

Research Article

Mapping Vulnerability and Resilience: Spatial Analysis and Mitigation Strategies for Culturally Based Violence Against Women and Children

Mapeo de la vulnerabilidad y la resiliencia: análisis espacial y estrategias de mitigación de la violencia cultural contra mujeres y niños

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Abstract

Introduction: This study maps vulnerability to violence and resilience mechanisms among women and children in Sorong City, Southwest Papua. **Methodology:** using a mixed-methods approach with a convergent parallel design. Quantitative data were collected from 696 respondents (348 women and 348 children) and qualitative insights from 5 informants. **Results:** Violence is spatially concentrated – women face clustered physical harm in urban centers and sexual risks in specific pockets, while children show similar patterns (46.6% physical; 36.8% psychological; 2.3% sexual) and high digital vulnerability (33.0% unsupervised use; 33.6% harmful content; 27.3% cyberbullying; ~40% unaware of reporting), with women’s risk driven by trauma (39.7%), family conflict (45.1%), and home insecurity (39.1%). **Discussions:** Despite this, women show resilience through decision-making ability (57.2%), recovery capacity (59.2%), and spirituality ($\geq 50.9\%$). Children depend strongly on family support (54.6%). A consistent challenge is limited access to formal services (38.5% of women; 31.9% of children know legal/psychological referral mechanisms). **Conclusions:** The study recommends integrated mitigation strategies through place-based interventions in urban hotspots, women’s economic empowerment via culturally rooted micro-enterprises, transformation of patriarchal norms, and enhanced child protection in digital spaces – to break the cycle of violence and foster sustainable safety in Sorong City.

Keywords: Mapping; Vulnerability; Resilience; Violence Mitigation; Culture.

Resumen

Introducción: Este estudio mapea la vulnerabilidad a la violencia y los mecanismos de resiliencia entre mujeres y niños en la ciudad de Sorong, suroeste de Papúa. **Metodología:** utilizando un enfoque de métodos mixtos con un diseño paralelo convergente. Se recopilaron datos cuantitativos de 696 encuestados (348 mujeres y 348 niños) y perspectivas cualitativas de 5 informantes. **Resultados:** La violencia está concentrada espacialmente: las mujeres enfrentan daños físicos agrupados en centros urbanos y riesgos sexuales en focos específicos, mientras que los niños muestran patrones similares (46,6% físico; 36,8% psicológico; 2,3% sexual) y alta vulnerabilidad digital (33,0% uso sin supervisión; 33,6% contenido dañino; 27,3% acoso cibernético; ~40% desconocedor de la denuncia), con el riesgo de las mujeres impulsado por el trauma (39,7%), el conflicto familiar (45,1%) y la inseguridad en el hogar (39,1%). **Discusiones:** A pesar de esto, las mujeres muestran resiliencia a través de su capacidad de toma de decisiones (57,2%), capacidad de recuperación (59,2%) y espiritualidad ($\geq 50,9\%$). Los niños dependen en gran medida del apoyo familiar (54,6%). Un desafío constante es el acceso limitado a los servicios formales (el 38,5% de las mujeres y el 31,9% de los niños conocen los mecanismos de derivación legal/psicológica). **Conclusiones:** El estudio recomienda estrategias integradas de mitigación mediante intervenciones locales en zonas urbanas conflictivas, el empoderamiento económico de las mujeres mediante microempresas con arraigo cultural, la transformación de las normas patriarcales y una mayor protección infantil en los espacios digitales, para romper el ciclo de violencia y fomentar la seguridad sostenible en la ciudad de Sorong.

Palabras clave: Mapeo; Vulnerabilidad; Resiliencia; Mitigación de la Violencia; Cultura.

1. Introduction

Violence against women is a global phenomenon rooted in gender inequality, in which socially constructed roles reinforce male dominance and position women in subordinate roles (Trisnawati et al., 2024).

