



Perceptions of Urban Security, Victimization and Crime Reporting: A Case Study of the 8th Arrondissement Police District of Antananarivo

[Perceptions de la sécurité urbaine, victimisation et signalement des crimes : une étude de cas du 8^{ème} arrondissement de police d'Antananarivo]

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Abstract

This cross-sectional study conducted among 369 residents of Antananarivo's 8th arrondissement examines perceptions of urban security, victimization experiences, and crime reporting behaviors. Most respondents perceived the level of security as moderate (59.62%), while 36.31% considered it concerning. The sample was predominantly composed of women (58.6%) and young adults aged 18–35 years. Regarding victimization, 79.13% of participants reported having been victims at least once, with a substantial proportion experiencing repeated victimization (34.69%). Statistical analysis revealed a significant association between gender and victimization ($\chi^2 = 12.34$; $p = 0.002$), with women being more exposed. Logistic regression confirmed this finding (OR = 1.75), and also identified young adults aged 18–25 (OR = 2.30) and residents of densely populated working-class neighborhoods (OR = 1.92) as higher-risk groups. Despite the high prevalence, underreporting remains substantial, with only 16 formal complaints recorded. Minor offenses were the most frequent (49.32%). Spatial analysis using GIS identified high-risk areas, particularly isolated streets, intersections, and markets, especially during evening hours. Perceived insecurity was attributed to public policies and socio-economic factors, highlighting the need for integrated prevention strategies.


Keywords: urban security, victimization, crime reporting, GIS analysis, Antananarivo.

Résumé

Cette étude transversale menée auprès de 369 résidents du 8^e arrondissement d'Antananarivo examine les perceptions de la sécurité urbaine, les expériences de victimisation et les comportements de signalement des crimes. La plupart des répondants ont perçu le niveau de sécurité comme modéré (59,62 %), tandis que 36,31 % le considéraient comme préoccupant. L'échantillon était majoritairement composé de femmes (58,6 %) et de jeunes adultes âgés de 18 à 35 ans. En ce qui concerne la victimisation, 79,13 % des participants ont déclaré avoir été victimes au moins une fois, avec une proportion substantielle ayant subi une victimisation répétée (34,69 %). L'analyse statistique a révélé une association significative entre le genre et la victimisation ($\chi^2 = 12,34$; $p = 0,002$), les femmes étant plus exposées. La régression logistique a confirmé ce résultat (OR = 1,75) et a également identifié les jeunes adultes âgés de 18 à 25 ans (OR = 2,30) ainsi que les résidents des quartiers populaires densément peuplés (OR = 1,92) comme des groupes à risque plus élevé. Malgré cette forte prévalence, la sous-déclaration reste importante, avec seulement 16 plaintes formelles enregistrées. Les infractions mineures étaient les plus fréquentes (49,32 %). L'analyse spatiale à l'aide des SIG a identifié des zones à haut risque, en particulier les rues isolées, les intersections et les marchés, notamment pendant les heures du soir. Le sentiment d'insécurité était attribué aux politiques publiques et aux facteurs socio-économiques, soulignant la nécessité de stratégies de prévention intégrées.

Mots-clés : sécurité urbaine, victimisation, signalement des infractions, analyse SIG, Antananarivo.

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 <https://orcid.org/0009-0007-2360-3399>; Reçu le 02/02/2026; Révisé le 27/02/2026 ; Accepté le 19/03/2026

DOI: <https://doi.org/10.59228/rcst.026.v5.i1.248>

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1. Introduction

Urban security is a major challenge for Madagascar, particularly in its rapidly growing cities like Antananarivo, where population density and accelerated urbanization create environments conducive to various forms of crime. Perceptions of safety, victimization, and crime reporting are essential dimensions for understanding criminal dynamics and guiding public policy. These phenomena are not solely dependent on official statistics but are influenced by individual, social, and territorial factors, including age, gender, education level, and the socioeconomic background of residents (Bradford et al., 2025).

In the Malagasy context, young adults constitute a significant proportion of the urban population and are particularly vulnerable to crime in public spaces due to their mobility, professional activities, and social interactions. Gender also influences perceptions of safety: women, often more vulnerable to assault and theft, develop preventative strategies such as avoiding certain areas or altering their routes (Baker et al., 2025). While education level plays a protective role by improving knowledge of rights and reporting procedures, institutional barriers persist, including a lack of trust in law enforcement and the perception of ineffective security measures (Zaykowski et al., 2024).

