence.
- Context: Latin America.

Methods

The aim was to map the available literature on psychological variables influencing adherence to antiretroviral therapy (ART) in Latin American women living with HIV. The review followed the five core stages of the scoping methodology: (1) identifying the research question; (2) identifying relevant studies; (3) study selection; (4) data charting; and (5) collating, summarizing, and reporting the results.

Eligibility criteria

Inclusion and exclusion criteria sought to ensure the selection of studies addressing the psychological dimensions of ART adherence among Latin American women:

Inclusion criteria

- Studies that included cisgender women of Latin American origin or ancestry living with HIV.
- Studies published in English or Spanish.
- Studies that identified or intervened on psychological variables associated with ART adherence.

The search and analysis included quantitative (cross-sectional, longitudinal, and experimental) and qualitative designs.

Exclusion criteria

- Studies focusing exclusively on men, children, adolescents, or transgender women.
- Studies addressing only sociodemographic or clinical variables without reference to psychological components.
- Reviews, editorials, opinion pieces, or studies lacking complete data.

Information sources and search strategy

A comprehensive literature search was conducted in September 2024 using the following databases:

- PubMed.
- PsycINFO.
- Cochrane Library.

Databases were selected for their relevance to biomedical, psychological, and clinical research. The search strategies combined medical subject headings (MeSH) terms and free-text keywords related to HIV, treatment adherence, women, Latin America, and psychological constructs (Table 1).

Search strategies used the following logistics

- PubMed: ("HIV Infections" [MeSH Terms] OR HIV [Title/Abstract]) AND ("Treatment Adherence and

Table 1. Terms used in the database search strategy

MeSH erms	Text words
HIV/AIDS: "HIV Infections", "Acquired Immunodeficiency Syndrome".	HIV/AIDS: HIV, AIDS. Treatment Adherence: adherence, compliance, treatment adherence, medication compliance. Mujeres: women, female. Latin America and Latinas: Latin America, South America, Central America, Caribbean, Hispanic, Latina. Psychological variables: psychological factors, mental health, coping, depression, anxiety, stress, self-efficacy, health attitudes.
Treatment Adherence: "Medication Adherence".	
Mujeres: "Women". Latin America and Latinas: "Latin America", "Hispanic Americans".	
Psychological variables: "Psychological Factors", "Mental Health", "Psychology", "Depression", "Anxiety", "Coping", "Self-Efficacy", "Health Knowledge, Attitudes, Practice".	

MeSH: medical subject headings, HIV: human immunodeficiency virus, AIDS: acquired immunodeficiency síndrome.

Compliance" [MeSH Terms] OR adherence [Title/Abstract]) AND ("women" [Title/Abstract] OR "females" [Title/Abstract]) AND ("Latin America" [MeSH Terms] OR Latin* [Title/Abstract]) AND ("psychology" [MeSH Terms] OR psychosocial [Title/Abstract]). This search yielded eight results.

- PsycINFO: (women OR females) AND (HIV OR "human immunodeficiency virus") AND (adherence OR compliance) AND (psychological OR psychosocial) AND (Latin America OR South America OR Latin*). This search yielded 13 results.
- Cochrane: (women AND HIV AND adherence AND psychological AND "Latin America"). This search yielded eight results.

Study selection figure 1 shows the process used to select the studies included in the review from the total results retrieved during the search.

Results

Following the search and selection of articles relevant to the PCC question, the analysis looked for psychosocial factors, barriers, and facilitators related to ART adherence among Latin American women living with HIV or of Latin American descent. The analysis included some studies not exclusively conducted with Latin American women, but included them as part of the sample. A summary table synthesizes the objectives, methodologies, and psychological variables indentidied in the selected studies (Table 2).

Discussion

In terms of psychological variables that can be addressed through interventions aimed at promoting, improving, or sustaining adherence among women of Latin American origin or descent, eight aspects were identified and classified into four dimensions:

Interpersonal relationships

Social support consistently emerges as a facilitator, indicating that family or community support networks increase motivation to maintain adherence[7-12]. Likewise, child care as a motivator reflects a highly gendered aspect within Latin American populations, where motherhood in this context was linked to self-care[12]. In contrast, domestic or intimate partner violence constitutes a significant barrier, as it increases the risk of treatment discontinuation and undermines women's agency. These findings suggest that interventions should include a component focused on strengthening support networks and, when necessary, screening for and addressing gender-based violence[8,11,13].

