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Spatial Analysis of Gender-Based Violence in Antananarivo's 3rd District in Madagascar.

[Analyse spatiale de la violence basée sur le genre dans le 3e arrondissement d'Antananarivo à Madagascar]

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Abstract

This study proposes an integrated analysis of gender-based violence (GBV) in urban settings, emphasizing the influence of geographical and socio-economic determinants on the spatial distribution of violence. The objectives are to produce a detailed map of high-risk areas, analyze family and social dynamics, and study the impact of economic conditions on vulnerability to GBV. The methodological approach combines the use of Geographic Information Systems (GIS) for spatial visualization with qualitative methods (interviews and focus groups) to deepen the understanding of local contexts. The expected results will help identify violence "hotspots" and develop prevention strategies adapted to territorial specificities. By integrating urban geography and social sciences, this research aims to contribute significantly to combating GBV and improving the safety of vulnerable populations.

Keywords: Gender-based violence, Spatial analysis, Territorial inequalities, Urban planning.

Résumé

Cette étude propose une analyse intégrée de la violence sexiste (GBV) en milieu urbain, en mettant l'accent sur l'influence des déterminants géographiques et socio-économiques sur la répartition spatiale de la violence. Les objectifs sont de produire une carte détaillée des zones à haut risque, d'analyser les dynamiques familiales et sociales, et d'étudier l'impact des conditions économiques sur la vulnérabilité à la GBV. L'approche méthodologique combine l'utilisation de systèmes d'information géographique (SIG) pour la visualisation spatialeavec des méthodes qualitatives (entretiens et groupes de discussion) afin d'approfondir la compréhension des contextes locaux. Les résultats attendus permettront d'identifier les « points chauds » de la violence et d'élaborer des stratégies de prévention adaptées aux spécificités territoriales. En intégrant la géographie urbaine et les sciences sociales, cette recherche vise à contribuer de manière significative à la lutte contre la VBG et à l'amélioration de la sécurité des populations vulnérables.

Mots clés : Violence basée sur le genre, Analyse spatiale, Inégalités territoriales, Urbanisme.

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1. Introduction

Gender-based violence (GBV) is a major issue in contemporary urban societies, presenting complex challenges in terms of public health, social justice, and urban development. In a context of rapid urbanization and increasing socio-economic inequalities, territorial dynamics play a determining role in the distribution and persistence of these violences.

This research aims to explore the interactions between geographical and socio-economic factors to identify high-risk areas and inform prevention policies tailored to sensitive urban environments. The primary objective of this study is to develop an integrated spatial analysis of GBV in an urban setting, highlighting the relationship between indicators of vulnerability (such as poverty), population density, and access to support services, and the distribution of violence. The research seeks to produce a detailed map of violence "hotspots" in order to understand how variables such as unemployment, poverty, and social isolation influence the vulnerability of populations. Special attention is given to family structures and social configurations, as household composition and gender roles can modulate the occurrence of GBV (García & López, 2022).

The importance of this approach lies in its ability to provide concrete decision-making tools for local actors and policymakers. Previous studies have demonstrated that integrating spatial analysis techniques with socio-economic surveys allows for a better understanding of the underlying mechanisms of urban violence (Smith & Brown, 2022 ; Müller et al., 2023). By combining quantitative data derived from GIS with qualitative data collected through interviews and focus groups, this research proposes a holistic approach to comprehending the multiple facets of GBV.

Recent literature emphasizes that the distribution of violence is not random but results from complex interactions between environmental conditions and social dynamics. Studies by Randrianarisoa et al. (2023) highlight the impact of urban density and territorial inequalities on the prevalence of GBV, while Tsiamalala et al. (2024) stress the need for fine-scale spatial analysis to assess urban vulnerability. Moreover, research conducted by Andrianavalona et al. (2022) and Andrianarison & Rasoanaivo (2024) provides valuable insights into the specificities of local environments, particularly in contexts marked by high social and economic disparities. By comparing local data with international experiences, notably those reported in the United States and Germany, it is possible to identify similarities and differences in the determinants of GBV (Johnson et al., 2023). The comparative analysis aims to enrich the understanding of the phenomenon and to outline pathways for interventions adapted to the specific realities of each urban environment.