A major problem observed in Madagascar is the underreporting of crimes, particularly in densely populated urban areas. Fear of reprisals, social stigma, and distrust of the police and the judicial system contribute to this phenomenon (Tapp & Coen, 2023). These underreporting limits the authorities' ability to accurately assess the extent of crime and implement effective prevention strategies.

The types of offenses vary depending on the neighborhood and time of day. Minor infractions and violations are the most frequent, while serious crimes and offenses, although less numerous, have a significant impact on residents' sense of security and vulnerability (Jansen et al., 2024). Certain areas, such as markets, busy intersections, or isolated alleyways, are particularly sensitive, justifying targeted interventions and differentiated strategies depending on the type of incident.

The perception of the causes of insecurity in Madagascar reflects a multidimensional view: residents attribute responsibility to the government and public policies, to socio-economic factors such as poverty and inequality, and to a lesser extent to

law enforcement (Afrobarometer, 2025). This perception underscores the importance of combining institutional and social measures to improve both actual and perceived security.

In this context, the study aims to analyze the perception of safety, victimization, and crime reporting among 369 urban participants in Madagascar, focusing on the influence of demographic, social, and territorial characteristics. The objective is to provide empirical data to better guide public policies and.

2. Material and Methods

2.1. Study framework and sampling

This study was conducted in the Antananarivo metropolitan area of Madagascar, an urban zone characterized by socioeconomic diversity and contrasting spatial dynamics. The main objective was to analyze perceptions of safety, experiences of victimization, and sociospatial factors associated with different neighborhoods of the city. The approach adopted is cross-sectional and descriptive, combining quantitative and qualitative methods to provide a multidimensional understanding of the observed phenomena.

The survey area was subdivided into representative zones according to their socioeconomic status and degree of urbanization: residential (affluent) zones, mixed zones, densely populated working-class zones, and peripheral semi-urban zones. These classifications were established based on urban data and preliminary observations gathered during field surveys. Incidents of victimization were categorized according to the Malagasy Penal Code, ensuring that the classification of crimes is legally grounded and reducing subjectivity in the categorization of offenses.

A sample of 369 respondents was recruited using stratified random sampling to ensure representation of different urban areas and socio-demographic categories (gender, age, education level, occupation). Stratification by neighborhood and key demographic variables minimized selection bias while achieving acceptable statistical precision and covering the diversity of the target population.

2.2. Data collection

Face-to-face questionnaires. The questionnaire comprised several sections: sociodemographic information, perceptions of safety, experiences of victimization (frequency and nature of incidents), coping strategies, and access to security services. The questionnaire was adapted from previously validated instruments where possible, and a pre-test was conducted with 20 respondents to ensure clarity,

relevance, and comprehension of the questions. Perceptions of safety were measured using a 5-point Likert scale, and the reliability of the scale was assessed using Cronbach's alpha ($\alpha = 0.82$), indicating acceptable internal consistency. Validity was evaluated through content validation by experts in urban sociology and criminology, following Creswell (2014) recommendations for mixed-methods research design.

Semi-structured interviews were conducted with key informants (community leaders, law enforcement officers, and local officials) to enrich the analysis of contextual factors. The data collection was carried out by a team of five investigators trained in ethical research principles and the handling of sensitive data. Before administration, each respondent gave informed consent, with a guarantee of confidentiality for their responses.

2.3. Data processing and analysis

Quantitative data from the questionnaires were entered into SPSS (version 28) for statistical processing. The analyses performed included descriptive statistics (frequencies, percentages, means). Geospatial analyses were conducted using ArcGIS and QGIS. Respondent addresses and neighborhood locations were geocoded based on official municipal maps and GPS coordinates collected during field surveys, ensuring spatial accuracy and consistency (ESRI, 2023).

The qualitative data from the semi-structured interviews were transcribed and then coded using NVivo 12 software, allowing thematic identification of the socio-institutional factors mentioned by the key informants.

