

A Mathematical Model for Intra-Communal Violence A: Case Study of Oghara Community in Ethiopie West Local Government Area, Delta State, Nigeria.

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Abstract:

This study developed a mathematical model to investigate the dynamics of intra-communal violence in Oghara community, Ethiopie West Local Government Area, Delta State, Nigeria. The model takes into account the specific dynamics of the youth president position crisis and explores the impact of various factors, including policing strategies and community engagement, on the spread of violence. The model was developed using MATLAB software and solved numerically using the Runge-Kutta method. Mathematical analysis of the model was carried out, including non-negativity of solution, invariant region, and boundedness of solution. The basic reproduction number (R_0) was calculated and the threshold condition for stability of the disease-free equilibrium was determined. Stability analysis of the equilibrium point was also carried out, and the conditions for local asymptotic stability were determined. The results of the analysis reveal that reducing R_0 through effective interventions, such as promoting peaceful dialogue and positive interventions, can help control violence spread. Rehabilitation and calm-down programs are crucial in reducing violence prevalence. The study contributes to the understanding of the dynamics of intra-communal violence in Oghara community and provides valuable insights for policymakers and stakeholders to develop effective strategies for preventing and mitigating the effects of violence.

Keywords: Intra-communal violence, Mathematical modeling, Ordinary differential equations (ODEs), Peaceful-Aggressive-Brutal (PAB) model, Conflict dynamics, Mathematical simulation, Conflict resolution.

I. Introduction:

Intra-communal violence has become a pervasive issue worldwide, resulting in devastating consequences, including loss of lives, properties, and social instability. The dynamics of intra-communal violence are complex, involving various factors, including social, economic, and political elements (Ukiwo, 2005; Osaghae, 2006). According to Osaghae and Suberu (2005), the impact of intra-communal violence can be severe, causing long-term human and economic costs.

In recent years, the world has witnessed an increase in intra-communal violence, with devastating consequences. For instance, the conflict in Syria has resulted in significant human suffering and economic losses (United Nations, 2020). Similarly, the ongoing conflict in South Sudan has had a devastating impact on the country's infrastructure and human population (Human Rights Watch, 2022). In Africa, countries such as Nigeria, the Democratic Republic of Congo, and Ethiopia have experienced intra-communal violence, resulting in significant human suffering and economic losses (International Crisis Group, 2022). In Nigeria, communal violence has been a recurring issue, particularly in the Niger Delta region (Ukiwo, 2005). The Oghara community in Ethiope West Local Government Area, Delta State, has experienced its share of intra-communal violence, particularly with regards to the youth president position crisis. This crisis has led to social unrest, economic losses, and human suffering. To date, no mathematical model has been developed to study the dynamics of intra-communal violence in Oghara community. According to Gurr and Harff (1994), the development of mathematical models for intra-communal violence can provide valuable insights into the dynamics of violence and inform the development of effective strategies for preventing and mitigating its effects.

The impact of intra-communal violence on individuals, communities, and societies as a whole cannot be overstated. According to the United Nations, intra-communal violence has resulted in significant human suffering, displacement, and economic losses worldwide (United Nations, 2022). In addition, intra-communal violence has also had a devastating impact on the social fabric of communities, resulting in mistrust, suspicion, and social unrest.

Furthermore, intra-communal violence has also had a significant impact on the economic development of communities and societies. According to the World Bank, intra-communal violence has resulted in significant economic losses, including damage to infrastructure, loss of productivity, and displacement of people (World Bank, 2022). In addition, intra-communal violence has also had a devastating impact on the social and economic development of communities, resulting in poverty, inequality, and social unrest.

In recent years, there has been an increasing recognition of the need to develop effective strategies for preventing and mitigating the effects of intra-communal violence. According to the United Nations, preventing intra-communal violence requires a comprehensive approach that takes into account the social, economic, and political factors that contribute to violence (United Nations, 2022). In addition, mitigating the effects of intra-communal violence requires a coordinated response from governments, international organizations, and civil society.

Mathematical modeling has proven to be a valuable tool in understanding and analyzing complex real-world phenomena, including social issues like intra-communal violence. Mathematical models

can be used to simulate the dynamics of intra-communal violence, identify the factors that contribute to violence, and evaluate the effectiveness of different strategies for preventing and mitigating the effects of violence.