The challenge of this research is to offer an original scientific contribution that combines methodological rigor with operational relevance. The objective is to formulate recommendations for more effective public policies capable of reducing territorial inequalities and improving the safety of vulnerable populations. The synthesis of the obtained results will help to better allocate resources and guide prevention efforts based on solid empirical evidence and relevant comparative analyses.

2. Materials And Methods

For this study on gender-based violence (GBV), a field survey was conducted in the 3rd District of Antananarivo, targeting a sample of 250 individuals. The choice of this area is based on its representativeness in terms of socio-economic and demographic diversity, thereby providing a comprehensive view of perceptions and experiences related to GBV in an urban context.

Participants were selected through a stratified random sampling method to ensure a balanced distribution according to age, gender, and socio-economic status. Each participant was informed about the objectives of the study and the confidential treatment of their responses. Informed consent was obtained before administering the questionnaires. These questionnaires included both closed and open-ended questions, allowing the collection of quantitative and qualitative data regarding experiences and perceptions of gender-based violence.

For data processing, two software packages were used. Quantitative data from the questionnaires were first entered into Microsoft Excel to perform an initial sorting, calculate statistical indicators (prevalence rates, means, and standard deviations), and create pivot tables to identify significant trends and correlations. At the same time, geolocated information was integrated into a Geographic Information System (GIS), which enabled the visualization of the spatial distribution of

GBV incidents and the identification of areas at high risk or requiring special attention. The combined use of Excel and GIS thus allowed for the integration of statistical analysis with a spatial dimension, offering a more comprehensive and contextualized view of the phenomena under study.

The entire methodology was governed by strict ethical protocols, ensuring the confidentiality of participants and the scientific rigor of the study. The results obtained provide a solid basis for formulating recommendations aimed at preventing GBV and improving public policies in this area.

3. Results

The survey conducted in the 3rd District of Antananarivo on the gender distribution by neighborhood shows a strong predominance of females. Out of a total of 66 respondents, 62 are women (93.94 %), while 3 are men (4.55 %) and 1 person is bisexual (1.52 %). The neighborhoods with the highest number of respondents are Andravoahangy Est (21.21 %), Tsaramasay (16.67 %), and Andranomahery Ankorondrano (16.67 %). In contrast, some neighborhoods such as Ankadindramamy, Avaradoha, and Mahavoky have only 1 respondent each (1.52 %).

The distribution of children according to marital status shows notable variations in fertility. Single individuals (6.35 %) show a low number of children, related to relationship instability and individual choices not conducive to reproduction. Conversely, couples living together (26.98 %) exhibit a more balanced distribution, with a strong presence of households with 2 children (11.11 %) and a non-negligible share with 3 children (6.35 %).

Legally married couples, who represent 42.86 % of cases, record the highest incidence of procreation, with peaks at 2 children (14.29 %) and 3 children (12.70 %). Traditional marriages (9.52 %) generally favor households with 3 children (4.76 %), while divorced and widowed individuals, despite their lower numbers (4.76 % and 9.52 % respectively), demonstrate continued parenthood even after the dissolution of the union.

Table I. Number of Children by Marital Status in the 3rd District

	Number of children							
Marital status	0	1	2	3	4	5	6	Total
Single	3.17	0.00	0.00	1.59	0.00	1.59	0.00	6.35
Cohabitation	1.59	1.59	11.11	6.35	3.17	3.17	0	26.98
Divorced	1.59	0.00	0.00	1.59	0.00	0.00	1.59	4.76
Legally married	0.00	1.59	14.29	12.70	11.11	3.17	0.00	42.86
Traditionnally married	0.00	1.59	3.17	4.76	0.00	0.00	0.00	9.52
Widowed	0.00	0.00	1.59	4.76	3.17	0.00	0.00	9.52
Total	6.35	4.76	30.16	31.75	17.46	7.94	1.59	100

In terms of GBV, Andravoahangy Est registers the highest proportion at 23.81 %, followed by Andranomahery Ankorondrano (17.46 %) and Tsaramasay (19.05 %), suggesting that these neighborhoods are particularly affected by such violence. Neighborhoods such as Ampandrana Besarety (7.94 %) and Andravoahangy Tsena (11.11 %) also show relatively high GBV rates, while other areas like Andraisoro (3.17 %) and Ampandrana Est (4.76 %) record lower percentages, though still of concern.