Violence against women and children constitutes a serious violation of human rights and may take various forms, including neglect, verbal abuse, and psychological intimidation, often leading to severe consequences, including death (Kaisar & Kurniawan, 2022). Although such violence can be addressed through social and cultural empowerment, cultural factors play a dual role: they may either strengthen resilience or perpetuate patriarchal structures that sustain violence (Tripp et al., 2019).

According to SIMFONI PPA data from the Ministry of Women's Empowerment and Child Protection (KemenPPPA), between January and March 2025 there were 4,821 reported cases of violence, of which 80.4% involved female victims and 62.6% involved children (Yamin & Prihatin, 2025). In Southwest Papua Province, 34 cases were reported, the majority involving women (Kementerian PPA, 2025).

At the local level, data from the Sorong City P3A Service recorded 91 cases of violence up to March 2025 (Laing, 2023; Safwan, 2023). Furthermore, the 2024 SPHPN and SNPHAR surveys indicate that 6.6% of women and 51.78% of girls have experienced violence, with approximately 11.5 million children affected overall (Kementerian PPA, 2024). These figures highlight the urgency of addressing violence through context-specific and evidence-based interventions.

Vulnerability to violence is closely associated with structural and socio-cultural factors, including poverty, limited economic access, low levels of education (Fahrani et al., 2023), gender conflict, and entrenched patriarchal norms (Modiano, 2021). In contrast, resilience is shaped by social support systems (Arsa & Lestari, 2024) and individual life experiences (Sapiie & Handoyo, 2023). Spatial mapping therefore becomes essential for identifying high-risk areas and informing targeted interventions (Munir S. et al., 2022).

Existing evidence suggests that effective mitigation requires multisectoral approaches involving education, economic empowerment, health services, and legal protection (Muluneh et al., 2021), alongside cultural transformation efforts that challenge patriarchal norms (Asido et al., 2023; Dinda Siska et al., 2024; Hamdy, 2022). Moreover, resilience is further strengthened by cultural and religious values (Ramli et al., 2023), family roles and community-government collaboration (Ali et al., 2023), and external support systems such as peer networks and stigma reduction initiatives (Soehardiman et al., 2024).

Despite the growing body of research, studies integrating spatial analysis and resilience in the context of culturally based violence remain limited. Kelling et al. (2021) demonstrated that spatial models can improve the analysis of domestic and sexual violence patterns, yet their study lacks explicit policy recommendations. Similarly, Salsabila et al. (2021) identified variations in violence types through correspondence mapping but did not explore causal mechanisms or policy implications.

Tielung et al. (2023) emphasized the role of institutions, leadership, and trust in safe-house collaboration, although empirical evidence of effectiveness remains limited. Ferrás et al. (2023) highlighted the importance of spatial analysis in planning services for women victims of violence but did not address implementation strategies. Other studies (Mukwidigwi & Naidu, 2024; Mission, 2024; Nasution, 2025) have examined spatial dimensions of violence but have not sufficiently integrated social, economic, and preventive policy perspectives.

This study addresses these gaps by integrating spatial mapping and resilience analysis to develop culturally grounded mitigation strategies. It focuses on four key aspects: spatial patterns of violence, contributing factors to vulnerability, resilience mechanisms, and the integration of these elements to reduce violence against women and children in Sorong City.

2. Methods

2.1. Research Design

This study employs a convergent parallel mixed-methods design, integrating quantitative and qualitative approaches conducted simultaneously to obtain a comprehensive understanding of the phenomenon (Creswell, 2018; Creswell & Clark, 2018). The quantitative component uses a survey method with structured questionnaires to collect standardized data (Babbie, 2013). Meanwhile, the qualitative component adopts an exploratory case study approach to explore participants' experiences and underlying social dynamics in depth (Merriam & Tisdell, 2016; Yin, 2018).

