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# Neutrosophic Analysis of the Origin of Domestic Violence

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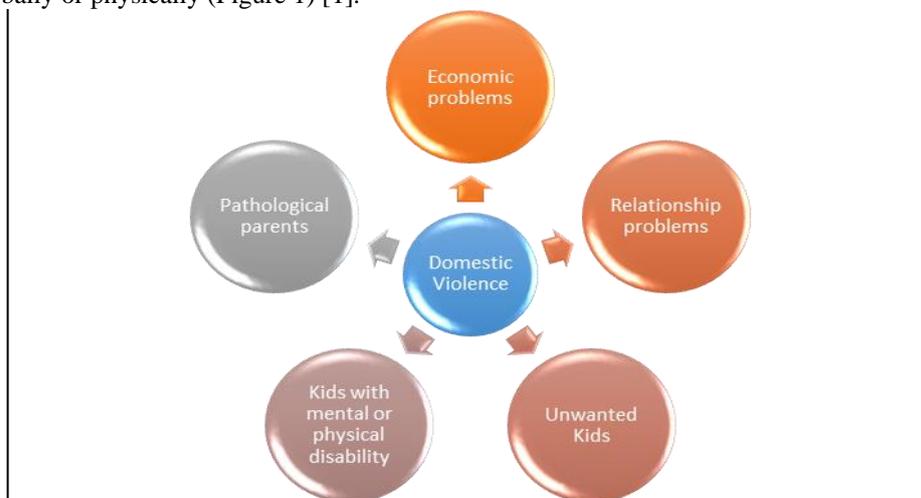
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**Abstract.** In Ecuador, domestic violence is the government’s priority as this affects the emotional balance of the injured people, leading them to the appearance of behavioral alterations. Therefore, any physical or psychological aggression damages the family nucleus. In the Constitution of the Republic of 2008, the right to personal integrity was established. However, there is still a social ignorance of the main elements that originate it and its effects on society. The incidence of violence against women, children, and adolescents reaches alarming global and national levels. According to the World Health Organization, 35% of women worldwide have been victims of physical and/or sexual violence by their partner or sexual violence by people other than their partner. It is worth mentioning that with the origin of COVID-19, it has increased problems in homes such as in the economic, family, and emotional sphere. This study's objective is to define the origin of domestic violence and its interrelation as a neutrosophic group and its modeling using neutrosophic statistics.

**Keywords:** Domestic violence, assault, victim, neutrosophic statistics.

## 1 Introduction

Domestic violence is considered any type of mistreatment generated by the aggressor or aggressors, either verbally or physically (Figure 1) [1].