Table II. Number of GBV Incidents by Neighborhood in the 3rd District

Neighborhood	Number of GBV incidents
Ampandrana besarety	7.94
Ampandrana est	4.76
Andraisoro	3.17
Andranomahery ankorondrano	17.46
Andravoahangy est	23.81
Andravoahangy tsena	11.11
Andravoahangy tsena	1.59
Androhibe	4.76
Ankadindramamy	1.59
Ankorondrano est	1.59
Avaradoha	1.59
Mahavoky	1.59
Tsaramasay	19.05
Total	100.00

Regarding the types of violence, mixed violence which combines several forms of abuse is the most widespread, representing 50.77 % of cases. Psychological violence follows at 29.23 %, indicating that nearly one-third of the incidents involve assaults on mental integrity. Economic violence is also notable, accounting for 12.31 % of cases, reflecting situations where individuals are deprived of financial resources or means of subsistence. Physical and sexual violence are 4.62 % and 3.08 % respectively figures which, although lower, still demand particular attention due to their severity and traumatic consequences for victims.

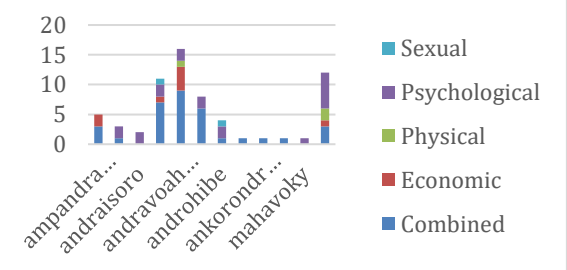

Figure 1. Type of Violence by Neighborhood in the 3rd District

Andranomahery Ankorondrano presents a high percentage of partner-related violence (10.77 %) as well as a significant rate of family-related incidents (4.62 %). Other neighborhoods such as Andravoahangy Est and Tsaramasay also display notable levels of violence, with respective figures of 24.62 % and 18.46 %, indicating a marked prevalence of family and partner-related violence.

In neighborhoods like Ampandrana Besarety and Androhibe, the data show more moderate results, with percentages ranging from 3.08 % to 7.69 %. However, it is noticeable that gender-related violence connected to current or past partners remains significant across different neighborhoods, as evidenced by the overall total of 33.85 % of cases.

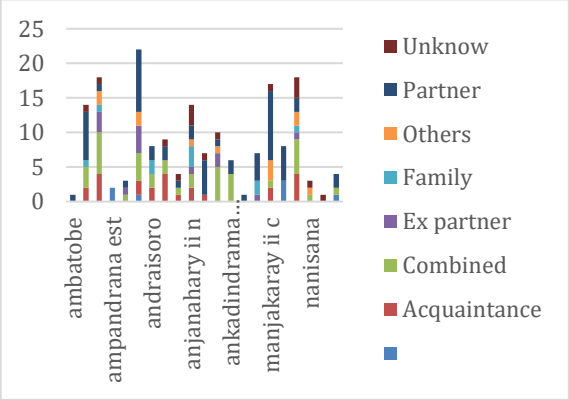

Figure 2.Identity of agressors by Neighborhood in the 3rd District

The GBV in these neighborhoods results from a combination of factors, with multiple causes accounting for 66.04 % of the cases. Thus, in neighborhoods such as Andravoahangy Est and Andranomahery Ankorondrano, high rates of multiple causes are observed (24.53 % and 15.09 % respectively). In some neighborhoods, isolation appears as the unique or dominant cause as in Ampandrana Besarety (7.55 %) whereas in Ampandrana Est, drug use predominates (5.66%).