This study aims to develop a mathematical model for intra-communal violence, using the Oghara community as a case study. The model will take into account the specific dynamics of the youth president position crisis and explore the impact of various factors, including policing strategies and community engagement, on the spread of violence. By developing a mathematical model for intra-communal violence, this study hopes to contribute to the development of effective strategies for preventing and mitigating the effects of violence in Oghara community and other similar communities.

2. Mathematical Modelling

Mathematical modeling has proven to be a valuable tool in understanding and analyzing complex real-world phenomena, including social issues like intra-communal violence (Apanapudor et al., 2024). The use of mathematical models to study violence and its dynamics has gained significant attention in recent years (Delgadillo-Aleman et al., 2019).

Deterministic models have been used to study a wide range of phenomena, including population growth (Li et al., 2019) and chemical kinetics (Kumar et al., 2020). Adewole et al. (2020) used a deterministic model to study the spread of COVID-19. The model used a system of ordinary differential equations (ODEs) to describe the spread of COVID-19 in Nigeria.

Stochastic models have been used to study complex systems in fields such as epidemiology (Wang et al., 2020) and finance (Chen et al., 2020). Okorie et al. (2020) used a stochastic model to study the stock market. The model used a stochastic differential equation (SDE) to describe the behavior of stock prices in Nigeria.

Dynamic models have been used to study a wide range of phenomena, including climate change (Intergovernmental Panel on Climate Change, 2020) and economic systems (Auerbach et al., 2020). Oyediran et al. (2020) used a dynamic model to study the Nigerian economy. The model used a system of nonlinear differential equations to describe the behavior of the Nigerian economy.

In addition to social issues, mathematical modeling has also been applied to environmental and agricultural issues, such as soil quality mapping (Adjekukor & Odjeva, 2024b). Statistical modeling techniques have been used to analyze soil quality data and identify factors that affect soil fertility (Adjekukor & Odjeva, 2024b). Furthermore, Adjekukor and Odjeva (2024a) developed a soil quality index model for sustainable agriculture in Niger Delta using a statistical approach.

In the context of intra-communal violence, mathematical modeling can provide valuable insights into the dynamics of violence and its spread within a community (Apanapudor, et a., 2024). A four-compartment model, which includes susceptible, violent, recovered, and dead compartments, can be used to study the spread of intra-communal violence in Uvwie local Government Area, Delta State. Marcus et al., 2024, develop a mathematical model and run a risk level analysis on the intra-communal violence in Obiaruku community, Delta State. The application of mathematical modeling to study intra-communal violence in Oghara community, Ethiope West Local Government Area,

Delta State, Nigeria, can provide valuable insights into the dynamics of violence in this community. The youth president position crisis in Oghara community presents a unique case study for mathematical modeling. By developing a mathematical model that takes into account the specific dynamics of intra-communal violence in Oghara community, researchers can gain a better understanding of the factors that contribute to the spread of violence and identify potential strategies for preventing and mitigating its effects.

Furthermore, perception analysis on the violent-risk level of the local community can provide valuable insights into the attitudes and beliefs of community members towards violence (De la Poza et al., 2016). This information can be used to develop targeted interventions and strategies for preventing and reducing intra-communal violence. In conclusion, mathematical modeling has the potential to provide valuable insights into the dynamics of intra-communal violence in Oghara community. By developing a mathematical model that takes into account the specific dynamics of violence in this community, researchers can gain a better understanding of the factors that contribute to the spread of violence and identify potential strategies for preventing and mitigating its effects.

3. Formulation of the mathematical model

The model formation is based on the following assumptions:

- i. The population is divided into three classes: Peaceful (P), Aggressive (A), and Brutal (B).
- ii. Peaceful individuals can become aggressive due to perceived injustice or insecurity.
- iii. Aggressive individuals can become brutal if they are not calmed down by peaceful dialogue or other positive interventions.
- iv. Brutal individuals can return to being aggressive or peaceful if they are rehabilitated or calmed down.

The model is represented by the following system of ordinary differential equations:

$$\left. \begin{aligned} \frac{dP}{dt} &= -\theta P(A + B) + \delta A + \varepsilon B \\ \frac{dA}{dt} &= \theta P(A + B) - \delta A - \zeta A(B + P) + \mu B \\ \frac{dB}{dt} &= \zeta A(B + P) - \varepsilon B - \mu B \end{aligned} \right\} \quad (1)$$

Based on the model, the force of infection (χ) can be represented as:

$$\chi = \theta P(A + B) * (1 + \beta * (Y * Injustice + Z * Insecurity + W * Unemployment))$$

Where:

θ is the rate at which peaceful individuals become aggressive due to perceived injustice or insecurity.