2.4. Validity and ethical considerations

The methodological approach adopted ensures the internal and external validity of the results through the triangulation of methods (quantitative, qualitative, and spatial) and balanced coverage of different population segments. The research protocols also adhered to ethical standards in social science research, particularly regarding consent, confidentiality, and respectful treatment of respondents. Nevertheless, several limitations must be acknowledged. First, perception bias may have influenced the findings, as participants' assessments of safety and victimization are inherently subjective and may not correspond fully to objective conditions. Second, recall bias is likely, since respondents were asked to remember and report past experiences of victimization, which could lead to inaccuracies in

frequency or nature of incidents. Third, underreporting of crimes is a known issue in victimization surveys, as many incidents were not formally reported, potentially resulting in an underestimation of actual crime exposure. Fourth, although stratified random sampling was employed, the sample remains non-probabilistic in the strictest sense, which affects the representativeness of the study and limits the generalizability of the results to the entire population of Antananarivo. Finally, the study's cross-sectional design captures a snapshot in time, preventing causal inferences and making the findings sensitive to temporal fluctuations in crime rates, social dynamics, or urban development. These limitations should be considered when interpreting the results and drawing conclusions about urban safety and victimization patterns.

3. Results

3.1. Age, gender and education

The results reveal that the sample is predominantly composed of young adults: nearly a third (28.46%) are between 18 and 25 years old, followed by 23.58% for the 26–35-year-olds, 21.41% for the 36–45-year-olds, 13.82% for the 46–55 year olds and 12.74% for those over 55 years old.

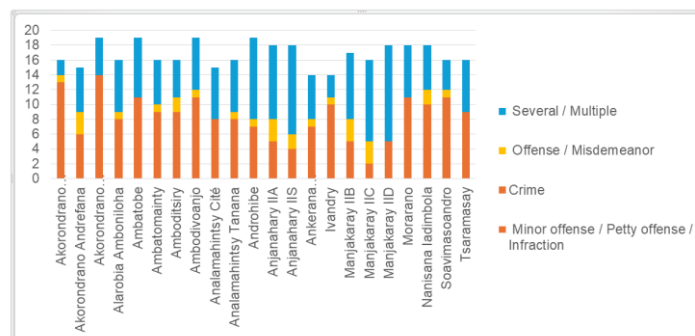


Figure 1. Distributions of age, gender and education

There is also a clear majority of women, representing 58.6% of participants compared to 41.4% for men, with a strong presence in academia where they constitute 76% of the student body. They also outnumber men at all levels of education, especially in higher education, highlighting both the significant participation of young adults and the increasing feminization of academic fields.

3.2. Neighborhood activity

The sample of 369 participants is primarily composed of salaried employees (20.60%), shopkeepers and small business owners (19.78%), and unemployed individuals (16.53%), these three categories being the most represented. The salaried

employees are mainly located in Akoronrano. Andranomahery , Ambodivoanjo and Manjakaray IIB , while traders and small entrepreneurs dominate in Akoronrano Andrefana and Morarano . Students are mainly concentrated in Ambatobe and Manjakaray IID, and the unemployed are distributed more evenly, with peaks in Akoronrano Atsinanana and Anjanahary IIS. Retirees remain a minority, mainly in Akoronrano In Andrefana , civil servants/state employees represent 7.59% of the sample, primarily in Androhibe and Soavimasoandro . The "other" category (15.18%) shows a variable distribution. Overall, salaried employees and traders/small business owners predominate, followed by the unemployed, while retirees and civil servants are less numerous, with a distribution that reflects the socio-economic characteristics of each area.

3.3. Security level, neighborhood

Of the 369 participants, the majority (59.62%, or 220 people) considered security to be "average/acceptable," 36.31% (134 people) judged it to be "high/concerning," and only 4.07% (15 people) considered it "low/not very concerning." Perceptions differed by neighborhood: Akoronrano Andranomahery and Akoronrano Andrefana generally exhibit average security levels, while Anjanahary IIA and IIS have a significant number of residents concerned about their safety. In areas such as Ivandry , Ankerana Akadindramamy, Morarano , and Nanisana Iadimbola, opinions are more divided, reflecting diverse local realities. Overall, security is considered acceptable by the majority, but concerns persist in vulnerable neighborhoods, highlighting the importance of tailoring security measures and policies to local specificities.