Mood-related factors

Stress associated with motherhood and depression emerge as barriers. This again highlights the role of motherhood, but in this case as a psychological vulnerability for women who not only face an HIV diagnosis but also additional burdens derived from it. The literature consistently identifies depression in particular as one of the strongest predictors of poor adherence, supporting the need to integrate psychotherapeutic interventions focused on mental health into comprehensive care[7-9,11,12].

Cognitive factors

Self-efficacy for adherence, and knowledge about HIV/medication appear as facilitators, which is consistent with behavioral and cognitive models emphasizing the importance of perceived personal control in health-related behavior[8,10,11,14]. Conversely, HIV-related stigma constitutes one of the most extensively documented and persistent barriers, as it negatively affects self-image as well as the willingness to seek social support. This indicates that programs may not only consider skill training and individual motivation but also incorporate psychoeducational and, where possible, community-based strategies to reduce stigma[7,11,15].

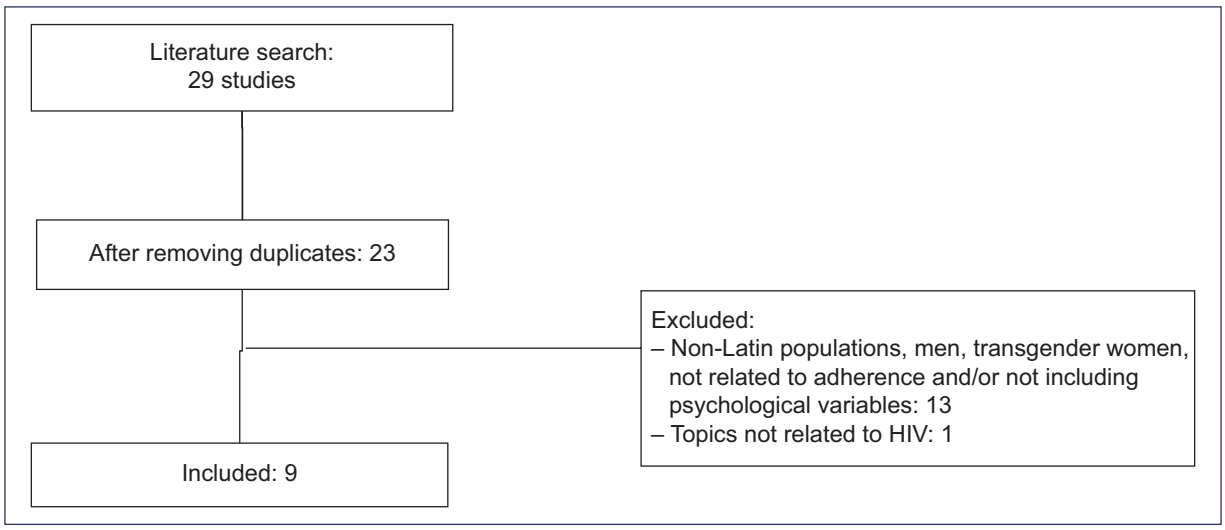

Figure 1. Selection of studies included in the analysis.

Table 2. Summary of the evidence found

Authors	Objective	Methodology	Psychological variables identified
Arrivillaga et al.[15]	Explore determinants of ART adherence in Colombian women from different socio-economic levels	Qualitative study with focus groups (n = 52), Cali, Colombia	HIV related stigma and disclosure
Contreras et al.[7]	Explore emotional experiences and recovery mechanisms in mothers with HIV in Lima, Peru.	Interpretative phenomenological analysis; in-depth interviews (n = 8)	Emotional and coping processes (guilt, distress, depression, resilience, hope, family support, reframing of motherhood)
Jones et al.[14]	Examine the impact of cognitive-behavioral stress management (CBSM) on ART adherence in women with AIDS	Experimental repeated measures study, USA (n = 174, 18% Latinas)	Maladaptive coping strategies (denial, self-blame, disengagement, and substance use) and knowledge about HIV/medication
Jones et al.[8]	Evaluate a group intervention combining CBSM and healthy lifestyle components to improve ART adherence	Factorial design 2 × 2, USA, group versus individual interventions (n = 237)	Depression, social support, beliefs about medication, and concerns regarding treatment
Mellins et al.[9]	Explore mental health, substance abuse, and family factors related to ART adherence in HIV-positive mothers	Longitudinal study with structured interviews (n = 128, 35% Latinas)	Psychiatric diagnoses (depression, PTSD); parental stress; family dynamics
Mendoza et al.[13]	Examine the association between partner violence and HIV treatment outcomes among sex workers in the Dominican Republic	Observational survey-based study (n = 268 sex workers)	Intimate partner/client violence
Murphy et al.[10]	Investigate factors associated with ART adherence in HIV-positive mothers	Longitudinal observational study with self-report and pill count (n = 46)	Alcohol use, perceived stress and self-efficacy
Pellowski et al.[11]	Determine the efficacy of a behavioral intervention to improve ART adherence in cisgender women	Systematic review and meta-analysis of randomized controlled trials	Behavioral interventions; ART adherence; self-efficacy; stigma; stress management
Wood et al.[12]	Explore adherence patterns, barriers, and facilitators among HIV-positive women who are primary caregivers	Qualitative study with semi-structured interviews (n = 36, mostly Latina women)	Depression, family support and motherhood-related motivation