2.2. Sampling Design

In the quantitative phase, sampling was conducted using stratified proportional techniques based on population distribution across districts and sub-districts in Sorong City. This approach ensures proportional representation of heterogeneous populations (Babbie, 2013). The sample size was determined using the Isaac and Michael table with a 10% margin of error for large populations (Uma & Bougie, 2019). A total of 696 respondents were selected, consisting of 348 women and 348 children distributed across 41 sub-districts, as presented in Table 1.

Table 1.

Research sample distribution mechanism

No	District	Sub-districts	Population Density	Estimated Samples	Women Sample	Children Sample
1	Sorong	4	6.87	8	32	32
2	East Sorong	4	14.42	10	40	40
3	West Sorong	4	13.09	10	40	40
4	Sorong Islands	4	4.60	8	32	32
5	North Sorong	4	1.30	4	16	16
6	Sorong Manoi	5	19.79	12	60	60
7	Central Sorong	4	7.41	8	32	32
8	Klaurung	4	5.57	8	32	32
9	Malaimsimsa	4	11.17	10	40	40
10	Maladummes	4	4.12	6	24	24
	Total	41	-	-	348	348

Source: Processed by the authors, 2025.

In the qualitative phase, informants were selected using purposive sampling based on their relevance and expertise (Patton, 2015). The criteria included:

- 1) government officials and security personnel,
- 2) religious and community leaders, and
- 3) representatives from women's and child protection institutions.

Based on these criteria, five key informants were selected.

2.3. Data Collection Methods

Data were collected concurrently using multiple techniques, including questionnaires, in-depth interviews, observation, literature review, and secondary data analysis to ensure triangulation. Quantitative data were obtained through structured questionnaires administered to respondents, while qualitative data were collected through semi-structured interviews. Secondary data were sourced from official institutions such as the Sorong City Statistics Bureau (BPS), the Department of Women's and Child Protection (DP3A), and administrative spatial data (maps), which supported the spatial analysis. The use of multiple data sources aimed to enhance the validity of the study (Creswell & Clark, 2018).

2.4. Data Analysis Procedure

Quantitative data were analyzed using descriptive statistics, while spatial analysis was conducted using ArcGIS, including Kernel Density Estimation (KDE), Moran's I, and Getis-Ord G_i^* to identify spatial patterns and clusters of violence. Qualitative data were analyzed using thematic analysis to identify key themes related to vulnerability and resilience. Both datasets were analyzed separately and then integrated to provide a comprehensive interpretation of the spatial and social dimensions of violence (Walker et al., 2023).

3. Results

3.1. Respondent Profile

This study was conducted using a survey method with 696 respondents, divided into 396 women and 396 children from 41 sub-districts in Sorong City. Respondents were grouped based on age, marital status, education level, and type of employment. This categorization aimed to ensure sample diversity and obtain more representative and comprehensive data on the conditions studied. The following table shows the respondent profiles:

Table 2.*Profile of female respondents*

Category	Information	Frequency	Percent
Age	17 - 25 years old	71	20.4
	26 - 35 years old	83	23.9
	36 - 45 years old	70	20.1
	46 - 55 years old	66	19
	56 - 65 years	40	11.5
	> 65 years	18	5.2
Education	No school	29	8.3
	Elementary School	46	13.2
	Junior High School	68	19.5
	Senior High School	164	47.1
	Diploma	2	0.6
	Bachelor	39	11.2
Marital status	Not married yet	46	13.2
	Marry	273	78.4
	Ever married	29	8.3
Work	daily laborer	5	1.4
	Housewife	252	72.4
	Students	24	6.9
	Market/traditional traders	15	4.3
	Civil servants (PNS)	9	2.6
	Private employees	13	3.7
	Farmer/Family Garden	6	1.7
	Health workers	2	0.6
	Unemployed/Unemployed	22	6.3

Source: processed data, 2025.