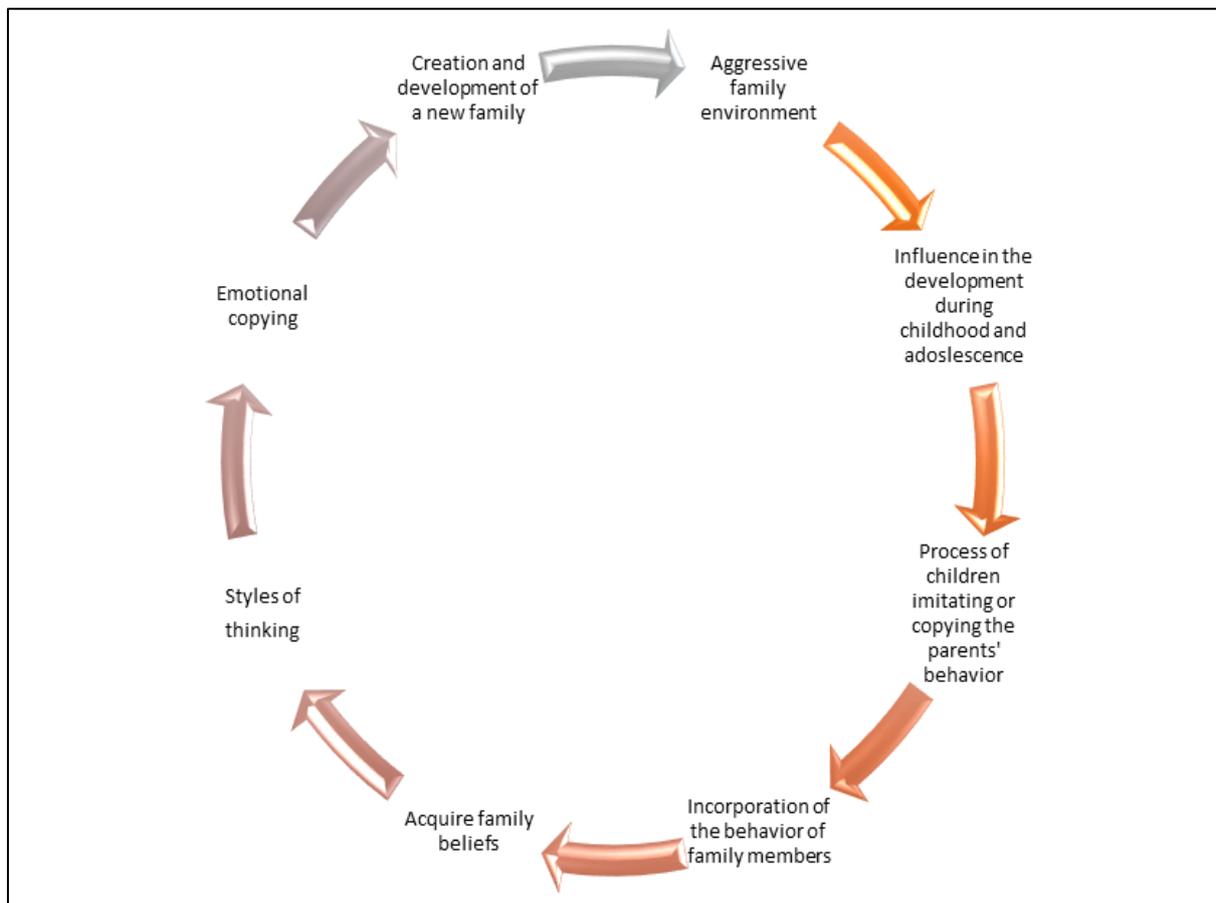
**Figure 1.** Causes that trigger domestic violence.

If there are high levels of violence in a home, there is a high probability that the descendants will apply this aggressive model in their lives as adults. This process begins in childhood when children learn by copying relatives' behavior and acquire their beliefs, styles of thoughts, and emotional coping. If the family has an aggressive model,

the child will learn aggressiveness. Thus, both the family and the sociocultural environment in which the child develops are very influential in his conduct because children would learn to behave through imitation [2-4].

In the case of aggressive behavior, the same principle applies, since certain stimuli induce offensive behavior, which is fixed after continuous exposures in a violent environment and with toxic emotional relationships. In essence, this theory postulates that behaviors are learned by imitation (figure 2), especially when the child sees that such behaviors have been rewarded or reinforced. If a subject observes that the aggressive behavior of a person is reinforced or rewarded, he will learn it [5]

Children who grow up in a violent environment learn that violence is something normal that manifests itself between adults and as they mature, they include abuse in the development of their personality, internalizing the role of aggressor. UNICEF points out that children who hear or witness violence in their home would probably have psychological problems, and the International Convention on the Rights of the Child considers this a form of child abuse, collecting it in article 19 as "mental violence" [6].



**Figure 2.** Influence of the aggressive family environment in childhood and adolescence. Adapted from [2]

Changes in behavior indicate that persistent frustration in the subject is reflected in the following deficiencies: social isolation, sudden changes in friendships, changes in eating habits, and sleep patterns [7].

The relevance of the environment on behavior is accepted since all conduct disorder manifests itself in the environment and is influenced by reinforcers existing in the environment (figure 3). The environment admits different levels of analysis, being the family and the context those that have the greatest weight for the child's mental health [8]. It will be essential to assess the environment and its interaction with the child's cognitive-affective structure because its behavior changes thanks to environmental circumstances [9, 10].