Behavioral factors

Substance use is identified as a barrier, in line with the literature associating alcohol and drug use with non-adherence to therapy. This implies that in contexts where this issue is present, adherence can only be effectively addressed if interventions also include strategies for managing problematic substance use[9,10,14].

The points discussed above are consistent with findings from other studies. For instance, Glynn et al.[16], confirmed that the similar factors (depression, violence, substance use, stigma, low educational attainment, and unstable housing) act as syndemic conditions that undermine adherence in a much more diverse sample (men, women, transgender individuals, MSM, etc.). This allows for a comparison showing that these are not phenomena exclusive to Latin American women; rather, various groups experience the weight of these variables, although the way they manifest may differ. For example, another study[17] provides evidence that unintended pregnancy constitutes a critical factor that reduces the likelihood of viral suppression at delivery and is associated with delayed initiation of ART. This finding suggests that, among women living with HIV, psychological phenomena such as stress, and self-efficacy are also shaped by reproductive determinants, which distinguishes their experience from that of men and transgender populations. Thus, psychological interventions aimed at improving adherence among women of reproductive age could benefit from including family planning counseling as a central component. This aligns with the findings of the present work, which identified motherhood within Latin American populations as a factor so salient that it can either facilitate or hinder adherence. The foregoing highlights that it is not sufficient to extrapolate findings from men or other key groups, as is sometimes done given that, in the Americas, the proportion of men living with HIV is typically greater than that of women, and consequently, more is known about the variables influencing adherence among men than among women living with HIV.

Finally, with regard to psychological treatments, a randomized controlled trial[18] evaluated the efficacy of integrating cognitive-behavioral therapy for depression with adherence counselling to antiretroviral therapy cognitive behavioural therapy for adherence and depression (CBT-AD). The study found that patients receiving CBT-AD showed significant improvements in both adherence and depressive symptoms compared with enhanced treatment as usual. In contrast, when compared with supportive psychotherapy plus adherence counselling, no significant differences were observed, suggesting that the key benefit lies in systematically integrating adherence counselling into any structured psychotherapy. These findings reinforce what has been observed among women of Latin American origin, where factors such as depression, stigma, or violence constitute barriers to adherence. In this sense, interventions better tailored to the needs of the target population may be more effective, as they have greater potential to explicitly integrate counselling components relevant to adherence. In line with the cited study, addressing mental health or adherence in isolation is insufficient to improve clinical outcomes.

Conclusion

Taken together, the evidence indicates that adherence among women of Latin American origin is influenced by emotional, cognitive, behavioral, and interpersonal dimensions, which reflect four relevant factors identified. Specifically, stress, and depression consistently emerge as critical barriers, not only due to the psychological burden of living with HIV but also due to the additional demands of motherhood and caregiving. Conversely, self-efficacy stands out as a decisive facilitator, reinforcing behavioral and cognitive models that link perceived control with health-promoting behaviors. Moreover, HIV-related stigma remains one of the most persistent challenges, undermining self-image and discouraging the use of social support networks. These phenomena, often acting synergistically, illustrate that treatment adherence cannot be understood or effectively addressed in isolation from the broader psychological context. This reinforces the notion that interventions must explicitly target the psychological variables most closely associated with non-adherence-such as mood disturbances, stress, stigma, and self-efficacy-in order to achieve meaningful and sustainable outcomes. Ultimately, the adaptation and sustainment of such integrative approaches could enhance adherence outcomes and improve the quality of life of women living with HIV in Latin America.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

Ethical considerations

Protection of humans and animals. The authors declare that no experiments involving humans or animals were conducted for this research.

Confidentiality, informed consent, and ethical approval. The study does not involve patient personal data nor requires ethical approval. The SAGER guidelines do not apply.

Declaration on the use of artificial intelligence. The authors declare that no generative artificial intelligence was used in the writing of this manuscript.

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