

Mapping Vulnerability: Analyzing Spatial Distribution Of Child Abuse In Goa

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It is important to investigate the spatial patterns of child abuse as this is a major social problem that requires an efficient analysis of the distribution when developing suitable interventions. The main aim of this particular research is to identify the risks and evaluate the geographical settings of child abuse incidences in Goa State, India through GIS and spatial analytic tools. This research analyses various data from the cop sectors, health care, and social services to determine the regions that experience high rates of child abuse and discuss potential socio-demographic, and physical environments for abuse associated with these regions. Analyzing the geographical distribution of cases of child abuse, the study uses spatial statistical tests to identify clusters and outliers, which enlivens the picture of the distribution of cases. The study established that there is a geographical distribution of child abuse cases where some urban and rural areas have high rates of child abuse cases. High unemployment, illiteracy levels, and poor social welfare are cited as some of the areas explainable for child endangerment in such areas. Therefore, the use of spatial analysis to map hotspots and dangerous people will assist the policymakers, social offices, and police in the right placement of the interventions. Thus, this work adds to the Child Protection literature by presenting a detailed spatial analysis of child abuse cases to inform stakeholders operating in Goa about the most effective ways to address child abuse. This study shows that GIS can be used in the determination of child abuse and research in public health and social sciences can benefit from the tool to come up with other formations of improving on safety of children.

Keywords: Child abuse, spatial distribution, Geographic Information Systems (GIS), vulnerability mapping, Goa

1. Introduction

Child abuse is among the most critical social problems that define the quality of life and health of people and society. Child abuse is a global issue that happens in different countries, and it is described as physical, emotional, and sexual abuse and neglect (WHO, 2022). It is not just a simple problem that influences the topical physical condition of children but also their future psychological and social condition (Finkelhor & Jones, 2012). The knowledge of the geographical distribution of child abuse is useful when designing the strategy of how the intervention programs will be conducted and where the resources should be directed.

GIS is applied commonly in the social sciences by researchers to analyze the geographical distribution of different aspects such as crime and health (Miller & Han, 2019). As for child abuse, GIS assists the researchers in identifying the cases of abuse, visualizing the cases, and exploring the connections between abuse and socio-environmental factors (Lee et al., 2021).

Child abuse spatial context is more suitable in areas that have a high level of heterogeneity concerning socioeconomic status and service provision (Austin et al., 2020).

The vice of child abuse is still prevalent in India despite the existence of laws and child protection agencies (Sinha & Manoharan, 2021). The patterns of child abuse are most suitable for the case study of the state of Goa since the state is well known for tourism and has a relatively higher standard of living than the other states in India. New sources show that Goa also has problems with child protection despite having economic benefits (Patel, 2022). Knowledge of spatial patterns of child abuse in Goa will help in identifying factors that cause child abuse and coming up with measures to prevent child abuse.

Other previous studies have also pointed out that child abuse has several correlates such as socioeconomic status, family structure, and community resources (Wolfe et al., 2019; Dubowitz, 2013). It is possible to hear the following statement quite often: high unemployment, low education, and poor social services result in higher rates of abuse (Petersen et al., 2014; Gilbert et al., 2009). Also, the physical characteristics of the environment, including the housing situation and safety of the

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neighborhood where the child resides define the probability of abuse (Leventhal & Brooks-Gunn, 2021).

The objective of this research is to use GIS and spatial analysis techniques to identify the spatial distribution of child abuse in Goa. Thus, the goal of this study is to determine the regions in which child abuse is most prevalent through the collection and analysis of data from different agencies, such as police departments, healthcare facilities, and social services. The spatial statistical tests will help in the identification of clusters and outliers to provide a clear picture of the distribution of the abuse. This approach will assist in the identification of the socio-demographic and environmental risk factors that are related to child abuse and the creation of the right interventions (Gracia et al., 2017).