World Health Organization (WHO) refers that physical violence originates from physical and psychological damage, at the body level it leaves scratches, internal wounds, cuts, burns, fractures, and even death. The immediate effect of pain is pain; children who have suffered violence are exposed to persistent neurological problems and manifest in irritability, lethargy, tremors, and vomiting [11]. The frequent shaking syndrome in young children predisposes them to suffer from permanent deafness or blindness, paralysis, coma, or even death. Concerning psychological effects, after a certain amount of time, these become catastrophic since they induce the risk of addictive behaviors to psychoactive substances [12, 13]

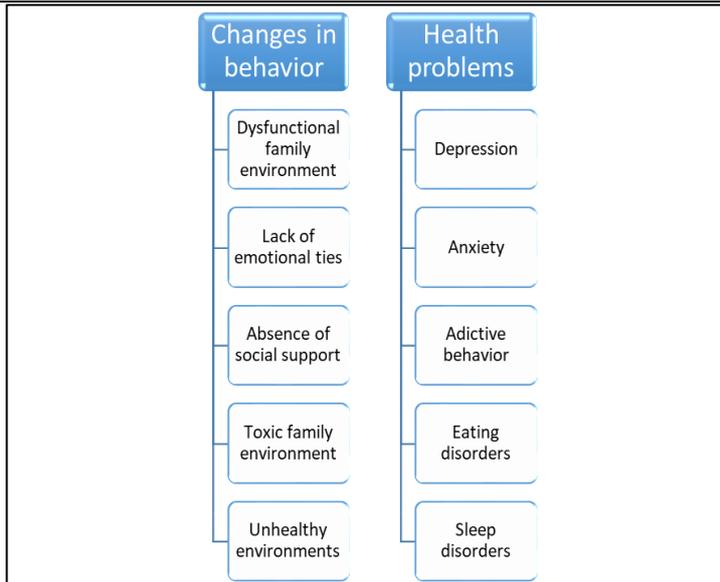


Figure 3. Changes in behavior and the presence of conduct disorders.

Among the anxiety disorders suffered by victims of abuse, we may find the following ones: obsessive-compulsive, panic, post-traumatic stress, generalized anxiety, agoraphobia, and other phobias among others [14] [15]. Pathological anxiety results from the daily confrontation between the attacked individual and the aggressor [16]. Pathological anxiety is also responsible for causing inadequate responses to certain conflicts [17].

