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## DYNAMICS OF GENDER-BASED VIOLENCE IN CORDOBA: A 2021-2023 TIME SERIES ANALYSIS

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### ABSTRACT

*The article addresses a topic with profound implications today, namely: gender violence that affects the population of the department of Córdoba and the specific characteristics of the victims. Its objective is to analyze the dynamics of gender-based violence in the department of Córdoba during the period 2021 – 2023. To this end, an ecological study was carried out using time series analysis to examine cases of gender-based violence based on the consultation of the cases reported to the Epidemiological Surveillance System SIVIGILA. Among the main findings, it stands out that during the period under study, 8162 cases were reported in the department of Córdoba, of which 37% were concentrated in the age range between 27 and 59 years, in 86% of the cases the victims were women, 85.5% of the identified aggressors are male, in addition, 41.5% of the victims live with the aggressor. From this it was possible to conclude that in the department of Córdoba, gender violence mainly affects women, making them a highly vulnerable population, especially in adolescence and early childhood.*

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**KEYWORDS:** Gender-Based Violence, Sexual Violence, Vulnerability.

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## INTRODUCTION

Gender-based violence encompasses various forms of violence directed at people on the basis of their sex<sup>1,2,3</sup>. It includes physical, sexual, mental and economic harm inflicted on people because of their gender, such as domestic violence, rape, feticide/infanticide and female genital mutilation<sup>4,5</sup>. This violence often stems from an unequal power dynamic between men and women in patriarchal societies<sup>6</sup>. Gender-based violence can manifest itself in intimate relationships through abusive behaviors such as physical assault, sexual abuse, emotional abuse, harassment, and economic deprivation<sup>7</sup>. It is a widespread human rights violation around the world, affecting a significant proportion of women<sup>8</sup>. Scholars underline the importance of addressing gender-based violence in a comprehensive way to promote non-violence and gender equality in society<sup>9,10</sup>.

In the global context, according to the World Health Organization, gender-based violence affected more than 50% of the world's population in 2020,<sup>20</sup> which is a determining factor in social relations in different communities and conglomerates. The panorama in Latin America is no different, in the region between 6 and 8 out of ten women have been victims of some type of violence throughout their lives<sup>21</sup>, which forces nations to establish regulatory systems that promote gender equity, in accordance with the SDGs<sup>14</sup>.

Gender-based violence represents a fundamental violation of human rights, perpetuating cycles of oppression, inequality and injustice. It manifests itself in numerous ways, including physical, sexual, psychological and economic abuse, as well as harassment, coercion and discrimination<sup>7,8</sup>. This type of violence not only inflicts immediate damage, but also generates long-term consequences that reverberate from generation to generation. Their pervasiveness undermines people's health, well-being and autonomy, hindering their ability to lead full and productive lives.<sup>11</sup>

In addition, gender-based violence profoundly affects society as a whole, impeding social cohesion, economic development and progress towards gender equality<sup>12</sup>. It perpetuates harmful stereotypes, reinforces power imbalances, and fosters a culture of impunity that normalizes and perpetuates abusive behavior.<sup>13</sup> It stifles the potential of affected people and undermines efforts to achieve sustainable development and inclusive societies.<sup>11,12</sup> Addressing gender-based violence is therefore not only a moral imperative, but also essential to

fostering peace, justice and prosperity.<sup>14</sup>

Given the complex and multifaceted nature of gender-based violence, analysing and predicting its incidence is crucial to developing effective prevention, intervention and response strategies<sup>15</sup>. By understanding the patterns, trends, and risk factors associated with gender-based violence, policymakers, advocates, and practitioners can tailor interventions to address root causes and mitigate harms<sup>16</sup>. In addition, the development of predictive models allows proactive measures to be applied, such as early intervention programs, resource allocation and specific support services<sup>17</sup>.

In addition, analysing and predicting cases of gender-based violence facilitates the identification of vulnerable populations and high-risk environments, guiding efforts to prioritise resources and interventions where they are most needed. It also improves data-driven decision-making, allowing stakeholders to monitor progress, assess the effectiveness of interventions, and adjust strategies accordingly. Ultimately, by harnessing the power of data and analytics, it is possible to transform ~~our~~ response to gender-based violence from reactive to proactive, thereby maximizing impact and reducing harm. The objective of this research was to characterize and predict the behavior of cases of gender violence in the department of Córdoba for future periods.