Table III. Causes of GBV by Neighborhood in the 3rd District

Neighborhood	Causes							
	A1	A2	A3	A4	A5	A6	A7	Total
Ampandrana besarety	0,00	0.00	0.00	0.00	0.00	0.00	7.55	7.55
Ampandrana est	0.00	0.00	0.00	5.66	0.00	0.00	0.00	5.66
Andranomahery ankorondrano	3.77	0.00	0.00	0.00	0.00	1.89	15.09	20.75
Andravoahangy Est	0.00	0.00	1.89	1.89	1.89	0.00	24.53	30.19
Andravoahangy tsena	0.00	0.00	0.00	0.00	0.00	1.89	11.32	13.21
Andravoahangy tsena	0.00	0.00	0.00	0.00	0.00	0.00	1.89	1.89
Androhibe	0.00	0.00	0.00	3.77	0.00	0.00	0.00	3.77
Ankadindramamy	0.00	0.00	0.00	1.89	0.00	0.00	0.00	1.89
Ankorondrano est	1.89	0.00	0.00	0.00	0.00	0.00	0.00	1.89
Avaradoha	0.00	0.00	0.00	0.00	0.00	0.00	1.89	1.89
Mahavoky	0.00	0.00	1.89	0.00	0.00	0.00	0.00	1.89
Tsaramasay	0.00	1.89	0.00	3.77	0.00	0.00	3.77	9.43
Total	5.66	1.89	3.77	16.98	1.89	3.77	66.04	100.00

A1: History of violence; A2: Others; A3: Unemployment; A4: Drug use; A5: Low education; A6: Isolation; A7: Multiple causes

In Andravoahangy Est, where the overall rate reaches 24.24 %, one can imagine that residents face repeated episodes of violence, making their daily lives particularly difficult. In contrast, neighborhoods such as Ampandrana Besarety and Ampandrana Est, with lower percentages of 7.58 % and 6.06 % respectively, may either have fewer incidents or the incidents may be underreported. Other neighborhoods, such as Andranomahery Ankorondrano and Tsaramasay, display intermediate levels (16.67 % and 18.18 % respectively), illustrating a reality where, even if violence is not omnipresent, it remains significant enough to affect residents' lives.

The description of Andravoahangy Est is repeated to emphasize that its overall rate of 24.24 % indicates residents likely face recurrent violence, while lower percentages in other neighborhoods might suggest either fewer incidents or underreporting. Similarly, neighborhoods like Andranomahery Ankorondrano and Tsaramasay show intermediate levels of violence.

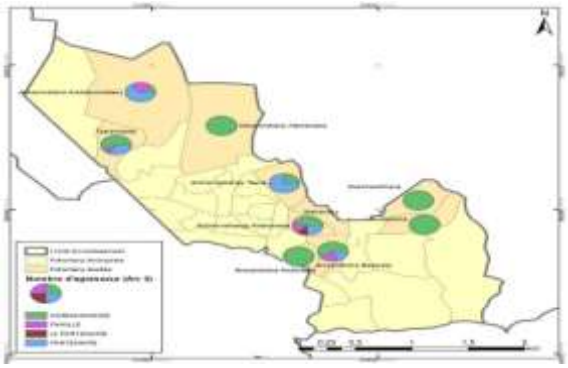

Figure 3.Identity of agressors GBV Antananarivo 3rd

Another interesting study comes from Spain. García & López (2022) examined the impact of family structures on domestic violence in urban areas, finding that households with strong social cohesion benefit from better support and exhibit lower rates of violence.

These conclusions suggest the potential for prevention strategies based on strengthening social networks and community support, elements that are also relevant for the neighborhoods of Antananarivo (Rakotomalala & Andrianarisoa, 2022).

Furthermore, Johnson et al. (2023) conducted a multi-country analysis emphasizing that socio-economic determinants such as unemployment and economic precariousness play a central role in the prevalence of GBV. Their work provides a global perspective that complements the Malagasy analysis by demonstrating that, even in diverse cultural and geographical contexts, structural factors converge to increase the risk of violence.