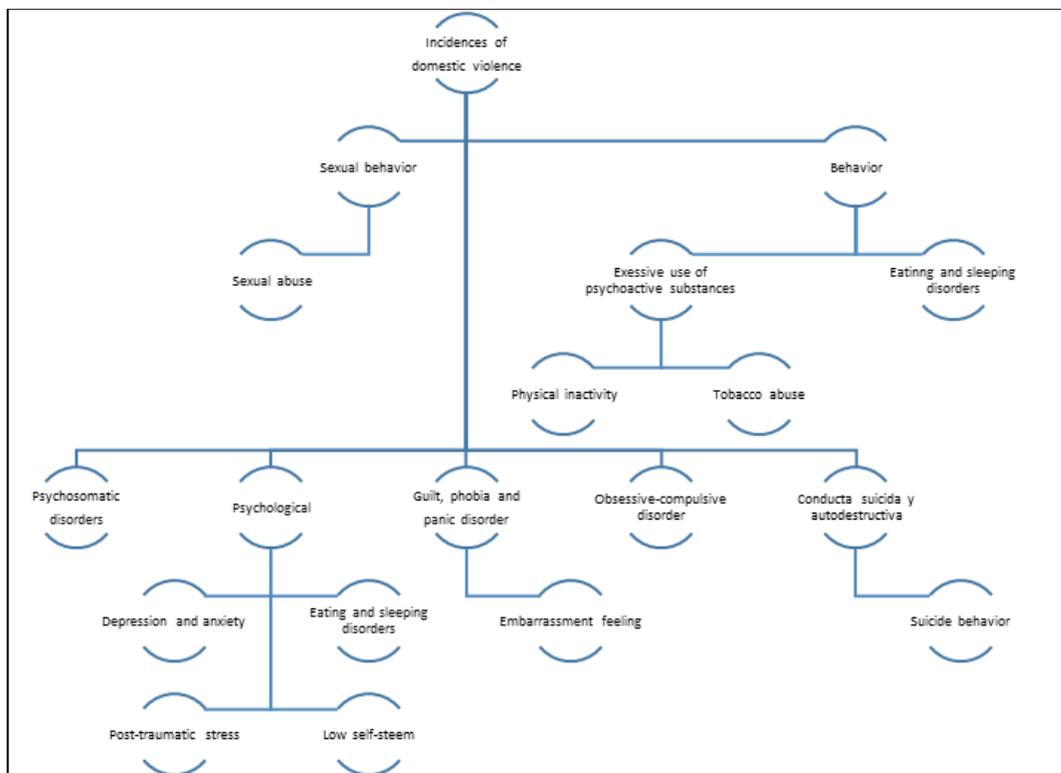
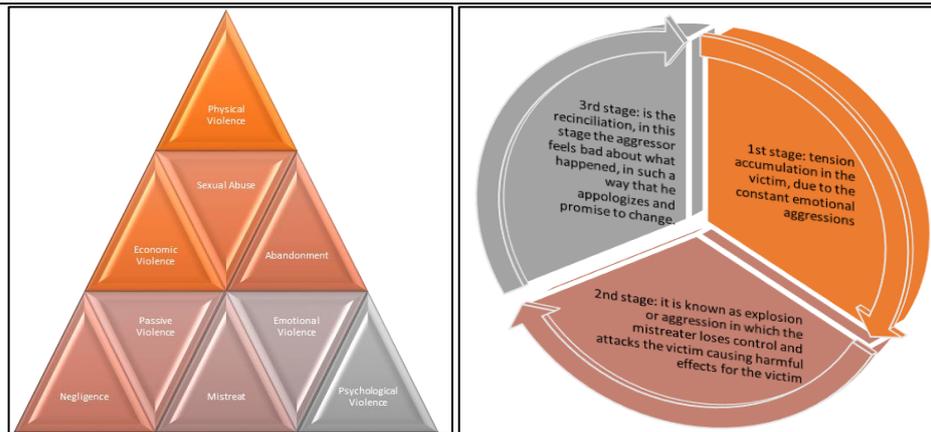


Figure 4. Psychological and behavioral consequences suffered by victims of violence.

According to Lorente, *machismo* in society takes place in various ways, and one of these is through the subjugation of women. The man uses some factors such as intimidation, abuse, control of money, the appropriation of space to try to subdue the woman and thus dominate her. It is about using psychological, economic, or personal moral force to convince her that they are right [18-20].



**Figure 5.** Types and cycle of violence and its interactions in the family environment.

Violence persists in the family because there are risk factors in the aggressor, the abused child, and the hostile environment (increased these days with COVID-19) [21]. Among the risk factors presented by the abuser are: having an antisocial personality disorder, a severe mental disorder such as schizophrenia in which violence occurs as a consequence of paranoid delusions or in response to auditory hallucinations; or have a manic disorder, which causes the subject to become aggressive in the face of minimal provocations; have an organic cause that generates the violent response, the abuse of psychoactive substance use, among others [22]. The risk factors that predispose the child to be abused are suffering from a complex mental illness or having irritable behavior. On the other hand, some of the environmental risk factors that induce domestic violence are economic or family problems, which leads to parents unloading violently with their children [23, 24].

It is considering that family violence is common in our environment and affects the psyche on the psychological development of children. In this research work, the conflictive family environment will be related to the appearance of behavioral disorders in the most vulnerable members of the affected family. The importance of this study lies in knowing the causes that lead to domestic violence and the consequences that occur in the members involved to create awareness in society [25, 26].