Most female respondents are in the productive age range – especially 26–35 years (23.9%) – with the majority being married (78.4%), having mid-level education (47.1% high school), and working primarily as housewives (72.4%). These characteristics indicate that women in Sorong City are predominantly engaged in the domestic sphere rather than the public sector.

Table 3.*Child respondent profile*

Category	Information	Frequency	Percent
Age	9 - 10 years	61	17.5
	11 - 12 years	69	19.8
	13 - 14 years	68	19.5
	15 - 16 years	150	43.1
Education	Not in school/Not in school	5	1.4
	Elementary School	105	30.2
	Dropped out of junior high school	4	1.1
	Junior High School	112	32.2
	High School Dropout	8	2.3
	Senior High School	114	32.8
Residence	With family	55	15.8
	With parents	271	77.9
	Not living with parents	22	6.3

Source: processed data, 2025.

Most child respondents are aged 15–16 (43.1%) and generally attend junior or senior high school (±32% each), with only a small portion having limited or no schooling. The majority live with their parents (77.9%), indicating generally adequate supervision, although a small group still experiences restricted access to education and parental care.

Table 4.*Experiences of Violence (Women & Children)*

Group	Type of Violence	Never (%)	Only Witnessed (%)	Experienced (%)	Experienced & Witnessed (%)
Women	Physical	34.5	29.3	22.1	14.1
	Psychological	39.4	20.1	25.0	15.5
	Sexual	75.9	18.4	4.6	1.1
	Economic	46.6	25.6	20.4	7.5
	Neglect	73.0	19.8	6.0	1.1
	Patriarchal/Cultural	71.3	15.5	6.9	6.3
Children	Digital	68.1	20.1	7.2	4.6
	Physical	34.5	19.0	25.0	21.6
	Psychological	49.4	13.8	19.8	17.0
	Sexual	80.5	17.2	1.4	0.9
	Digital	62.1	20.1	11.8	6.0

Source: processed data, 2025.

Women and children most frequently experience or witness physical and psychological violence, while sexual violence is the least reported but remains an important concern. Both groups show similar patterns, with children experiencing particularly high levels of physical (46.6%) and psychological (36.8%) violence.

Table 5.*Vulnerabilities (Women & Children)*

Group	Vulnerability Category	Highest Indicators (%)
Women	Psychological-Emotional	Trauma 39.7; fear of reporting 33.0
	Family Dynamics	Disharmony 45.1; unsafe at home 39.1
	Cultural-Patriarchal Norms	Violence normalized 34.8
	Socio-economic	Financial dependence 31.3
	Education/Information	Lack of rights knowledge 37.1; never accessed counseling 37.6
Children	Digital Vulnerability	Unsupervised phone use 33.0; harmful content 33.6; online bullying 27.3
	Reporting Literacy	Do not know reporting channels 31.9
	Environment/Play	Limited safe play areas (21-27 somewhat agree)
	Home/School Protection	Feel safe at home/school >50%

Source: processed data, 2025.

Women's vulnerability is primarily driven by psychological factors, family disharmony, patriarchal norms, and economic dependence, all of which reduce their sense of safety. Among children, the greatest risks come from unsupervised digital exposure and limited knowledge of reporting mechanisms.

Table 6.

Resilience Levels (Women & Children)

Group	Strongest Resilience Dimensions	Weakest Dimensions
Women	Individual resilience (decision-making, recovery) 74-75%	Access to formal services (legal/ psychological) 45-58%
	Positive future orientation 69-74%	
	Cultural-spiritual support 60-69%	
Children	Family support 64%	Access to services 31-37%
	Community/neighborhood support 59%	
	Personal resilience 55%	

Source: processed data, 2025.

Women show strong internal resilience, particularly in decision-making, recovery ability, and support from cultural and spiritual values. Children’s resilience is mainly supported by family and community environments, although their access to formal support services remains limited.