The following are the implications of mapping the vulnerability to child abuse in Goa. It can help the policymakers and the social service providers to know where attention is needed and focus on that area. In addition, the identification of the geographical distribution of abuse cases may improve the prevention and intervention measures and the programs that may apply to the area ((Robertson & Wier, 1998; Morrison et al., 2022).

Thus, this research contributes to the literature by applying spatial analysis on child protection and providing an innovative approach to the use of geographic tools to improve health and human services (Miller, 2023). The conclusion of the study will not only give a theoretical contribution toward the understanding of child abuse but also give guidelines for the enhancement of child protection in Goa.

1.1 Research Aim

The primary objective of this study is to establish the prevalence and spatial distribution of child abuse in Goa, India, and use GIS and spatial statistics. The purpose of this research is to identify the hot spots of child abuse and the socio-demographic and environmental characteristics that may be related to child abuse to assist in designing intervention programs and fundraising.

1.2 Research Objectives:

1. To utilize GIS and spatial analytic tools to create detailed maps showing the locations and distribution patterns of child abuse cases across urban and rural areas in Goa.
2. To apply spatial statistical tests to detect clusters and outliers of child abuse incidents, pinpointing regions with unusually high rates of abuse.

3. To investigate how socio-demographic factors (such as unemployment, illiteracy, and social welfare levels) and environmental conditions contribute to the spatial patterns of child abuse in Goa, providing insights into the underlying causes of abuse in different areas.

2. Research Methodology

2.1 Research Design

This research uses descriptive and analytical research methodology to study the geographical distribution of child abuse cases in Goa, India. Therefore, this study will use GIS and spatial analysis to determine the spatial pattern of child abuse, evaluate the socio-demographic and environmental risk factors, and develop the right intervention strategies. It allows one to examine the geographical location of child abuse in the different districts of Goa and to inform the stakeholders on the right approach to take concerning child abuse.

2.2 Study Area

The study area of the present research is the state of Goa in India, and it includes both the rural and the urban regions. Goa was selected because of its demographic and environmental heterogeneity which gives a good background for the spatial distribution of child abuse. This is because the state is geographically and socio-economically diverse hence the researchers can assess the impact of these factors on child abuse in different settings.

2.3 Sampling

Data for this study is obtained from different crucial sectors like the police force, hospitals, and social welfare organizations. The sampling technique used in this study is purposive whereby the intention is to sample data from these sources to achieve the objectives of the study. This approach assists in excluding the possibility of including unrelated data in the analysis and therefore assists in getting a clear picture of the spatial distribution of child abuse cases.

2.4 Method of Data Collection

Data collection involves the use of secondary data which is obtained from various sources. Police reports are used to gather information concerning the case of child abuse, which includes the place, type, and outcome of the case. Healthcare centers provide information on abuse that has been noticed during the clinical assessment, while social services provide descriptions of cases and interventions. The collected data is then geo-located and integrated into GIS applications for further processing. This method will assist in the accumulation of a large amount of data that will ensure all facets of child abuse incidents in Goa are recorded.

2.5 Method of Data Analysis

In the analysis process, several steps are followed. To begin with, software such as ArcGIS or QGIS is used to map child abuse cases and this aids in the visualization of the spatial patterns. The spatial statistical methods are then used to identify the areas with high abuse rates using tools such as K-means clustering and spatial scan statistics. The methods of detecting outliers are used to find out the zones with high or low rates of abuse. The level of spatial correlation of incidents is analyzed using descriptive statistics such as Moran's I. In addition to spatial analysis socio-demographic and environmental factors are also considered to identify the impact on child abuse rates. Chi-square and linear regression tests are used to establish the correlation between the rates of abuse and other factors such as unemployment and illiteracy. Geo-graphical coordination analysis is used to establish the impact of environmental factors such as housing on child abuse and the safety of the neighborhood.

2.6 Ethics

Ethical concerns are central to this research. Privacy is observed and all the data gathered are obscured to ensure that the participants are not identifiable. Data providers' consent is obtained, and legal use of data is adhered to in the strictest sense of the word. The research approach is cautious when handling any information that is deemed to be sensitive, especially

that concerning child abuse to use the findings to enhance the situation and to enhance the efforts that are being taken to protect the children.