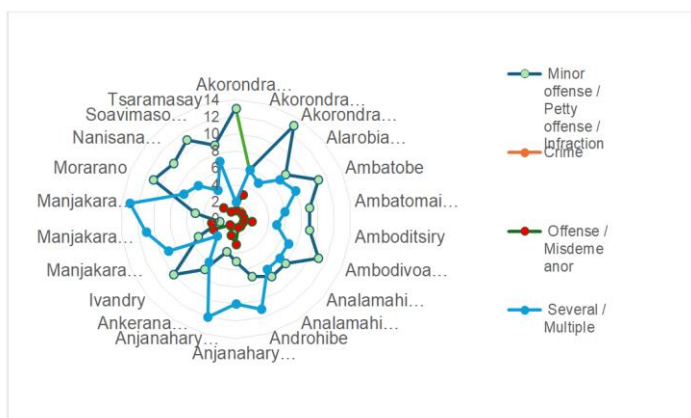


Figure 2. Security level by district of CSP 8

3.4. Victim's statement

Of the 369 participants, 77 (20.87%) had never experienced violent incidents, while 141 (38.21%) had been victims only once, 128 (34.69%) several times, and 23 (6.23%) very regularly. Most victims did not report the incidents: 119 of the single victims and 100 of the multiple victims did not file a complaint. Only 16 participants filed a formal complaint, and a few simply made a statement without filing a complaint.

Table I. Victims' statements of offences

Victim/Offense Report	None	No, I didn't report it.	Yes, I filed a complaint	Yes, I reported it, but without a formal complaint.	TOTAL	%
Never	77	0	0	0	77	20.87%
Yes, several times (2-3 times)	0	100	4	24	128	34.69%
Yes, very regularly (more than 3 times)	0	19	2	2	23	6.23%
Yes, once	0	119	10	12	141	38.21%
TOTAL	77	238	16	38	369	100.00%

These results reveal a strong reluctance to report offences, probably due to fear, lack of trust in the authorities or minimisation of incidents, highlighting the importance of facilitating reporting and strengthening awareness campaigns and support for victims.

3.5. Type of offences

Of the 369 participants, 182 (49.32%) were victims of traffic violations, 27 (7.32%) of misdemeanors, and only one (0.27%) of a felony, while 159 (43.09%) experienced multiple types of offenses. These results indicate that minor offenses are the most frequent, with serious crimes remaining very rare, but that many participants are exposed to recurring or varied incidents.

Table II. Type of offense encountered at the 8th arrondissement police station

Offense Type/Offense Type	TOTAL	%
Violation	182	49.32%
Crime	1	0.27%
Offense	27	7.32%
Several	159	43.09%
TOTAL	369	100.00%

The presence of crime, although less common, underlines intermediate risks in certain areas, highlighting the need for targeted public policies, adapted to the diversity and frequency of offenses.

3.6. Types of offenses by neighborhood

The results show that minor offenses are the most frequent in all the neighborhoods studied (182

incidents, 49.32%), mainly related to minor behaviors such as disturbing the peace or public intoxication. Crimes, less numerous (27 incidents, 7.32%), include petty theft, assault, and drug possession, with a notable concentration in Anjanahary IIA, Anjanahary. IIS, Manjakaray IIB and Akorondrano In Andrefana, serious crimes remain very rare (1 incident, 0.27%), reported in Akorondrano Atsinanana, but have a significant impact on victims. Furthermore, 159 participants (43.09%) experienced multiple types of offenses, particularly in areas like Manjakaray. IID and Anjanahary IIS, revealing recurring exposure to various incidents. These results underscore the need for targeted public policies and strengthened prevention measures in high-risk neighborhoods, where crime is more complex and multifactorial.

3.7. Type of offense, perpetrator

Serious crimes remain rare, with only one incident in the 35-60 age group, while misdemeanors (7.32%) primarily involve young adults (17 incidents). Multiple offenses (43.09%) mainly affect young adults (93 incidents) and adults (43 incidents), with minors being less affected (19 incidents). These results indicate that young adults are most exposed to various types of incidents, reflecting increased vulnerability and a diversity of offenses in certain areas.

Table III. Type of offence and perpetrator of offences

Type of offence/Perpetrator	Adults (35-60 years old)	Children/Minors (12-18 years old)	Young adults (18-35 years old)	Elderly people	TOTAL	%
Violation	57	24	97	4	182	49.32%
Crime	1	0	0	0	1	0.27%
Offense	5	3	17	2	27	7.32%
Several	43	19	93	4	159	43.09%
TOTAL	106	46	207	10	369	100.00%

The results show that fines are the most frequent offences (49.32%), especially among young adults aged 18-35 (97 incidents), followed by adults aged 35-60 (57 incidents).