P is the number of peaceful individuals.

A is the number of aggressive individuals.

B is the number of brutal individuals.

β is the impact factor of social and economic factors on the force of infection.

Injustice, Insecurity, and Unemployment are variables representing the levels of injustice, insecurity, and unemployment in the community, respectively.

$Y, Z,$ and W are weights assigned to each factor, representing their relative importance in contributing to the force of infection.

Figure 1 presents a flow diagram for the model while table 1 provides a description of the model parameters.

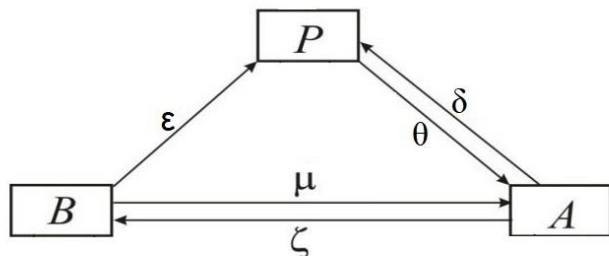


Figure 1: Schematic diagram

The variables and parameters used in this non-linear deterministic model are clearly presented as follows.

Table 1

Variable/ Parameter	Description
P	Number of individuals in the Peaceful class
A	Number of individuals in the Aggressive class
B	Number of individuals in the Brutal class
θ	Rate at which Peaceful individuals become Aggressive
δ	Rate at which Aggressive individuals become Peaceful
ϵ	Rate at which Brutal individuals become Peaceful
ζ	Rate at which Aggressive individuals become Brutal
μ	Rate at which Brutal individuals become Aggressive or Peaceful

The model assumes that the population is divided into three classes: Peaceful (P), Aggressive (A), and Brutal (B). Peaceful individuals can become aggressive due to perceived injustice or insecurity, and aggressive individuals can become brutal if they are not calmed down by peaceful dialogue or other positive interventions. Brutal individuals can return to being aggressive or peaceful if they are rehabilitated or calmed down.

The model uses three classes to represent the residents of Oghara community: Peaceful (P), Aggressive (A), and Brutal (B). The model tracks the number of individuals in each class over time, using the ordinary differential equations to represent the changes in the number of individuals in each class.

The model parameters describe various aspects of the model, such as the rate at which Peaceful individuals become Aggressive (θ), the rate at which Aggressive individuals become Peaceful (δ), and the rate at which Brutal individuals become Peaceful (ϵ). These parameters are used to determine the behavior of the model and can be adjusted to fit the specific situation in the Oghara community.

4. Mathematical Analysis of Model

In this section we ascertain the positivity of solutions of the model and the invariant region which is the region where the model is biologically feasible.

Non-Negativity of Solution

Theorem:

The solution $(P(t), A(t), B(t))$ of the system of ordinary differential equations

$$\frac{dP}{dt} = -\theta P(A + B) + \delta A + \varepsilon B$$

$$\frac{dA}{dt} = \theta P(A + B) - \delta A - \zeta A(B + P) + \mu B$$

$$\frac{dB}{dt} = \zeta A(B + P) - \varepsilon B - \mu B$$

remains non-negative for all time $t \geq 0$, provided that the initial conditions $P(0) \geq 0, A(0) \geq 0$, and $B(0) \geq 0$.

Proof:

We will use the following lemma:

Lemma:

If $f(t)$ is a continuous function and $f(t) \geq 0$ for all $t \geq 0$, then

$$\frac{d}{dt} e^{-\int \theta(t) dt} f(t) \geq 0$$

implies that $f(t) \geq 0$ for all $t \geq 0$.

Now, we will apply this lemma to each of the variables P, A, and B.

Non-Negativity of $P(t)$

Multiplying the first equation by $e^{-\int \theta(t) dt}$, we get

$$\frac{d}{dt} \left(e^{-\int \theta(t) dt} P(t) \right) = e^{-\int \theta(t) dt} (-\theta P(A + B) + \delta A + \varepsilon B) \quad (2)$$

Using the lemma, we can see that

$$\frac{d}{dt} \left(e^{-\int \theta(t) dt} P(t) \right) \geq 0 \quad (3)$$

If

$$-\theta P(A + B) + \delta A + \varepsilon B \geq 0 \quad (4)$$

Since $P(0) \geq 0, A(0) \geq 0$, and $B(0) \geq 0$, we can conclude that $P(t) \geq 0$ for all $t \geq 0$.