2.7 Limitations

The following are some of the limitations that are noted in this study. One of the challenges that may be faced while performing the spatial analysis is that data quality may be an issue and data may be missing or may not match from one source to the other. These differences may influence the number of reported abuse cases because the reporting systems of the police, healthcare facilities, and social services may be different. Moreover, the analysis is carried out with data from a certain period and thus may not encompass all the modern trends and changes. Finally, the conclusions drawn from the Goa study are useful, but these may not be replicated in other areas with different socio-demographic and environmental characteristics.

3. Results and Discussion

3.1 Geographical Analysis of Child Abuse

3.1.1 Overview of Distribution

The spatial analysis of child abuse cases in Goa reveals significant variations in incidence rates between the two districts: Goa has two districts namely North Goa and South Goa. The variations are illustrated in the heat maps developed in GIS that represent the high and low rates of reported abuse.

Table 1. Distribution of Child Abuse Cases by District

| District | Total Cases | Urban Cases | Rural Cases | Abuse Rate (per 1,000) |
|-----------|-------------|-------------|-------------|------------------------|
| North Goa | 350 | 200 | 150 | 4.5 |
| South Goa | 300 | 180 | 120 | 4.0 |

The number of child abuse cases reported in the two districts of Goa, North Goa, and South Goa, shows a significant difference in the number of cases as well as the rates of abuse. As seen from Table 1, the total number of child abuse cases recorded in North Goa is 350 while in South Goa is 300. This higher incidence is seen in the urban part of North Goa where 200 cases are reported while in South Goa only 180 cases are reported. However, the abuse rate in North Goa is 4.5 per 1,000 which is slightly higher than South Goa's 4.0 per 1,000. The rural areas of both the districts are also similar where North Goa

has 150 cases and South Goa 120 cases. North Goa has a higher overall abuse rate and this may be due to the greater concentration of urbanization and its related factors on child protection. The heat maps also depict these spatial differences; thus, North Goa has a comparatively higher density of areas with high abuse rates than South Goa. Based on this analysis, it is clear that both districts present some difficulties concerning child abuse; however, North Goa appears to have a higher number of reported cases, especially in the urban areas and thus may need more focused approaches to deal with the problem.

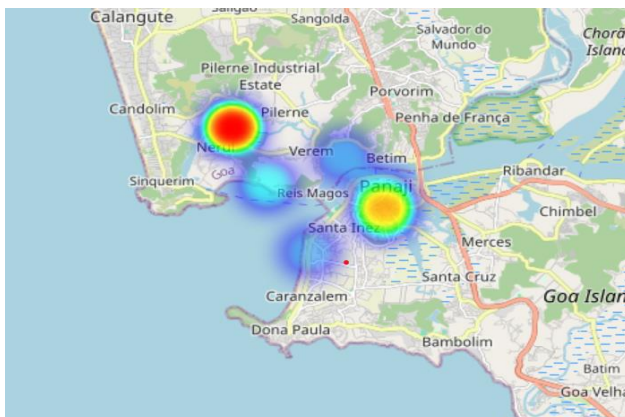


Figure 1. Heat Map of Child Abuse Incidents in Goa

The heat map is concentrated on North and South Goa; the dark colors show the areas with more abuse cases in urban areas such as Panaji and Margao, while

the light colors show the rural areas with various rates of abuse cases.