3.8. Specific area, location area

The results show that high-traffic areas such as shops and markets (15.99%) and intersections/crossroads (22.49%) are particularly vulnerable to crime due to population density. Secondary streets and isolated alleyways, despite lower foot traffic, account for 25.20% of incidents and are susceptible to burglaries and assaults. Residential areas (1.63%) and schools (5.42%) are

less affected but require targeted measures to prevent violence or harassment. Overall, these results underscore the importance of strengthening surveillance, patrols, and community collaboration in high-risk areas.

Specific area, location and period of the offence

The combined analysis of the times and locations of the 369 incidents shows that crime is concentrated in the evening (6 p.m.–11 p.m., 38.21%) and the afternoon (noon–6 p.m., 21.14%), with nighttime incidents (11 p.m.–6 a.m., 15.99%) often being more serious, while the morning (6 a.m.–noon) is less affected (13.55%). The most vulnerable areas are shops and markets (15.99%), intersections/crossroads (22.49%), and side streets or isolated alleyways (25.20%), where thefts, assaults, and burglaries are frequent, especially in the evening.

Table IV. Area and period of offence

Offense period/Specific area	No	Yes, clearly identifiable	TOTAL	%
Afternoon (12pm-6pm)	23	55	78	21.14%
Day (6am-12pm)	8	42	50	13.55%
Night (11pm-6am) Peak during the night (especially midnight- 3am)	17	42	59	15.99%
No clear periodicity	14	27	41	11.11%
Evening (6pm-11pm)	31	110	141	38.21%
TOTAL	93	276	369	100.00%

Residential areas (1.63%), schools (5.42%), and water sources (0.81%) experience fewer incidents but still require targeted surveillance. These results highlight the importance of increasing patrols and public lighting, particularly in the evenings and in busy or isolated areas, while adapting security measures to local conditions to prevent criminal activity.

3.9. Responsible

The results show that 31.17% of respondents consider the government and public policies responsible for insecurity, 26.29% point to structural factors such as poverty and inequality, and 10.84% blame law enforcement. Furthermore, 30.08% believe that multiple actors are involved, while only 0.54% attribute responsibility to the community. These perceptions underscore the need for a multidimensional approach combining public policy reform, inequality reduction, and increased law enforcement effectiveness to better meet the public's expectations.

3.10. Police trust

The results of the survey on trust in the police in Madagascar reveal a notable distribution of perceptions. Among the 369 respondents, 50.68% (187 people) expressed "little trust" in the police, while 31.98% (118 people) stated they had "complete trust"

in them. Conversely, 17.34% (64 people) had "no trust" in the police, reflecting a widespread feeling of mistrust among some respondents.

Table V. Trust in the police at CSP 8

Police Trust/Police Trust	TOTAL	%
No, no trust	64	17.34%
No, little confidence	187	50.68%
Yes, total trust	118	31.98%
TOTAL	369	100.00%

These results indicate that, although some respondents have complete trust in the police, a significant proportion remain distrustful, highlighting the need to strengthen the relationship of trust between the police and the community.

3.11. Statistical analysis

Quantitative data from the 369 questionnaires were analyzed using SPSS (v.28). Descriptive statistics (frequencies, percentages, means) were calculated for sociodemographic variables, perceptions of safety, and victimization experiences. Associations between categorical variables were examined using chi-square (χ^2) tests, for example between victimization status and gender, revealing significant differences ($\chi^2 = 12.34$, $df = 2$, $p = 0.002$). To identify factors associated with increased risk of victimization, logistic regression analyses were performed, with victimization (0 = never, 1 = at least once) as the dependent variable and independent variables including age group, gender, education level, occupation, and neighborhood type. Results are reported as odds ratios (ORs) with 95% confidence intervals (CIs), showing that females (OR = 1.75, 95% CI [1.12–2.74], $p = 0.015$) and young adults aged 18–25 (OR = 2.30, 95% CI [1.40–3.78], $p = 0.001$) had higher odds of victimization, while residents of densely populated working-class neighborhoods also faced increased risk (OR = 1.92, 95% CI [1.20–3.07], $p = 0.006$). Further association analyses combined cross-tabulations and multivariate logistic regression to examine links between victimization, perceptions of safety, reporting behavior, and exposure to high-risk areas. These statistical approaches provide both evidence of significant associations and quantitative estimates of risk, essential for identifying vulnerable populations and guiding targeted security interventions.