They consider that behaviors are created by associating a specific response to a specific stimulus. In the case of aggressive behavior, the same principle applies since certain stimuli induce offensive behavior, which is fixed after continuous exposures in a violent environment and with toxic emotional relationships. Albert Bandura's theory of social learning has been very useful to understand aggressive behavior, in essence, what this theory postulates is that behaviors are learned by imitation, especially when the child sees that such behaviors have been rewarded or reinforced. If the subject observes that a person's aggressive behavior is reinforced or rewarded, he will learn it [5].

Based on the analyzed antecedents, this study defines:

- Problem situation: increase in cases of domestic violence
- Objective: define the triggers of domestic violence
- Specific objectives:
  - Determine the causes that affect the analyzed variable
  - Carry out the measurement and modeling of the variable
  - Project potential alternatives to protect victims of domestic violence

## 2 Materials and methods

Neurosophic probabilities and statistics are a generalization of classical and imprecise probabilities and statistics. The Neurosophic Probability [4, 27-47] of an event E is the probability that event E will occur [48], the probability that event E does not occur, and the probability of indeterminacy (not knowing whether event E occurs or not). In classical probability  $n_{sup} \leq 1$ , while in neurosophic probability  $n_{sup} \leq 3 +$ . The function that models the neurosophic probability of a random variable x is called the neurosophic distribution:  $NP(x) = (T(x), I(x), F(x))$ , where T(x) represents the probability that the value x occurs, F(x) represents the probability that the value x does not occur, and I(x) represents the indeterminate or unknown probability of the value x.

Neurosophic Statistics is the analysis of neurosophic events and deals with neurosophic numbers, the neurosophic probability distribution [49], neurosophic estimation, neurosophic regression, etc. It refers to a set of data formed totally or partially by data with some degree of indeterminacy and the methods to analyze them.

Neurosophic statistical methods allow the interpretation and organization of neurosophic data (data that can be ambiguous, vague, imprecise, incomplete, or even unknown) to reveal the underlying patterns [50].

In short, the Neutrosophic Logic [51] [52], Neutrosophic Sets, and Neutrosophic Probabilities and Statistics have a wide application in various research fields and constitute a new reference of study in full development.

The Neutrosophic Descriptive Statistics includes all the techniques to summarize and describe the characteristics of the neutrosophic numerical data [53].

Neutrosophic Numbers are numbers of the form where a and b are real or complex numbers [54], while "I" is the indeterminacy part of the neutrosophic number N.

$$N = a + bI.$$

The study of neutrosophic statistics refers to a neutrosophic random variable where  $X_l$  and  $X_u I_N$  represent the corresponding lower and upper level that the studied variable can reach in an indeterminate interval  $[I_l, I_u]$ . Following the neutrosophic mean of the variable when formulating:

$$X_N = X_l + X_u I_N; I_N \in [I_l, I_u] \tag{1}$$

$$\text{Where } \underline{x}_a = \frac{1}{n_N} \sum_{i=1}^{n_N} X_{il}, \underline{x}_b = \frac{1}{n_N} \sum_{i=1}^{n_N} X_{iu} n_N \in [n_l, n_u] \tag{2}$$

is a neutrosophic random sample. However, for the calculation of neutral squares (NNS), it can be calculated as follows

$$\sum_{i=1}^{n_N} (X_i - \bar{X}_{iN})^2 = \sum_{i=1}^{n_N} \left[ \begin{matrix} \min \left( (a_i + b_i I_L)(\bar{a} + b I_L), (a_i + b_i I_U)(\bar{a} + b I_U) \right) \\ (a_i + b_i I_U)(\bar{a} + b I_L), (a_i + b_i I_L)(\bar{a} + b I_U) \\ \max \left( (a_i + b_i I_L)(\bar{a} + b I_L), (a_i + b_i I_U)(\bar{a} + b I_U) \right) \end{matrix} \right], I \in [I_L, I_U] \tag{3}$$