## METHODOLOGY

An ecological study was conducted using time series analysis to examine cases of gender-based violence over a specific time period<sup>18,19</sup>. This approach made it possible to analyze the trends and patterns in the cases reported in the municipalities of the department of Córdoba from 2021 to 2023.

Data on reported cases of gender-based violence were obtained from the Departmental Secretariat of Health, covering a period between 2021 and 2023. The dataset included information on the number of reported cases, categorized by type of violence, age and gender of the victims, and geographic location. All data was anonymised to ensure the privacy and confidentiality of the people involved.

Prior to analysis, the dataset was pre-processed to ensure accuracy and consistency. To do this, outliers or missing values were identified and removed and, if necessary, the data were transformed to account for seasonality or trends present in the time series.

To analyze the data from the time series and generate forecasts of future incidences of gender-based violence, the smoothed exponential model was applied. This model is well suited to capturing both short-term

fluctuations and long-term trends in data, making it particularly useful for predicting future cases of gender-based violence based on historical patterns.

The smoothed exponential model incorporates a smoothing parameter that adjusts the weight given to past observations, allowing flexibility in capturing changes in the underlying process over time. By iteratively updating estimates based on new data, the model can adapt to changes in the incidence of gender-based violence and provide accurate forecasts for future times.

To evaluate the validity and reliability of the smoothed exponential model, a validation process was carried out. To do this, the model's predictions were compared with the actual cases reported for a subset of data, using parameters such as absolute mean error and mean square error to assess the accuracy of the predictions.

Once the model was validated, the results were interpreted to identify trends, patterns, and potential drivers of gender-based violence in the study area. This involved examining the magnitude and direction of the predicted changes in incidence, as well as performing sensitivity analyses to assess the robustness of the results to variations in the model parameters.

The results of the time series analysis were used to inform evidence-based recommendations on preventive measures, interventions and policy initiatives aimed at reducing the prevalence and impact of gender-based violence. By identifying high-risk populations, geographic hotspots, and temporal trends, stakeholders were able to prioritize resources and tailor interventions to address the specific needs of affected communities.

## RESULTS

Reports of 8162 cases of gender-based violence during the period between January 1, 2021 and December 31, 2023 were included. The age range most frequently was 27-59 years (37.0%), followed by the range of 12-18 years (27.3%); 84.6% of the victims were female, which shows a ratio of 6 cases of women for every man; In relation to the aggressors, it was highlighted that 85.5% are male and 15.8% are female. In addition, 41.5% of the victims live with the aggressor. It was estimated that, during the year 2021, rates of 8.5 cases of sexual violence were registered daily, while in 2022 this rate increased considerably, reaching 13.9 cases per day; and 97.7% of the victims were of Colombian nationality, while 2.3% were migrant population **Table 1**

During the period analyzed, 9.6% of cases of sexual violence against pregnant women, 0.4%

against disabled people and 0.1% against the prison population were registered. In relation to the socioeconomic stratum of the victims, it was observed that 97.4% reside in depressed strata or marginal areas of poverty (strata 1 and 2), while 1.1% correspond to the middle classification (strata 3 and 4) and another 1.1% to strata 5 and 6, which, using the classification of the strata of the System of Beneficiaries of the State Social Programs, places strata 1 to 3 as low, the distribution corresponds to 98.3% of the total cases in the low socioeconomic level **Table 1**

In relation to the different moments of the life cycle, it was identified that adolescence represents the most vulnerable population in terms of sexual violence (27.3%); followed by childhood (8.23%); while the extreme ages of life also present worrying figures: early childhood represents 4.41% and old age 3.32%. These figures show the presence of pedophilia and gerontophilia in the communities.

Sexual violence also affects specific groups such as victims of socio-political violence (12.7%), pregnant women (9.92%) and ethnic groups (3.76%). Among ethnic groups, cases predominated in indigenous (3.7%) and Afro-descendant (2.0%). In addition, although the frequency is low, the event was reported in migrants, displaced persons, individuals under ICBF protection, people with disabilities, in prison, with mental illnesses, in street conditions (indigent) and demobilized.

In the time series analysis according to the results of the model, both the stationary R-square and the R-square indicate a strong fit of the model to the data, with values of 0.831 and 0.782 respectively. This suggests that the model captures a substantial portion of the variability in the data. The RMSE (*Root Mean Square Error*) of 21.567 is relatively moderate, indicating that the model's predictions are on average close to the observed values. The MAPE (*Mean Absolute Percentage Error*), with 5.429%, and the MaxAPE (*Maximum Absolute Percentage Error*), with 10.139%, show that the model has a good percentage of accuracy overall.