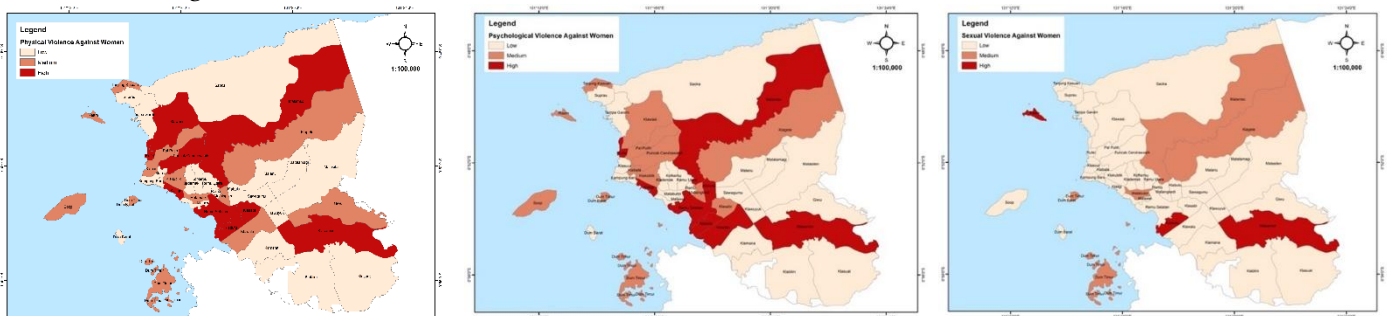
4. Discussion

4.1. Spatial patterns of vulnerability of women and children to violence

The spatial distribution of women’s vulnerability reveals variations in violence risk across regions, providing important insights for identifying high-risk areas and designing targeted interventions. The spatial maps (Figure 1) show that physical and psychological violence against women are concentrated in densely populated urban and transitional areas, while sexual violence appears more localized in specific locations such as Klasaman, Klaudu, and Raam Island.

Figure 1.

Spatial map of a) physical violence against women; b) psychological violence against women; c) sexual violence against women

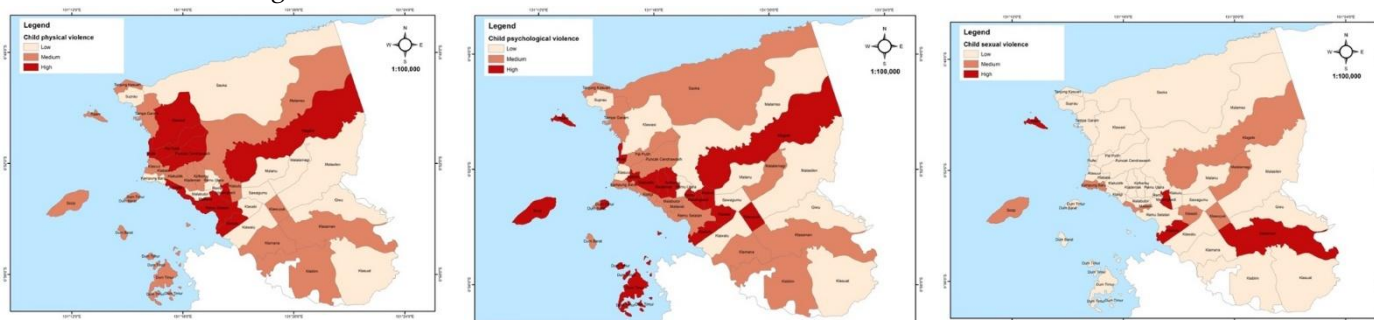


Source: processed data, 2025.

Physical violence is closely associated with urban density and socio-economic pressures, whereas psychological violence is more widely distributed across both urban and border areas. Although geographically limited, sexual violence remains severe and likely underreported. These patterns indicate multiple layers of vulnerability and highlight the need for integrated interventions, including stronger legal protection, expanded counseling services, and community awareness programs.

Figure 2.