Where  $a_i = X_l, b_i = X_u$ . The variance of the neutrosophic sample can be calculated by

$$S_N^2 = \frac{\sum_{i=1}^{n_N} (X_i - \bar{X}_{iN})^2}{n_N}; S_N^2 \in [S_L^2, S_U^2] \tag{4}$$

The neutrosophic coefficient (NCV) measures the consistency of the variable. The lower the NCV value, the more consistent the factor's performance of the other factors are. NCV can be calculated as follows [55].

$$CV_N = \frac{\sqrt{S_N^2}}{\bar{X}_N} \times 100; CV_N \in [CV_L, CV_U] \tag{5}$$

### 3 Results

The study is developed from the interrelation of the group of experts and non-profit associations in support of victims of abuse. The modeling has 60 people who have been direct and indirect victims of domestic violence. Those involved receive e-mail surveys that address family violence according to types of abuse received, feelings, and behaviors experienced after exposure to abuse. The individuals surveyed come from the urban sector, aged between 18 and 25 years. The results obtained are presented to the team of experts to evaluate and define the main trends as the most frequent types of domestic violence.

From the results obtained, the following characteristics are determined:

Variable	Coding	Sample	Scale
Domestic violence	DV	60	$[0; 1], \forall F_n$ $IIE = 0$ (false) $IIE = 1$ (True) $0 \leq IIE \leq 1$ (Indeterminacy on the increase in VI)

**Table 1.** Characteristics of the domestic violence variable.

Variable analyzed: domestic violence

For a sample of n = 60, for each factor (f)

Initials	Factors that promote Intrafamily violence	Factor	Source	Scale
PPR	Pathology presented by relatives	F1	Behaviors are learned by imitation when exposed to a violent family environment	[0; 7]
EPH	Economic problems within the home	F2	The lack of necessary resources creates a hostile environment with children	[0; 7]
RPH	Relationship problems that then spill over to the children	F3	Crossfire effect, they are victims of the differences between their tutors	[0; 7]
HUC	Having an unwanted child or one with a complication	F4	Unplanned children in the relationship. Abandonment processes and negative	[0; 7]

OC	Other causes	F5	All causes that are not included within factors 1 to 4	[0; 7]
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**Table 2:** Characteristics of each factor that originate domestic violence.

For the development of the statistical study, the neutrosophic frequencies of the factors are analyzed to relate to domestic violence.

Neutrosophic frequencies					
Days	PPR	EPH	RPH	HUC	OC
1	[5 ; 6]	[0; 1]	[2 ; 2]	[1 ; 6]	[1 ; 2]
2	[4 ; 6]	[4 ; 6]	[2 ; 5]	[2 ; 3]	[0; 6]
3	[1 ; 3]	[3 ; 5]	[2 ; 4]	[0; 3]	[1 ; 1]
4	[0; 2]	[4 ; 4]	[0; 4]	[2 ; 5]	[0; 2]
5	[1 ; 2]	[1 ; 1]	[2 ; 4]	[2 ; 6]	[1 ; 3]
6	[2 ; 3]	[3 ; 4]	[3 ; 5]	[0; 2]	[1 ; 3]
7	[0; 0]	[4 ; 4]	[3 ; 7]	[0; 4]	[0; 2]
8	[2 ; 2]	[2 ; 2]	[3 ; 3]	[0; 5]	[1 ; 1]
9	[2 ; 3]	[4 ; 5]	[0; 0]	[1 ; 4]	[0; 0]
10	[4 ; 5]	[3 ; 6]	[3 ; 6]	[0; 0]	[0; 6]
11	[4 ; 5]	[1 ; 1]	[0; 2]	[0; 1]	[0; 2]
12	[3 ; 4]	[2 ; 5]	[1 ; 2]	[2 ; 2]	[0; 2]
13	[1 ; 2]	[0; 2]	[3 ; 7]	[1 ; 4]	[0; 5]
14	[1 ; 3]	[3 ; 4]	[1 ; 2]	[0; 5]	[0; 4]
15	[5 ; 7]	[1 ; 2]	[0; 1]	[0; 0]	[1 ; 6]
16	[4 ; 6]	[1 ; 4]	[0; 1]	[0; 3]	[1 ; 2]
17	[4 ; 4]	[1 ; 2]	[1 ; 2]	[2 ; 4]	[1 ; 7]
18	[4 ; 6]	[4 ; 4]	[0; 1]	[1 ; 4]	[1 ; 2]
19	[0; 0]	[2 ; 2]	[3 ; 3]	[2 ; 2]	[1 ; 1]
20	[5 ; 7]	[1 ; 4]	[3 ; 6]	[2 ; 7]	[0; 6]
<b>0-60</b>	<b>[143; 205]</b>	<b>[122; 202]</b>	<b>[105; 237]</b>	<b>[62; 219]</b>	<b>[26; 192]</b>