The MAE (*Mean Absolute Error*) and MaxAE (*Maximum Absolute Error*) are 18.175 and 32.545 respectively, which gives an idea of the standard deviations and the worst-case scenario in the model's predictions. The BIC (*Bayesian Information Criterion*) normalized at 6,540 confirms that the complexity of the model is adequate for the data.

### Model Statistics

The result of the Ljung-Box Q(18) test (p-value = 0.002) indicates that there is a statistically significant

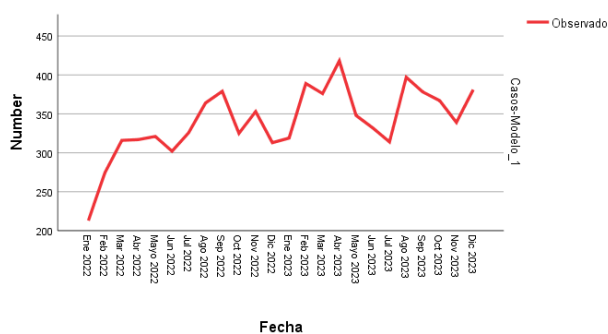
autocorrelation at delay 18, suggesting that the residuals may not be completely random. This could warrant further investigation or refinement of the

model. The Alpha (level) at 0.408 with a t-value of 2.340 (p-value = 0.029) confirms the importance of the level parameter in the model. **Table 3**

| Adjustment Statistic | Media      | Minimum    | Maximum    | Percentiles |            |            |
|----------------------|------------|------------|------------|-------------|------------|------------|
|                      |            |            |            | 25          | 50         | 75         |
| Stationary square R  | 0,8305793  | 0,8305793  | 0,8305793  | 0,8305793   | 0,8305793  | 0,8305793  |
| R squared            | 0,78201938 | 0,78201938 | 0,78201938 | 0,78201938  | 0,78201938 | 0,78201938 |
| RMSE                 | 21,5668123 | 21,5668123 | 21,5668123 | 21,5668123  | 21,5668123 | 21,5668123 |
| MAP                  | 5,42916976 | 5,42916976 | 5,42916976 | 5,42916976  | 5,42916976 | 5,42916976 |
| MaxAPE               | 10,1387528 | 10,1387528 | 10,1387528 | 10,1387528  | 10,1387528 | 10,1387528 |
| IT IS                | 18,1753853 | 18,1753853 | 18,1753853 | 18,1753853  | 18,1753853 | 18,1753853 |
| MaxAE                | 32,5453964 | 32,5453964 | 32,5453964 | 32,5453964  | 32,5453964 | 32,5453964 |
| Normalized BIC       | 6,53956806 | 6,53956806 | 6,53956806 | 6,53956806  | 6,53956806 | 6,53956806 |

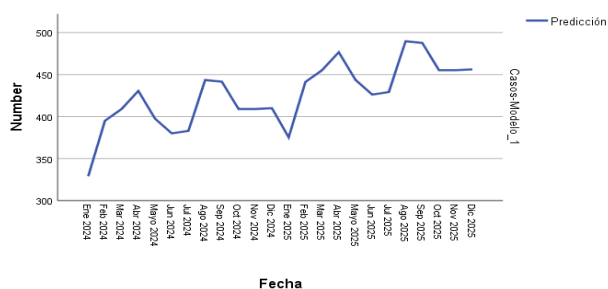
Source: 875 event databases and projections estimate

Observational vs. prediction charts show that the model tracks seasonal patterns and overall trends in the data well. There are fluctuations in the data that the model captures to a reasonable extent, although there are some mismatches, especially in the prediction of peaks or sudden changes. **Graph 1**



Source: Event 875 databases

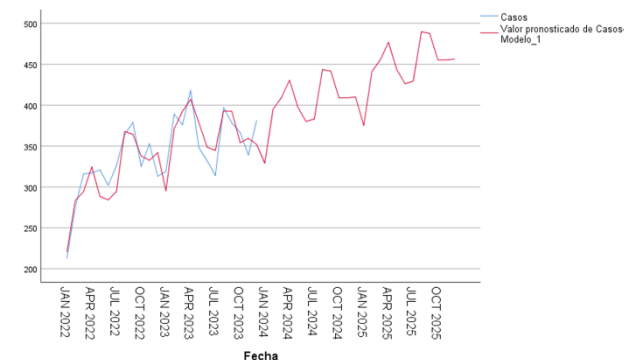
The prediction chart goes beyond historical data and suggests a continuation of the observed seasonal pattern. Confidence in the prediction seems solid given the model's previous results. **Figure 2.**