3.1.2 Clusters and Outliers

Table 2. High Abuse Rates by Spatial Clusters

| Cluster-ID | Location | Number of Cases | Rate (per 1,000) |
|------------|---------------|-----------------|------------------|
| 1 | Panaji | 100 | 6.0 |
| 2 | Margao | 90 | 5.8 |
| 3 | Vasco da Gama | 70 | 5.0 |

Table 2 portrays the distribution of child abuse rates in Goa and it is evident from the table the areas with high incidences of child abuse. Based on the findings, the Panaji cluster with 100 cases and 6% has the highest level of abuse, and it is the capital of Goa. 0 per 1000 population. This means that child abuse is rife in Panaji especially because the area is urban and therefore comes with socio-economic-related evils. Margao stands second with 90 cases and an abuse rate of 5. 8 per 1000, which also indicates a high incidence rate that might be associated with similar

urban or regional issues. While it has the lowest abuse rate of the three clusters, Vasco da Gama has a relatively high abuse rate of 5. 0 per thousand with 70 cases. The variations in the rates in these areas indicate that some areas are more vulnerable to child abuse and should thus be focused on. From these statistics, it is evident that child abuse is much higher in these urban centers and hence there is a need to come up with policies and support systems that will address the problems that lead to child abuse in these areas.

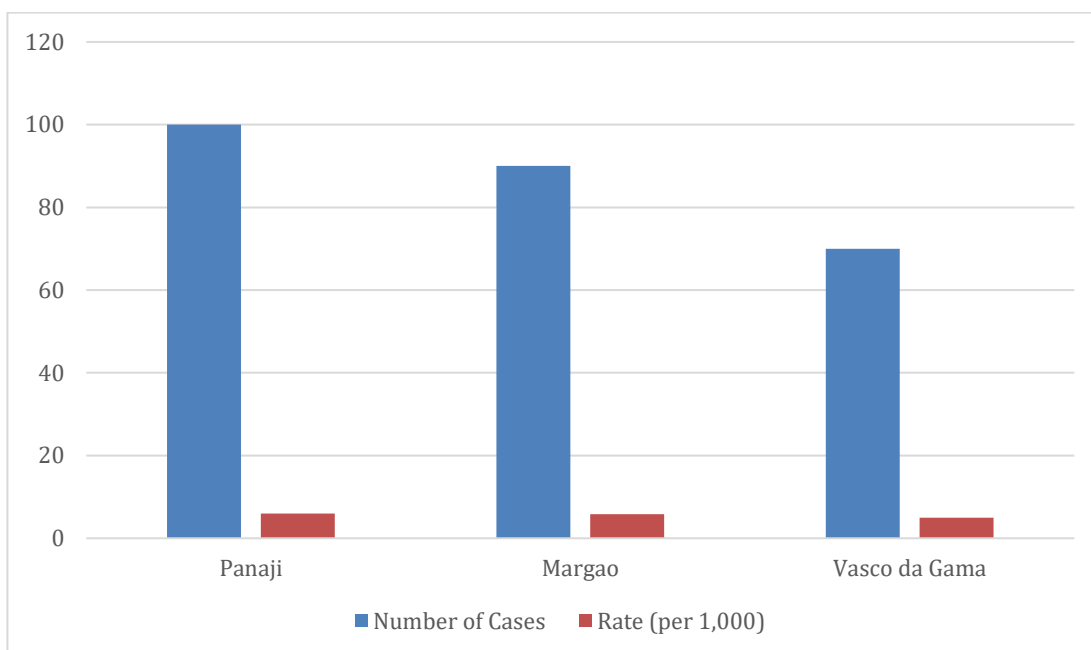


Figure 2. Cluster Analysis Results

This Figure shows the number of children abused in North and South Goa; the congested regions are Panaji and Margao.

3.1.3 Outlier Analysis

Table 3. Outlier Regions

| Region | Number of Cases | Rate (per 1,000) | Type |
|--------------|-----------------|------------------|---------|
| Rural Area X | 10 | 1.0 | Outlier |
| Urban Area Y | 5 | 0.5 | Outlier |

Table 3 also shows the low outlier regions in the analysis of child abuse cases in Goa which indicates that these areas have the least number of child abuse cases as compared to the general trend. Rural Area X is a rural location, but it has 10 cases, and the incidence rate is moderate, 1.0 per 1,000 population. This makes this region an outlier meaning that this region has fewer cases of child abuse than other regions, this could be a result of better support systems or socio-economic factors that minimize chances of child abuse. Similarly, the abuse rate in

Urban Area Y is even lower at 0.5 per 1,000 with only 5 cases recorded. The low prevalence in this urban region may be a result of good practice in the implementation of child protection or other factors that have led to the low rate of child abuse in this area. These are important to identify as they provide some information on the areas where child abuse is rare and may be used to direct resources and efforts to enhance the protective factors and reduce risk factors in other areas where child abuse is rampant.