Spatial map of a) physical violence against children; b) psychological violence against children; c) sexual violence against children



Source: processed data, 2025.

Similarly, the spatial pattern of child vulnerability (Figure 2) demonstrates distinct but related distributions. Violence against children is concentrated in urban centers, coastal zones, and small islands, while inland and southeastern areas show relatively lower risk. Physical violence is most prevalent in urban cores, psychological violence is more widespread, and sexual violence occurs in specific hotspots such as Klasaman, Klabulu, and Raam Island.

These findings suggest that urbanization, socio-economic pressures, and limited access to services significantly influence vulnerability, requiring priority interventions in high-risk areas, preventive measures in moderate-risk zones, and continuous monitoring in low-risk regions.

4.2. Factors contributing to increased vulnerability of women and children to violence

The vulnerability of women and children is shaped by interconnected structural, social, and psychological factors. Key drivers include economic hardship, low levels of education, patriarchal norms, unsafe environments, weak protection systems, and family conflict. These conditions are reflected in high economic dependence (47.7%), unstable income (37%), unmet basic needs (28.2%) (Dini Rahmayani et al., 2025; Putra et al., 2019), limited education and rights awareness (Siregar, 2024), and persistent gender inequality (Vidyadhara, 2024).

Environmental risks and limited access to services further exacerbate vulnerability (UNICEF, 2022), while family disharmony and exposure to violence contribute to psychological distress and social isolation (Siregar, 2024; Vidyadhara & Pertiwi, 2024). For children, vulnerability is reinforced by risks across multiple settings, including home, school, and digital environments. This is evident in cases of caregiver violence (17.2%), school bullying (39.7%), unsupervised digital use (41.6%), and cyberbullying (27.3%).

These findings are consistent with previous studies highlighting the role of family dynamics (Lafton et al., 2023), school environments (Qiu, 2021), limited safe spaces (OECD, 2023), and unequal access to protection systems (UNICEF). In addition, digital risks are intensified by low parental supervision (Gath, 2024), further increasing children’s exposure to harm.

4.3. Resilience mechanisms used in the face of violence

Women's and children's resilience is shaped by the interaction between social support, individual capacity, access to services, and cultural-spiritual values. Family support emerges as the most significant factor, reported by 52% of women and 54.6% of children. Support from peers and communities also contributes to reducing isolation and strengthening emotional security. Individual resilience is relatively strong, with 57.2% of women and around 43–45% of children demonstrating the ability to make decisions and recover from stress.

However, access to formal services remains limited, as only 38.5% of women and 31.9% of children are aware of available legal or psychological support. This indicates the need to expand access to protection services. These findings are consistent with previous studies emphasizing the importance of social support, psychological capacity, and institutional access in building resilience (Machisa et al., 2018; Abate et al., 2024; Cansever et al., 2025).

In addition, cultural and spiritual values play a crucial role. More than half of respondents identify religion and spirituality as sources of strength, while support from traditional and religious leaders enhances coping capacity. Optimism about the future also contributes to resilience, with 57.5% of women and 50% of children expressing positive expectations. Overall, resilience is formed through the interaction of internal strengths (capacity, optimism, spirituality) and external support systems (family, community, services), enabling individuals to cope with and recover from violence.

4.1. Integration of spatial analysis and resilience resulting in culture-based mitigation strategies

4.2.

The integration of spatial vulnerability analysis and resilience mechanisms enables the development of more targeted and culturally grounded mitigation strategies. Spatial findings indicate that violence is concentrated in specific urban hotspots such as Klawasi, South Remu, and Klasaman, while resilience data show that 52% of women and 54.6% of children rely on family support. These findings support previous research emphasizing the importance of hotspot identification for targeted interventions (Osborne et al., 2025). Quantitative results further indicate that vulnerability is strongly influenced by structural factors, including economic dependence (31.3%), family disharmony (45.1%), and trauma (39.7%). These conditions are reinforced by qualitative findings. As one government official stated,

"If women do not have higher education, they do not know their rights... poverty and low education make women and children more vulnerable" (Interview, August 12, 2025).