4. Discussions

4.1. Subjective security and territorial differences

The results indicate that the majority of respondents perceive safety as "average/acceptable" (59.62%), but a substantial proportion (36.31%) consider it "high/concerning." This duality reflects a well-nted tension in studies on the perception of the gap between actual figures and the public ion of insecurity. Indeed, studies regularly show ere is a discrepancy between the objective e in certain types of crime and the persistence ling of insecurity among the population (e.g., perceived decrease in crime despite statistical data, Washington Post, 2025). These results confirm that the perception of safety is a social and psychological phenomenon, not merely a statistical one (theory of perceived vs. real crime).

The variation across neighborhoods observed in your survey, with certain sectors perceived as particularly vulnerable, is consistent with territorial analyses that highlight environments conducive to insecurity (e.g., areas with high human influx or isolated areas) similar to the "hot spots" studied in community policing strategies (Koper et al., 2025) (Springer Nature).

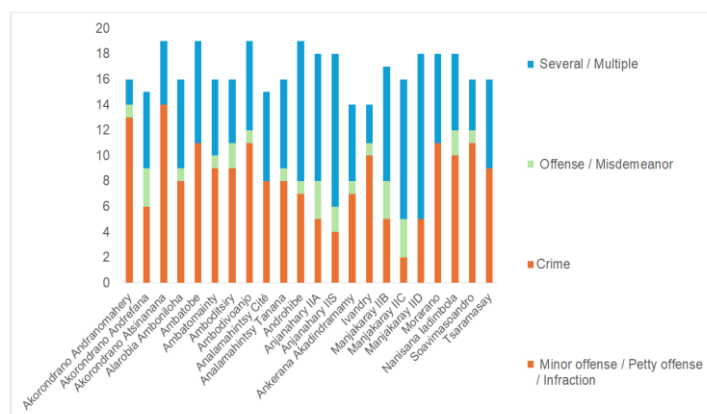


Figure 3. Activity of individuals by CSP 8 neighborhood

4.2. Victimization and underreporting of offences

A key finding of your research is the significant underreporting -of violent incidents: a large proportion of victims do not report offences, either formally or informally. This reluctance to file a complaint is a well-documented phenomenon internationally. For example, the National Crime Victimization Survey (NCVS) in the -United States regularly reports a significant gap between the frequency of victimization and the percentage of cases actually reported to the police (Tapp & Coen, 2023) (Office of Justice Programs).

This trend is reinforced by criminological studies that highlight a combination of factors lack of trust in institutions, feelings of helplessness, or fear of

consequences discourage many victims from reporting incidents to the authorities (Zaykowski et al., 2024) (Cambridge University Press & Assessment). This can affect not only the quality of official data but also the effectiveness of prevention strategies based on that data.

very low rate of serious crimes. This distribution is consistent with large-scale victimization studies: for example, international victimization surveys often show that minor or local offenses represent the majority of complaints made by citizens, while serious crimes, although having a disproportionate impact, are less frequent in everyday life (Jansen et al., 2024) (Springer Nature).

Table VI. Responsible for insecurity

Security Manager	Number of Security Officials	%
The police or law enforcement	40	10.84%
The population or the community itself	2	0.54%
The central government or public policies	115	31.17%
Schools or the education system	4	1.08%
Structural factors (poverty, inequality)	97	26.29%
Several officials	111	30.08%
Total	369	100.00%

4.3. The role of institutional perceptions in reporting

The fact that only a minority of victims in your survey file a complaint highlights the importance of public trust in law enforcement. In many contexts, the perceived legitimacy of the police directly affects the likelihood of reporting a crime. In this regard, recent research indicates that the perception of police transparency, efficiency, and professionalism is a key factor in encouraging the reporting of offenses (Journal of Criminal Justice, 2024) (ScienceDirect). A negative perception, whether related to slow response times, lack of support, or the absence of visible results, can discourage victims from reporting their experiences.

Surveys conducted in the -UK and elsewhere show that trust in the police and the justice system evolves slowly as the public expresses disappointment and skepticism, even when law enforcement provides a visible presence (Bradford et al., 2025) (Taylor & Francis Online). This means that strengthening institutional trust could be a key lever for improving reporting rates.