Source: 875 event databases and projections estimate

Figure 3 provides information about the actual observations and values predicted by the time series model. The model appears to capture with reasonable accuracy the overall trend and seasonality observed in the data. The red line (predicted values) closely follows the blue line (observed cases), indicating a good adaptation of the model to historical data. Specific times are observed, especially

around peaks and valleys, where the model does not exactly match the observed values. This could indicate certain limitations of the model in capturing abrupt or atypical changes in the data. On the right side of the chart, where predictions are projected beyond the data observed until July 2025, the model anticipates a continuation of the trend with a slight upward fluctuation. This suggests that the model expects the current trend to continue in the near future. The good monitoring of the red line with respect to the blue line throughout the historical period reflects a good fit of the model, possibly due to an adequate adjustment of parameters such as level ( $\alpha$ ), trend ( $\gamma$ ) and seasonality ( $\delta$ ).



Source: event databases and projections estimate

Areas where the red line deviates from the blue line may indicate prediction errors, which could be examined to fine-tune the model or better understand the factors that cause these discrepancies. The model's ability to track seasonality and trend suggests that these components are well represented in the model, which is crucial for making effective forecasts on temporal data. The projection indicates an expectation of continued behavior of gender-based violence based on historical pattern, which is typical in most time-series models that assume that past trends will repeat themselves in the future.

## DISCUSSION

The findings are consistent with the results of Negrín (2019) who reports that violence is closely related to gender issues; in his analysis, he highlights how there is a predominance of the female sex among the victims of sexual violence and men among the aggressors, which coincides with the findings of the present study. Likewise, in both studies, the influence of the historical, social and cultural pattern is reaffirmed, regarding the expectation for both genders, establishing girls and adolescents as sexual objects or passive entities and men as active subjects and responsible for bending women<sup>1</sup>; all as a result of the androcentric perspective to which Vásquez (2020) has referred, which is immersed in the sociocultural reality of environments of poverty<sup>2</sup>. In this regard, Velásquez et al. (2020)<sup>3</sup> also agree that gender-based violence is a social problem in which it develops within the framework of a system of relations of domination of men over women, a perspective from which sexual violence occurs as an expression of gender-based<sup>4</sup> violence.

This gender-based violence (sexual and non-sexual) in the territorial scenario of the study analyzed from the sequence of the time series, is on the rise; the trend of the predictive or prognostic model allows us to identify the tendency to sustain itself in exponential increase, with brief periods in which peaks and abrupt changes of decline are seen that occur or originate after the implementation of control measures within the framework of surveillance passive epidemiological of this notifiable event<sup>5</sup> 6.

Regarding gender-based violence, when contrasting with Lorente-Acosta (2020)<sup>7</sup> in her study on "Gender-based violence in times of pandemic and confinement", a similarity is observed in both studies

regarding the trend of sustained increase in gender-based violence during the period of confinement.

In relation to sexual violence, figures close to the global figures reported by the World Health Organization (WHO) in 2013 have been identified in the data<sup>8</sup>, according to which three out of ten women have suffered physical or sexual violence by their partner. However, the sexual violence of the study triples the reported figure of 3.33% when estimated in Córdoba (Colombia) values of 9.92% of sexual violence in pregnant women. The aspects related to the aggressor of the pregnant woman coincide with the study by Barzola et al. in Peru in the sense that the main aggressor is her current partner, who exercises this type of gender violence on a weekly basis<sup>9</sup>.

Based on the connotations of gender-based violence in pregnant women, Martín (2020)<sup>10</sup> in his study on "accompaniment of pregnant women victims of gender-based violence" suggests that there is a high tendency to increase the victim's state of vulnerability, decreasing their self-esteem and increasing the level of dependence on the aggressor, which in the context of the Department of Córdoba, It is considered even more burdensome, given that 97.4% of the reported victims reside in depressed strata or marginal areas of poverty (strata 1 and 2).

Regarding victims of sexual violence belonging to indigenous peoples, during the period analyzed, 3.7% of the victims of this type of violence stated that they belonged to indigenous groups, a worrying situation as it is a population group that enjoys special constitutional and legal protection, which contrasts with the national trend presented by the Akubadoura Community of Jurists Corporation in (2020)<sup>11</sup> its report on "gender-based violence against indigenous women, girls and adolescents in

<sup>1</sup> Negrín, Y. M. (2016). Child abuse: a gender problem? *Cuban Journal of Integral General Medicine*, 32(1), 28-35.