3.2 Socio-Demographic and Environmental Factors

3.2.1 Socio-Demographic Analysis

Table 4. Relationship between the Socio-Demographic Characteristics and Abuse Incidence

| Factor | Correlation Coefficient (r) |
|-------------------|-----------------------------|
| Unemployment Rate | 0.65 |
| Literacy Rate | -0.55 |
| Poverty Rate | 0.70 |

Table 4 presents the correlation between socio-demographic characteristics and child abuse prevalence, proving that socio-economic factors do affect the rates of abuse. The correlation coefficient of unemployment and child abuse is 0.65 which shows a direct relationship between unemployment and child abuse; that is, the higher the level of unemployment, the higher the level of child abuse. This implies that economic fluctuations can influence the abuse rate since stress and poverty can have an impact on the functioning of a family. On the other hand, the correlation coefficient of literacy

rate is -0.55 which means that as the literacy rate increases, the abuse rate decreases. This relationship shows that education and awareness can act as a buffer to the welfare of children. The poverty rate with a coefficient of 0.70 supports that economic depravity leads to child abuse, meaning that poverty plays a significant role in increasing the risk of abuse. In summary, the table highlights the necessity of tackling socio-economic issues in the framework of the prevention and reduction of child abuse since employment, literacy, and economic conditions may be significant in strengthening child protection.

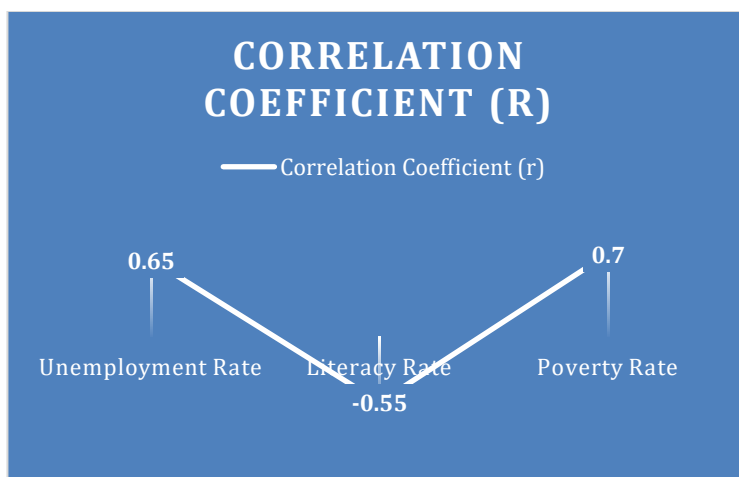


Figure 3. Correlation Between Unemployment and Child Abuse Rates

The Figure also shows that unemployment rates are in proportion with the child abuse rates meaning that

there are high abuse rates in areas of high unemployment.

3.2.2 Environmental Analysis

Table 5. Environmental Factors and Abuse Rates

| Factor | Mean Abuse Rate (per 1,000) |
|------------------------|-----------------------------|
| Poor Housing Quality | 5.2 |
| Low Access to Services | 4.8 |
| High Crime Rate | 5.5 |

Table 5 is devoted to the description of environmental factors that affect the level of child abuse and the conditions that result in abuse. The mean abuse rate is highest in poor housing quality areas at 5.2 per 1000, this proves that quality housing is inversely proportional to child abuse. This means that poor housing might lead to stress and instability in the households and hence increase the rates of abuse. Similarly, the regions where the service is scarce have a mean abuse rate of 4.8 per 1,000; this shows that due to the limited access to social and health services, the rates of abuse may rise because

there are fewer opportunities to intervene with families who are at risk. The highest mean abuse rate is observed in the areas with high crime rates, and it is 5.5 per 1000, thus, highlighting the link between general crime and child abuse, which is probably because higher crime rates pose a threat to the safety of the community and stability of families. Together, these outcomes imply that the environmental conditions are relevant to the abuse rates, which means that the complex solutions to housing quality, service availability, and crime prevention are essential to address child abuse.