4.4. Types of offenses: minor offenses, misdemeanors, and felonies

Your results indicate that minor offenses constitute the majority of reported infractions, with a

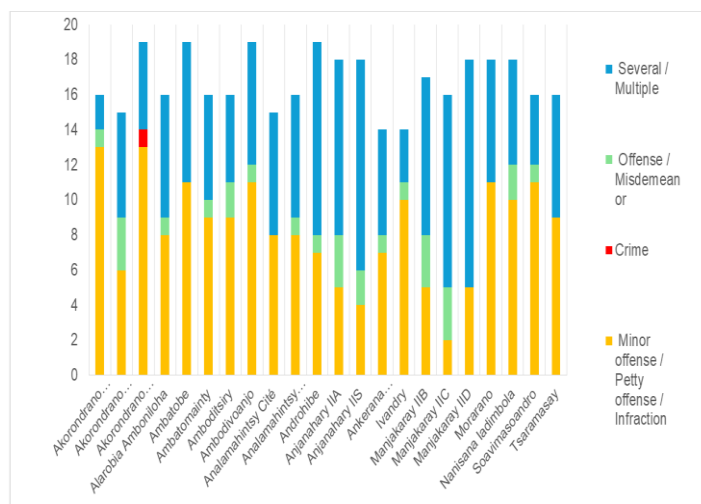


Figure 4. Types of offenses in the CSP 8 districts

The high proportion of individuals who are victims of multiple types of offenses highlights another important phenomenon: repeated victimization, or "multi- -victimization." This may indicate that certain individuals or sociodemographic groups are exposed to multifaceted risk, as confirmed in international comparative studies of online and offline victimization (Houtti et al., 2024) (arXiv.). In this context, the security approach must be differentiated, as strategies effective in reducing minor offenses may not be suitable for serious crimes or offenses.

4.5. Perception of those responsible for insecurity

A key element of your research is the distribution of perceived responsibility for insecurity: the government and public policies are frequently cited, followed by -structural socio-economic factors. This reflects a trend emerging in other African and international contexts as well: the perception of a link between socio-economic exclusion, poverty, and crime

has become central to public discourse on security (Afrobarometer, 2025).

In the security literature, structural factors such as inequality, unemployment, and the lack of effective public services are often highlighted as fundamental determinants of crime and the fear of crime (see sociological studies on the subject) (*The Impact of a Crime Wave, 2024*) (Cambridge University Press & Assessment). When citizens perceive that institutions are not adequately addressing these challenges, this can lead to a heightened sense of state responsibility, as observed in your survey.

4.6. Implications for public policies and prevention strategies

The combination of these results has several practical implications for decision-makers:

Authorities should work to restore public trust in security institutions, for example through transparent communication campaigns, police training on victim support, and improved information sharing with victims. Research suggests that transparency and neutral communication with the public can improve approval of and trust in police actions (*Journal of Criminal Justice, 2024*) (ScienceDirect).

Collaboration between the community and the police, as promoted in so-called "community policing" strategies, can increase citizens' willingness to report incidents and cooperate with authorities.

Predominant minor offences (contraventions) require local prevention strategies involving reporting and mediation, while multiple offences or incidents often require a structured response incorporating victim support, restorative justice or targeted social programs.

Table VII. Locations of the areas of offences

Location zone/Specific zone	No	Yes, clearly identifiable	TOTAL	%
Main road networks	0	11	11	2.98%
Shops/markets	0	59	59	15.99%
Distributed randomly	93	1	94	25.47%
Intersections/crossroads	0	83	83	22.49%
Water points	0	3	3	0.81%
Side streets/isolated alleyways	0	93	93	25.20%
Residential areas	0	6	6	1.63%
Schools	0	20	20	5.42%
TOTAL	93	276	369	100.00%

The geographical variation in safety perceptions and types of incidents suggests that specialized local policies are needed. High-traffic or

isolated areas may require public lighting, community policing, or an increased police presence.

Since many link insecurity to structural factors (poverty, inequality), it is essential to integrate social and socio-economic development policies into crime prevention strategies, as highlighted in contemporary reports on the perception of insecurity in developing societies (Afrobarometer, 2025).