Data related to the distribution of the number of children according to marital status highlight marked differences. Single individuals show low fertility (6.35 %), whereas cohabiting couples and legally married couples present higher rates, predominantly with households of two or three children. These family dynamics directly influence vulnerability to GBV. In environments where family relationships are complex, intrafamilial conflicts may be exacerbated by difficult economic conditions, leading to an escalation of tensions and violence (Andriamihaja & Raharimanana, 2023).

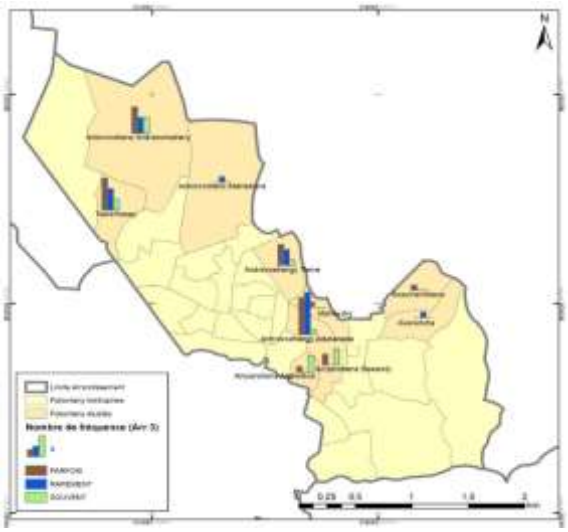

Figure 4. Frequency of GBV in the 3rd District of Antananarivo

From an international perspective, studies such as those by García & López (2022) and Smith & Brown (2022) show that stable family environments with a strong social support network reduce the risk of domestic violence. These findings underscore the importance of an integrated approach that combines social development and urban planning to create safer living environments.

The causes of GBV identified in the survey with 66.04 % of cases attributable to multiple factors (history of violence, isolation, drug consumption, unemployment) highlight the complexity of the mechanisms behind violence. These factors are closely interrelated and form a network of vulnerabilities that, if not addressed holistically, perpetuates violence. International literature consistently emphasizes that combating GBV must integrate economic, social, and spatial dimensions (Müller et al., 2023 ; Johnson et al., 2023). In Madagascar, as elsewhere, a detailed understanding of these determinants is essential for developing effective prevention strategies.

The spatial disparities highlighted by this study point to the need for public policies that incorporate a geographical dimension. Mapping risk zones not only helps identify the most vulnerable neighborhoods but also guides the design of targeted interventions. For example, establishing support centers for GBV victims in the identified “hotspots”such as Andravoahangy Est or Tsaramasay could facilitate access to support services and improve responsiveness in emergency situations (Randrianasolo & Ralambomahay, 2024).

International experiences, notably in Germany (Müller et al., 2023) and the United States (Smith & Brown, 2022), show that an interdisciplinary approach combining urban planning, sociology, and public health can reduce territorial inequalities and enhance the safety of populations. Integrating spatial data into urban planning thus offers an opportunity to optimize resource allocation and tailor interventions to local realities.

Moreover, strengthening data collection is essential for refining analyses and measuring the impact of implemented policies. Continuous monitoring of GBV, combined with regular geographical analysis, would allow for adjusting prevention strategies according to evolving field conditions. Partnerships between local institutions, non-governmental organizations, and international bodies are crucial to facilitate knowledge exchange and the implementation of effective monitoring systems (Rakotomalala & Andrianarisoa, 2022).

Comparisons with international studies demonstrate that, despite different cultural and economic contexts, certain determinants of GBV are universal. For example, the study by Johnson et al. (2023) highlights that unemployment and economic precariousness significantly increase the risk of violence across various contexts, which aligns with the findings in the 3rd District of Antananarivo. Similarly,

research conducted by García & López (2022) in Spain underscores the importance of family support and social networks in reducing domestic violence.

These convergences indicate that a multi-level, intersectoral strategy is imperative in the fight against GBV. Adopting a holistic approach that considers not only individual and family factors but also territorial and economic determinants is a necessary condition for sustainably reducing violence. This interdisciplinary perspective is especially relevant in a globalized context, where the exchange of practices and experiences can enrich local strategies (Randrianasolo & Ralambomahay, 2024 ; Smith & Brown, 2022).