In addition, economic constraints prevent many women from leaving abusive situations. As another informant explained,

"Many mothers do not have a steady income... if they leave, they are afraid their children will not be able to eat" (Interview, August 12, 2025).

These findings are consistent with studies highlighting the role of economic dependence in sustaining cycles of violence (Jacob & Munuswamy, 2022). Cultural factors also play a dual role. Survey data show that 34.8% of respondents perceive violence as acceptable under certain conditions, indicating the persistence of patriarchal norms. This is reinforced by qualitative evidence. As a security officer noted,

“Many families say domestic problems should not be brought outside... victims are pressured into silence”(Interview, August 14, 2025).

This aligns with previous research showing that cultural norms can both support resilience and perpetuate gender inequality (Juncos & Bourbeau, 2022). At the same time, resilience is strengthened by cultural and spiritual values. The data indicate that more than 50% of women (50.9%) and children (52%) rely on spirituality as a source of strength, while 57.5% of women and 50% of children remain optimistic about the future. These findings are supported by interview data, where a religious leader emphasized that,

“violence is not part of religious teaching... women must be respected” (Interview, August 25, 2025).

This highlights the potential of religious and cultural actors in promoting protective norms, as also noted in previous studies (Pérez de la Varga et al., 2024; Suen et al., 2025). Community-based approaches further strengthen resilience. Approximately 46.3% of women and 49.4% of children report receiving support from their community. This is consistent with interview findings indicating that culturally embedded communication strategies are more effective. As one informant stated,

“We use local language and symbols... people understand more quickly compared to formal approaches” (Interview, August 25, 2025).

However, selective adaptation is necessary to ensure that protective cultural values are strengthened while harmful norms are challenged. Despite these strengths, access to formal services remains limited. Only 38.5% of women and 31.9% of children are aware of reporting mechanisms, indicating that many cases remain hidden. This reflects the “hidden nature” of violence and underscores the importance of improving access to services (Osborne et al., 2025).

Therefore, building trust between communities and formal institutions—supported by culturally legitimate intermediaries—is essential to create safe and accessible reporting pathways. Overall, culture-based mitigation strategies that integrate spatial targeting, economic empowerment, cultural transformation, community support, and institutional strengthening provide a more effective and context-sensitive approach to reducing violence against women and children.

5. Conclusion

Violence against women and children in Sorong is shaped by the interaction of structural, cultural, and individual factors, reflected in distinct spatial patterns. Physical violence is concentrated in dense urban areas, psychological violence is more widespread across border and coastal zones, and sexual violence appears in localized hotspots, with similar patterns observed among children (physical 46.6%; psychological 36.8%). Women’s vulnerability is primarily driven by family disharmony (45.1%), trauma (39.7%), home insecurity (39.1%), normalized gender norms (34.8%), and economic dependence (31.3%).

Meanwhile, children face increasing risks in digital environments, including unsupervised phone use (33.0%), exposure to harmful content (33.6%), and cyberbullying (27.3%), combined with low awareness of reporting mechanisms. Despite these vulnerabilities, resilience remains relatively strong. Women demonstrate substantial recovery capacity (59.2%) and decision-making ability (57.2%), supported by spiritual values ($\geq 50.9\%$). Children rely heavily on family and community support ($\geq 54.6\%$).

However, limited access to formal services (women 38.5%; children 31.9%) continues to hinder effective reporting and protection. These findings highlight the need for integrated mitigation strategies that combine spatially targeted interventions with socio-economic and cultural approaches. Key priorities include strengthening women's economic empowerment, transforming harmful gender norms, expanding accessible reporting systems, and enhancing child protection in digital spaces. Such strategies are essential to break the cycle of violence and promote sustainable safety in Sorong.

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