<sup>2</sup> Vásquez Hernández, Y. M. (2020). Invisible Victims: Gender-Based Violence Within the Maras in Honduras. *Cultural and Political Constructions of Gender*, 622-643.

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<sup>4</sup> Ramos, G. E. H., Muñoz, J. V. I., Ponce, V. M. V., & Cataño, C. R. (2020). Emotional dependence and its relationship with intimate partner violence. A descriptive approach to literature review. *Desafíos*, 11(2), 165-170.

<sup>5</sup> Rohlf, I., & Valls-Llobet, C. (2003). Acting against gender-based violence: a challenge for public health. *Gaceta Sanitaria*, 17(4), 263-265.

<sup>6</sup> Serna-Trejos, J. S. (2022). Epidemiological perspective of gender and intrafamily violence in Colombia, 2022. *Camagüey Medical Archive*, 27, 9361.

<sup>7</sup> Lorente-Acosta, M. (2020). Gender violence in times of pandemic and confinement. *Spanish Journal of Legal Medicine*, 46(3), 139-145.

<sup>8</sup> Organización Mundial de la Salud [OMS]. (2013). *Global and regional estimates of violence against women: prevalence and health effects of intimate partner violence and non-partner sexual violence*. Washington, D. C.: OMS.

<sup>9</sup> Barzola Macha, MK, Moquillaza Alcántara, VH, & Diaz Tinoco "I", CM. (2020). Domestic violence during pregnancy in a specialized hospital in Peru: Prevalence and associated factors. *Chilean Journal of Obstetrics and Gynecology*, 85(6), 641-653. <https://dx.doi.org/10.4067/S0717-75262020000600641>

<sup>10</sup> Martín, J. (2020). Accompanying pregnant women who are victims of gender violence. Ethical aspects for midwives. *Musas Magazine*, 5(1), 60 - 79. DOI: 10.1344/musas2020.vol5.num1.4

<sup>11</sup> Akubadoura Community of Jurists Corporation, Fokus, Women and Development Forum (2020). Report on gender-based violence against indigenous women, girls and adolescents in Colombia.

Colombia", which explains that during 2019, 2527 cases of victims of sexual violence belonging to the indigenous population were reported in Colombia, which is equivalent to 8.11% of the total cases reported to SIVIGILA for that year. With what is presented in the report, it is identified that acts of sexual violence occur in the universe that subscribes to national ethnic diversity, including indigenous groups.

Situations of special interest include people in conditions of social vulnerability due to their age group such as Children and Adolescents (NNA), as well as older adults who serve as victims of forms of gender violence. It should be noted that situations coincide with the contributions of Romero (2010)<sup>12</sup> in the sense that children and adolescents are direct victims, as well as indirect victims, of forms of gender-based violence when they are present as spectators or when they experience in themselves the aggression inherent in this situation.

If the predictivity of the model presented is applied intentionally, to the possible consequences of finding among the victims of gender-based violence among children and adolescents, a vulnerable generation with lower self-esteem is expected in the medium term, which are typical of the victims of this type of violence; in this regard, Penado and Rodicio -García (2017)<sup>13</sup> report emotional consequences and mental health sequelae that accompany the victims.

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## CONCLUSION

The evidence collected within the research and consultation process shows that gender-based violence is a phenomenon that had an impact on the well-being of the population of the department of Córdoba during the period 2021 – 2023. The figures show that there is a marked trend towards the victimization of women, indicating a state of vulnerability vis-à-vis men, who stand as the main aggressors. In the same way, it was possible to establish that there is a relationship between the socioeconomic level of the victim and the occurrence of victimizing events, which represents that in strata 1 and 2 there is greater vulnerability. Regarding age groups, although the highest frequency of occurrence of cases is concentrated between 27 and 59 years old, in all the ranges analyzed cases were presented, placing the adolescent and infant population as vulnerable subjects according to the life cycle. In addition, in terms of sexual violence, the existence of pregnant women among victims denotes factors of deterioration within social dynamics, which lead to a type of behavior that generates risk for the integrity of the mother and the fetus in gestation. Therefore, it is recommended that public policies be implemented to prevent gender-based violence in all its forms and that a comprehensive care system be consolidated to restore the rights of victims and guarantee non-repetition.

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