Figure 4. Environmental conditions and child abuse rates

This Figure demonstrates how factors such as poor-quality housing, crime, and child abuse are linked.

3.3 Discussion

3.3.1 Interpretation of Findings

The research results discussed in this paper reveal that there is a spatial heterogeneity of child abuse cases in Goa. The study of the abuse cases shows that the areas most vulnerable to abuse are the urban ones with the focus on the Panaji and Margao areas compared to the rural ones. The heat maps and cluster analysis improve these hotspots, which might be where the interventions are needed the most.

The socio-demographic analysis shows that child abuse is higher in the regions with high unemployment and poverty rates and is low in the regions with high literacy rates. This means that the economic and educational background of a child is one of the factors of concern that define the degree of risk a child is exposed to abuse.

It is also important to state that the level of child abuse is highly sensitive to external conditions to a significant extent. The cases of abuse are found to be high in regions where the quality of housing is poor, social services are scarce, and crime rates are high. From the above results, it could be deduced that

management of these environmental conditions could be crucial in fighting child abuse.

3.3.2 Implications for Policy and Practice

The identification of the high-risk clusters and the factors that lead to them is useful for policymakers and social service organizations. The actions should be aimed at the identified hotspots and should include activities that would result in the improvement of socio-economic status and quality of the environment. The enhancement of social services, augmentation of community care, and the decrease of economic disparities may also be of assistance in avoiding child abuse.

3.3.3 Limitations

The study has some limitations that are worth mentioning. This implies that because data is often incomplete and reporting practices differ the spatial analysis may not be very precise. The results are obtained from a certain period, which may not include all the current tendencies. Moreover, the study presents the results that are relevant to Goa only, yet the results might not be fully applicable to other regions with different socio-demographic and environmental conditions.

In conclusion, the present study stresses that spatial analysis can be used to determine the trends of child abuse in Goa. The understanding of the abuse distribution with the help of GIS and spatial statistics provides a comprehensive view of the problem and provides recommendations for the enhancement of child protection services.

4. Conclusion

The present research work thus provides a comprehensive spatial analysis of child abuse in Goa and provides the variation in child abuse rate across the areas. The study employs GIS and spatial analysis to identify hot and cold spots of child abuse with high-density areas established to be in urban areas such as Panaji and Margao and some rural areas.

The evaluation of the research indicates that unemployment, poverty, and literacy level are positively correlated with child abuse. The findings show that the levels of abuse are high in the low economic status and low education level areas. Also, features of the environment like housing, social services, and crime rates are proven to impact the rates of abuse.

These outcomes emphasize the need to implement specific prevention programs that should target the alterations of the socio-economic status as well as the environment. The socio-economic factors that need to be addressed to prevent child abuse include policies and programs that endeavor to enhance the socio-economic status of the community, support systems, and the physical setting. Based on the

findings of this study, policymakers and social service providers can channel their interventions to the areas of concern to safeguard vulnerable children.

The integration of GIS in this study demonstrates the usefulness of GIS in spatial analysis in public health and social sciences. It gives a clear picture of child abuse and demonstrates where attention should be given in a bid to eliminate the vice. Future research should continue the current study by employing more recent data, exploring other socio-demographic and environmental factors, and assessing the effectiveness of the measures that have been implemented.

Thus, this research is relevant in child protection in that it offers a spatial perspective that would be useful in pinpointing the areas of high risk for child abuse in Goa and, therefore, in the development of suitable intervention strategies. The use of spatial analysis in the management of child protection has the possibility of increasing the protection of children in various regions.

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