**Table 3.** Neutrosophic frequencies of each factor.

Table 3 studies the factors that promote domestic violence for 60 days, with a level of occurrence of for each factor per day, with a total indeterminacy level of  $[0; 7]f_1 = 62, f_2 = 80, f_3 = 132, f_4 = 157, f_5 = 166$ , with a level of representativeness of, on the days that 7 occurrences per factor are recorded, with a higher incidence of 60% in the  $[30.24%; 86.46\%]$  pathology presented by relatives. As a result of the existing indeterminacy, the use of classical statistics is not possible, so the use of neutrosophic statistics is necessary for its greater understanding.

Neutrosophic statistical analysis

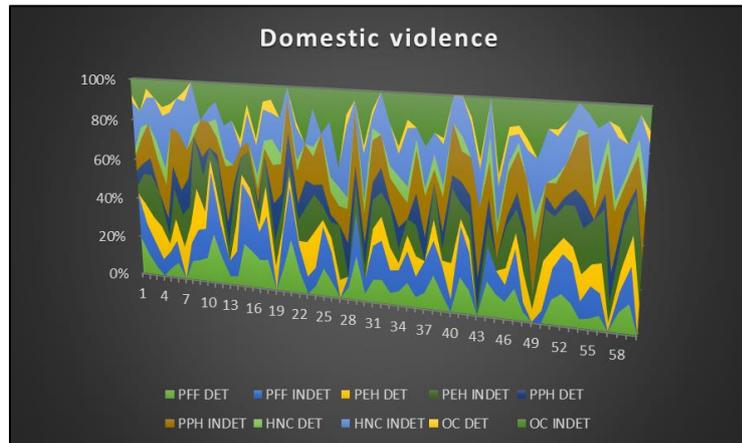
In the modeling, it is observed that the *Pathology factor presented by relatives* is one of the causes that most influence the origin of domestic violence (Table 5). To understand which factor implies a representative mean  $\underline{x}_f = \in [ \underline{x}_{L_f}; \underline{x}_{U_f} ]$ , the values of the neutrosophic means and the variation of the variable are calculated to study the indeterminacies in the final result, with the incorporation of the values of the neutrosophic standard deviation for each factor  $S_{N_f} \in [ S_{L_f}; S_{U_f} ]$ . To determine which factor requires greater attention in the process of preventing possible acts of domestic violence through the values provided by the  $CV_{N_f} \in [ CV_{L_f}; CV_{U_f} ]$ .

Factors	$\underline{x}_N$	YN	CVN
<i>Pathology presented by relatives</i>	[2.383; 3,417]	[1.849; 3.149]	[0.776; 0.922]
<i>Economic problems within the home</i>	[2.033; .,367]	[1.202; 2,573]	[0.591; 0.764]
<i>Relationship problems that then spill over to the children</i>	[1.75; 3.95]	[0.877; 2.68]	[0.501; 0.678]

<i>Having an unwanted child or one with a complication</i>	[1.033; 3.65]	[0.428; 2.642]	[0.414; 0.724]
<i>Other causes</i>	[0.433; 3.2]	[0.127; 2.622]	[0.293; 0.819]