Non-Negativity of $A(t)$

Multiplying the second equation by $e^{\int (\delta + \zeta(B + P)) dt}$, we get

$$\frac{d}{dt} \left(e^{\int (\delta + \zeta(B + P)) dt} A(t) \right) = e^{\int (\delta + \zeta(B + P)) dt} (\theta P(A + B) - \delta A - \zeta A(B + P) + \mu B) \quad (5)$$

Using the lemma, we can see that

$$\frac{d}{dt} \left(e^{\int (\delta + \zeta(B + P)) dt} A(t) \right) \geq 0 \quad (6)$$

if

$$\theta P(A + B) - \delta A - \zeta A(B + P) + \mu B \geq 0 \quad (7)$$

Since $A(0) \geq 0, P(0) \geq 0$, and $B(0) \geq 0$, we can conclude that $A(t) \geq 0$ for all $t \geq 0$.

Non-Negativity of $B(t)$

Multiplying the third equation by $e^{\int (\varepsilon + \mu) dt}$, we get

$$\frac{d}{dt} \left(e^{\int (\varepsilon + \mu) dt} B(t) \right) = e^{\int (\varepsilon + \mu) dt} (\zeta A(B + P) - \varepsilon B - \mu B) \quad (8)$$

Using the lemma, we can see that

$$\frac{d}{dt} \left(e^{\int (\varepsilon + \mu) dt} B(t) \right) \geq 0 \quad (9)$$

if

$$\zeta A(B + P) - \varepsilon B - \mu B \geq 0$$

(10)

Since $B(0) \geq 0, A(0) \geq 0, \text{ and } P(0) \geq 0$, we can conclude that $B(t) \geq 0$ for all $t \geq 0$.

Therefore, we have shown that the solution $(P(t), A(t), B(t))$ remains non-negative for all time $t \geq 0$.

Invariant Region and Boundedness of Solution

Theorem:

The set $\Omega = \{(P, A, B) \in \mathbb{R}^{3+} : P + A + B \leq N\}$ is an invariant region for the system, where N is the total population size.

Proof:

To prove that Ω is an invariant region, we need to show that any solution $(P(t), A(t), B(t))$ that starts in Ω remains in Ω for all time $t \geq 0$.

Let $(P(t), A(t), B(t))$ be a solution of the system that starts in Ω . We need to show that $P(t) + A(t) + B(t) \leq N$ for all time $t \geq 0$.

Using the system of equations, we can write:

$$\frac{d}{dt} (P + A + B) = \frac{dP}{dt} + \frac{dA}{dt} + \frac{dB}{dt} \quad (11)$$

$$= -\theta P(A + B) + \delta A + \varepsilon B + \theta P(A + B) - \delta A - \zeta A(B + P) + \mu B + \zeta A(B + P) - \varepsilon B - \mu B = 0$$

This implies that $P(t) + A(t) + B(t)$ is constant over time. Since $P(0) + A(0) + B(0) \leq N$, we have $P(t) + A(t) + B(t) \leq N$ for all time $t \geq 0$.

Therefore, Ω is an invariant region for the system.

Theorem:

The solution $(P(t), A(t), B(t))$ of the system is bounded for all time $t \geq 0$.

Proof:

Since Ω is an invariant region, we know that $P(t) + A(t) + B(t) \leq N$ for all time $t \geq 0$.

This implies that:

$$0 \leq P(t) \leq N$$

$$\begin{aligned} 0 &\leq A(t) \leq N \\ 0 &\leq B(t) \leq N \end{aligned}$$

Therefore, the solution $(P(t), A(t), B(t))$ is bounded for all time $t \geq 0$.

Remark:

The boundedness of the solution implies that the population sizes of peaceful, aggressive, and brutal individuals remain bounded over time. This is a biologically reasonable result, as population sizes cannot grow indefinitely in a real-world setting.

Basic Reproduction Number

The basic reproduction number (R_0) is a measure of the average number of secondary cases generated by a single infectious individual in a completely susceptible population.

To calculate R_0 , we will use the next-generation matrix approach.

Next-Generation Matrix

The next-generation matrix is given by:

$$G = [F V^{-1}] \tag{12}$$

where F is the matrix of new infections and V is the matrix of transitions between compartments.