4. Discussion

The strong predominance of females in the survey can be explained by an increased exposure to violence and a greater propensity to report abuses experienced (Andrianavalona et al., 2022). In the Malagasy context, women are often on the front line when it comes to addressing domestic violence and sexual abuse, which results in more active participation in surveys and support initiatives. However, the low representation of men raises the issue of underreporting, potentially linked to socio-cultural norms that stigmatize male victimization (Randrianarisoa et al., 2023). The spatial analysis of responses shows that certain neighborhoods have a high number of respondents, suggesting that the most densely populated and economically deprived urban areas, such as Andravoahangy Est, concentrate both strong female participation and a high incidence of GBV. These observations are in line with recent studies demonstrating that rapid urbanization and a lack of adequate infrastructure can exacerbate gender inequalities and vulnerability to violence (Tsiamalala et al., 2024).

The mapping of GBV cases reveals an unequal distribution across neighborhoods. For instance, neighborhoods like Andravoahangy Est, Tsaramasay, and Andranomahery Ankorondrano record significant percentages of cases, which can be attributed to a combination of factors such as population density, poverty, and limited access to social services. For example, the concentration of GBV in Andravoahangy Est (23.81 %) is likely the result of an overcrowded urban environment combined with insufficient resources for victim support (Raveloarisoa et al., 2023). In contrast, neighborhoods with low representation in the survey, such as Ankadindramamy, Avaradoha, and Mahavoky (each 1.52 %), could either signal a lower incidence of violence or indicate underreporting related to social isolation or the lack of data collection structures (Rasoanaivo & Rakotomalala, 2022).

The mapping and spatial analysis tools used in the study help to detect “hotspots” of violence. These critical zones require special attention and targeted interventions. International studies show that identifying these areas enables local authorities to allocate resources more effectively and design prevention strategies that are adapted to local realities (Smith & Brown, 2022). Moreover, spatial analysis allows for exploring the correlation between socio-economic factors and the prevalence of GBV, which is essential for the implementation of integrated public policies.

The results observed in the 3rd District of Antananarivo resonate with several international studies. For example, research conducted by Smith and Brown (2022) in the United States demonstrated that urban density and limited access to social services significantly increase vulnerability to GBV in urban areas. Their geomatic approach directly compares the structural factors identified in Antananarivo, such as poverty and isolation, with determinants of violence in American contexts.

In Europe, Müller et al. (2023) in Germany showed that the integration of geographical data into the analysis of GBV makes it possible to identify correlations between family dynamics and the spatial distribution of violence. Their study emphasizes the importance of social and familial structures in reducing cases of domestic violence. These results reinforce the findings observed in Madagascar, where marital configurations particularly cohabitation and civil marriage—are associated with higher fertility rates and, consequently, with complex family environments that may be conducive to conflicts and violence (Andriamihaja & Raharimanana, 2023).

5. Conclusion

The spatial analysis of gender-based violence in the 3rd District of Antananarivo reveals marked disparities in terms of gender distribution, family structures, and socio-economic determinants. The high prevalence of female respondents and the concentration of GBV cases in certain neighborhoods illustrate the complex interaction between social and spatial dynamics. The comparison with international studies, including those conducted in the United States,

Germany, and Spain, highlights common trends—particularly the impact of urban density, unemployment, and social isolation on the occurrence of violence.

These results call for a rethinking of prevention and intervention strategies for GBV. It appears essential to develop integrated public policies based on a fine-scale spatial analysis to target the most vulnerable areas and adapt interventions to local realities. Simultaneously, strengthening data collection and promoting interdisciplinary partnerships are critical to ensure the relevance and effectiveness of prevention measures.

In summary, the study of the 3rd District of Antananarivo provides valuable insights into the territorial dynamics of GBV while emphasizing the importance of a comprehensive and internationally comparative approach. The lessons learned from this analysis could serve as a model for other urban contexts facing similar challenges, reinforcing the importance of spatial research in the fight against gender-based violence.

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