**Table 5.** Neutrosophic statistics of the causes of domestic violence.

Each factor in the neutrosophic set has a strong interrelation with indeterminate elements, so that representatively in this group, the RPH factor has a greater incidence of repercussion, as it corresponds to the children as the weakest links in the family with a higher level of indeterminacy of occurrence, while for the *Pathology factor presented by relatives* is on average the one that most affects the origin of domestic violence on a neutrosophic scale [0; 1] (figure. 6). In affirmation, the value  $CV_{N_{f_1}}$  of this factor is lower if compared to the rest. This represents that the PPR factor is more consistent and accurate than the other factors (Figure 6).



**Figure 6.** neutrosophic Stacked graph [0; 1] of the interrelationships of the factors in domestic violence.

Comparative analysis

To determine the associated referent indeterminacy measure for the form of neutrosophic numbers (Table 6). In the results obtained, it is observed that for the values they go from  $\underline{x} \in [\underline{x}_L; \underline{x}_U], S_N \in [S_L; S_U] CV_N \in [CV_L; CV_U] CV_N 0.293$  to  $0.776$  with the indeterminacy measure from 15.8% to 64.2%, which generates a relevant cause to be mitigated by having a lower level of indeterminacy, such as its influence on the other factors.

Factors	$\bar{x}_N$	YN	CVN
PPR	$2.383 + 3.417 I; I \in [0; 0.30]$	$1.849 + 3.149 I; I \in [0; 0.41]$	$0.776 + 0.922 I; I \in [0; 0.15]$
EPH	$2.033 + 3.367 I; I \in [0; 0.39]$	$1.202 + 2.573 I; I \in [0; 0.53]$	$0.591 + 0.764 I; I \in [0; 0.22]$
RPH	$1.75 + 3.95 I; I \in [0; 0.55]$	$0.877 + 2.68 I; I \in [0; 0.67]$	$0.501 + 0.678 I; I \in [0; 0.26]$
HUC	$1.033 + 3.65 I; I \in [0; 0.71]$	$0.428 + 2.642 I; I \in [0; 0.83]$	$0.414 + 0.724 I; I \in [0; 0.42]$
OC	$0.433 + 3.2 I; I \in [0; 0.86]$	$0.127 + 2.622 I; I \in [0; 0.95]$	$0.293 + 0.819 I; I \in [0; 0.64]$

**Table 6:** Neutrosophic forms with indeterminacy measure.

Preliminary solutions

The following is suggested from the result obtained and the interrelation of the PPR factor with the rest:

- The institutions and governing bodies in favor of protecting the family and the rights of children and adolescents should propose that victims who have been abused or mistreated in their family nucleus be investigated and treated, addressing the feelings that this situation has generated in them, and the thoughts that this problem has brought to them, suggesting a group dynamic aimed especially at children to prevent future acts of violence when they form a family.
- It is suggested that domestic violence be studied more deeply. The information must be socialized so that people can feel identified with any of them because they have similar cases or because they are victims.
- Expand the panorama of violence, where people place situations of abandonment and indifference towards their children as forms of psychological.

- The state must promote and modify policies and programs for the prevention, protection, punishment, and restitution of victims' rights of any type of violence.

## Conclusions

- Even though domestic violence is a phenomenon that has physical and emotional consequences, it is important to identify that abandonment and lack of attention are other ways of child abuse. It is considered that this research creates awareness in readers since domestic violence is always seen as a problematic situation of physical abuse between the aggressor and the victim, leaving aside other types of existing aggressions such as psychological and passive violence.
- The analysis of the data carried out determined the causes that, in the form of a chain reaction, affect the victims and their families. When determining the causes that originate domestic violence with the use of neutrosophic statistics due to the degree of indeterminacy in the variable analyzed. The result shows a lower value of CV for the *Pathology presented by the relatives* as a key factor and trigger of domestic violence.
- The governing bodies must promote programs and actions aimed at breaking the cycle of family violence from generation to generation, in addition to creating a healthy family environment.

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