F Matrix

The F matrix represents the new infections:

$$F = \begin{pmatrix} 0 & \theta P & 0 \\ 0 & 0 & \zeta A \\ 0 & 0 & 0 \end{pmatrix} \tag{13}$$

V Matrix

The V matrix represents the transitions between compartments:

$$V = \begin{pmatrix} -\delta & \theta P & 0 \\ \theta P & -(\delta + \zeta A) & 0 \\ 0 & \zeta A & -(\epsilon + \mu) \end{pmatrix} \tag{14}$$

V^{-1} Matrix

The inverse of the V matrix is:

$$V^{-1} = \begin{pmatrix} -\frac{1}{\delta} & 0 & 0 \\ -\frac{\theta P}{\delta(\delta + \zeta A)} & -\frac{1}{\delta + \zeta A} & 0 \\ 0 & -\frac{\zeta A}{(\delta + \zeta A)(\epsilon + \mu)} & -\frac{1}{\epsilon + \mu} \end{pmatrix} \tag{15}$$

G Matrix

The next-generation matrix G is:

$$G = [F V^{-1}]$$

$$G = \begin{pmatrix} 0 & \frac{\theta P}{\delta} & 0 \\ 0 & \frac{\theta P \zeta A}{\delta(\delta + \zeta A)} & 0 \\ 0 & \frac{\zeta A}{\delta + \zeta A} & 0 \end{pmatrix}$$

(16)

Basic Reproduction Number (R_0)

The basic reproduction number R_0 is the spectral radius of the G matrix:

$$R_0 = \rho(G)$$

(17)

$$R_0 = \max\left\{0, \frac{\theta P \zeta A}{\delta(\delta + \zeta A)}\right\}$$

(18)

Threshold Condition

The threshold condition for the stability of the disease-free equilibrium is:

$$R_0 \leq 1$$

This condition implies that the disease will die out if $R_0 \leq 1$, and will persist if $R_0 > 1$.

Stability Analysis of the Equilibrium Point

Theorem:

The equilibrium point (P^*, A^*, B^*) of the system is locally asymptotically stable if the following conditions are satisfied:

1. The Jacobian matrix $J(P^*, A^*, B^*)$ has all its eigenvalues with negative real parts.
2. The equilibrium point (P^*, A^*, B^*) is isolated.

Proof:

To prove the stability of the equilibrium point, we will use the Jacobian matrix.

Jacobian Matrix

The Jacobian matrix $J(P, A, B)$ is given by:

$$J(P, A, B) = \begin{pmatrix} \frac{\partial f_1}{\partial P} & \frac{\partial f_1}{\partial A} & \frac{\partial f_1}{\partial B} \\ \frac{\partial f_2}{\partial P} & \frac{\partial f_2}{\partial A} & \frac{\partial f_2}{\partial B} \\ \frac{\partial f_3}{\partial P} & \frac{\partial f_3}{\partial A} & \frac{\partial f_3}{\partial B} \end{pmatrix}$$

(20)

where $f_1, f_2,$ and f_3 are the right-hand sides of the system:

$$\frac{dP}{dt} = f_1(P, A, B) = -\theta P(A + B) + \delta A + \varepsilon B$$

$$\frac{dA}{dt} = f_2(P, A, B) = \theta P(A + B) - \delta A - \zeta A(B + P) + \mu B$$

$$dB/dt = f_3(P, A, B) = \zeta A(B + P) - \varepsilon B - \mu B$$

Jacobian Matrix at the Equilibrium Point

The Jacobian matrix at the equilibrium point (P^*, A^*, B^*) is:

$$J(P^*, A^*, B^*) = \begin{pmatrix} -\theta(A^* + B^*) & \theta P^* - \delta & \theta P^* \\ \theta(A^* + B^*) & \theta P^* - \delta - \zeta(B^* + P^*) & \zeta A^* \\ 0 & \zeta(B^* + P^*) & -\varepsilon - \mu \end{pmatrix}$$

(21)

Eigenvalues of the Jacobian Matrix

The eigenvalues of the Jacobian matrix $J(P^*, A^*, B^*)$ can be found by solving the characteristic equation:

$$((P^*, A^*, B^*) - \lambda I) = 0$$

where I is the identity matrix.