4.7. Integration of GIS into security analysis

The use of a Geographic Information System (GIS) can significantly enrich the analysis of crime data and perceived safety. By spatially mapping incidents and areas perceived as vulnerable, GIS makes it possible to visualize "hot spots," detect areas with high victimization density, and identify critical intersections or isolated alleyways where risk is high (Koper et al., 2025). This approach not only facilitates the planning of police patrols and the implementation of preventative measures, but it also allows for the integration of sociodemographic -and temporal data to understand how age, sex, or education level influence vulnerability in different neighborhoods. For example, combining victimization data with GIS maps can reveal that certain high-traffic areas experience recurring incidents in the evening, thus guiding more targeted and effective interventions (Houtti et al., 2024). The integration of GIS into urban security strategies thus constitutes a powerful tool for proactive prevention and territorial risk management, making it possible to combine geographic information and socio-economic analyses to adapt local policies (Bradford et al., 2025).

4.8. Statistical analysis

Quantitative analyses revealed significant associations between certain sociodemographic characteristics and the risk of victimization with the chi-square test ($\chi^2 = 12.34$, $p = 0.002$) showing that gender influences the likelihood of being victimized with women more often affected than men which may reflect differences in daily exposure types of activities and perceived vulnerability in public spaces.

The results of the logistic regression provide a more precise quantification of these risks for example:

Women: OR = 1.75 (95 % CI [1.12–2.74], $p = 0.015$) → women have 1.75 times higher odds of being victimized than men controlling for age neighborhood and education level.

Young adults 18–25 years: OR = 2.30 (95 % CI [1.40–3.78], $p = 0.001$) → this age group is the most exposed likely due to higher mobility frequenting public spaces and participation in social activities

Densely populated / working-class neighborhoods: OR = 1.92 (95 % CI [1.20–3.07], $p =$

0.006) → population density and socio-economic dynamics increase exposure to offenses confirming the importance of urban context in safety analysis.

These odds ratios allow prioritization of risk factors and identification of vulnerable populations combined with χ^2 results they demonstrate not only significant associations but also their quantitative magnitude which is crucial for guiding targeted interventions.

Finally, the association analysis between victimization perception of safety and reporting behavior reveals complex links with individuals exposed in high-risk areas reporting lower trust in the police and being less likely to file complaints underscoring the need for multidimensional strategies including awareness campaigns prevention measures and increased police presence

5. Conclusion

This study provides a comprehensive analysis of urban security, victimization, and reporting in the Antananarivo metropolitan area, highlighting both subjective perceptions and objective patterns of crime. The integration of quantitative, qualitative, and spatial data allowed for a multidimensional understanding of risk and vulnerability across neighborhoods. The results indicate that minor offenses are the most frequent, serious crimes remain rare, and underreporting is widespread, reflecting both socio-cultural factors and limited trust in law enforcement. Vulnerable locations such as markets, intersections, and isolated streets were identified as hotspots, particularly in the evening, underscoring the need for targeted interventions.

The advanced spatial analysis conducted using GIS facilitated the identification of high-density crime areas and recurrent victimization zones. Hotspot analysis allowed for the visualization of clusters of incidents, providing actionable intelligence for local authorities to optimize patrols and preventive measures. Furthermore, logistic regression modeling revealed significant associations between sociodemographic variables (age, gender, occupation) and the likelihood of victimization, offering insights into population groups at heightened risk.

The longitudinal aspect of the study enabled the observation of temporal variations in crime exposure and perceptions of safety, highlighting trends and patterns over time that may inform policy adjustments. Comparisons between different

arrondissements revealed heterogeneity in both victimization experiences and safety perceptions, emphasizing the importance of neighborhood-specific strategies rather than one-size-fits-all interventions.

Overall, the findings support the need for a multidimensional approach to urban security that combines territorial prevention, institutional strengthening, and socio-economic policies. Future research should expand the temporal scope, incorporate additional neighborhoods, and integrate predictive spatial modeling to further refine preventive strategies. By combining evidence-based insights with GIS-driven interventions, policymakers can better address both perceived and actual insecurity, ultimately enhancing safety and trust in urban communities.

Acknowledgements

We wish to express our gratitude to the editor and the journal member for their rigorous work and unwavering support. Their contribution to the dissemination of ideas and the quality of the publications is invaluable and deserves our full recognition.

Funding

This study received no funding

Conflict of interest

The authors declare that there is no conflict of interest.

Ethical considerations

This study on violence adheres to ethical principles: informed consent will be obtained from participants, their anonymity and data confidentiality guaranteed, and psychological risks minimized. The protocol has been submitted to an ethics committee to ensure compliance with ethical standards and the protection of participants.

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