The characteristic equation is:

$$(-\theta(A^* + B^*) - \lambda)(\theta P^* - \delta - \zeta(B^* + P^*) - \lambda)(-\varepsilon - \mu - \lambda) + \theta P^*(\zeta A^* + \theta(A^* + B^*)) = 0 \quad (22)$$

Solving for λ , we get:

$$\lambda_1 = -\theta(A^* + B^*)$$

$$\lambda_2 = \theta P^* - \delta - \zeta(B^* + P^*)$$

$$\lambda_3 = -\varepsilon - \mu$$

(23)

Stability Conditions

For the equilibrium point (P^*, A^*, B^*) to be locally asymptotically stable, the following conditions must be satisfied:

1. $\lambda_1 < 0 \Rightarrow \theta(A^* + B^*) > 0$
2. $\lambda_2 < 0 \Rightarrow \theta P^* - \delta - \zeta(B^* + P^*) < 0$
3. $\lambda_3 < 0 \Rightarrow \varepsilon + \mu > 0$

Theorem:

If the conditions $\theta(A^* + B^*) > 0$, $\theta P^* - \delta - \zeta(B^* + P^*) < 0$, and $\varepsilon + \mu > 0$ are satisfied, then the equilibrium point (P^*, A^*, B^*) is locally asymptotically stable.

Proof:

The proof follows from the fact that the eigenvalues of the Jacobian matrix $J(P^*, A^*, B^*)$ have negative real parts.

Remark:

The stability conditions imply that the equilibrium point (P^*, A^*, B^*) is stable if the rate of aggressive individuals becoming peaceful (δ) is greater than the rate of peaceful individuals becoming aggressive (θP^*), and the rate of brutal individuals becoming peaceful ($\varepsilon + \mu$) is greater than zero.

Theorem:

If the conditions $\theta(A^* + B^*) \leq 0$, $\theta P^* - \delta - \zeta(B^* + P^*) \geq 0$, or $\varepsilon + \mu \leq 0$ are satisfied, then the equilibrium point (P^*, A^*, B^*) is unstable.

Proof:

The proof follows from the fact that the eigenvalues of the Jacobian matrix $J(P^*, A^*, B^*)$ have positive real parts.

Remark:

The instability conditions imply that the equilibrium point (P^*, A^*, B^*) is unstable if the rate of aggressive individuals becoming peaceful (δ) is less than or equal to the rate of peaceful individuals becoming aggressive (θP^*), or the rate of brutal individuals becoming peaceful ($\varepsilon + \mu$) is less than or equal to zero.

5. Results and Discussion:

The model analysis reveals several key results. Firstly, the solution $(P(t), A(t), B(t))$ remains non-negative for all time, provided non-negative initial conditions. The basic reproduction number R_0 is given by $R_0 = \theta P \zeta A / (\delta(\delta + \zeta A))$, and the threshold condition for stability of the disease-free equilibrium is $R_0 \leq 1$. The equilibrium point (P^*, A^*, B^*) is locally asymptotically stable if certain conditions are met.

The results have significant implications for understanding intra-communal violence dynamics in Oghara community. Reducing R_0 through effective interventions, such as promoting peaceful dialogue and positive interventions, can help control violence spread. Rehabilitation and calm-down programs are crucial in reducing violence prevalence. Overall, the findings suggest that combining peaceful dialogue promotion, rehabilitation, and calm-down programs can help reduce violence and promote a peaceful and stable society.

6. Conclusion

This study has developed a mathematical model to investigate the dynamics of intra-communal violence in Oghara community. The model analysis has revealed the importance of promoting peaceful dialogue, rehabilitation, and calm-down programs in reducing the prevalence of violence.

The study has shown that the basic reproduction number R_0 plays a crucial role in determining the stability of the disease-free equilibrium. Reducing the value of R_0 through effective interventions can help to control the spread of violence. The stability analysis of the equilibrium point has highlighted the importance of rehabilitation and calm-down programs in reducing the prevalence of violence. The study has also shown that the rate of aggressive individuals becoming peaceful must be greater than the rate of peaceful individuals becoming aggressive, and the rate of brutal individuals becoming peaceful must be greater than zero.

In conclusion, this study has contributed to the understanding of the dynamics of intra-communal violence in Oghara community. The findings of this study can be used to inform policy decisions and develop effective strategies for reducing the prevalence of violence and promoting a more peaceful and stable society.

Conflict of Interest

The authors declare that they have no conflict of interest

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