



# Analysis of the Right to Monetary Contribution for Illness through Neutrosophic Statistics

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**Abstract.** The right to receive social assistance for sickness is considered a right of every low-income citizen. Social security must ensure that people without access to health insurance have the option of this type of compensation. However, to access the monetary contribution for illness, a rigorous process is required to validate and approve it. In some cases, some people have been affected by the budget deficit that the locality presents, due to the non-payment of taxpayers. Therefore, the present study focuses on determining the causes of non-compliance with the monetary contribution for the illness that affect the violation of the right to receive a subsidy. For the modeling of the study, neutrosophic statistics are used to detect the existing uncertainties. Among the neutrosophic results, the implementation of mechanisms and ways to control the collections for the monetary contribution for illness is proposed, in addition to informing society and giving attention to those workers who are disabled.

**Keywords:** monetary contribution, neutrosophy, neutrosophic statistics, subsidy.

## 1 Introduction

Many prerogatives that society enjoyed have been lost because people in their ignorance do not claim them. It is time for society to claim the subsidy as a fundamental human right that must be protected and increased. The lack of jobs, new educational spaces, and economic support to prepare human capital are some of the situations that occur with increasing frequency, even within the country.

The Constitution of Ecuador is a guarantor of rights and because it is the supreme norm as established in its article 424, the other norms must strictly comply with what is established in it and thus avoid the violation of the right to sick pay, to those affiliated to the Ecuadorian Institute of Social Security (EISS) [1].

The subsidy for disability derived from illness or accident of common origin is an economic benefit that initially corresponds to the employer and then, the responsibility for its recognition and payment, is transferred to the Comprehensive Social Security System. This, as part of its economic benefits, grants a temporary monetary subsidy when the member is unable to work, as a result of illness or maternity. Among the different types of disability are:

- Temporary Disability: It is the one that prevents the affiliated worker from going to work, due to an accident or professional illness. While the member receives medical, surgical, hospital, or rehabilitation care, he has the right to:
  - ✓ Subsidy: In cases of temporary disability, the insured will receive a cash subsidy, in the percentages of the worker's remuneration, set in the Statutes, during a base year, in accordance with the certificates granted by the occupational hazard medical professionals. The cash subsidy is equal to 75% of the salary or contribution salary, during the first ten weeks; and 66%, during the time after those first ten weeks, until completing the year (52 weeks).
  - ✓ Provisional Pension for up to two years: If the disability exceeds one year, the member will have the right, for the subsidized period, to a pension equivalent to 80%, prior opinion of the Disability Assessment Commission.
- Partial Permanent Disability: This is one that causes the worker an injury or definitive functional disturbance that means a decrease in the physical integrity of the member, which will be calculated subject to the Table of Values of Disabilities and the regulations in force.
  - ✓ Compensation: When the percentage of partial permanent disability is up to 20% inclusive, the member is entitled to a Single Global Compensation only once.
  - ✓ Pensions: They are paid monthly, for life. Income for partial permanent disabilities ranges from 21% to 80% decrease in capacity for work. These rents do not cause the right to montepío.

- **Total Permanent Disability:** Is that which disables the member from performing all the fundamental tasks of his or her usual profession or trade. The insured will receive a monthly income equivalent to 80% of the average wages or salaries of the last year of contribution or the average of the five best years, if higher. This disability causes the right to *montepío*.

The subsidy for incapacity for work is a cash benefit that is intended to cover the contingency or state of need that is generated to a worker due to the temporary suspension of the ability to work, caused by illness or common accident, professional illness or accident of the work or disease [2] [3], [17]. A monetary subsidy is granted to active dependent workers who for medical reasons are unable to work, the (EISS) grants it from the fourth day of disability caused by non-professional illness and for a maximum of 185 days. To acquire the right to this subsidy, the requirements established in article 189 of the Social Security Law must be met, of which [4], [16], [18]:

- a) The insured registers no less than sixty monthly contributions, of which no less than six must be immediately before the incapacity;
- b) The contingency has affected the main activity in such a way that it deprives the insured of obtaining most of the income necessary for sustenance;
- c) It has been verified that the insured ceased in said activity due to the contingency, understanding as such that he interrupted the performance of his work or had to terminate the employment or contractual relationship under which he fulfilled it; and,
- d) The disability is not covered by the General Work Hazard Insurance.

To access the sickness subsidy, members must complete a procedure and follow the process manual for validation, registration of medical certificates, and payment of monetary sickness benefits. For this, they must be aware of the medical certificates issued by the specialists, even when they are in the Intensive Care Unit (ICU), which means that the relatives who are in the care of these members must be aware of a cumbersome procedure. It consists of validating and registering each medical certificate, for which you must go to the social work area. If this procedure is not carried out due to lack of knowledge or information, you lose the right to receive this subsidy of 75% of your remuneration during the first sixty days, from 66 to 64 from day 61 to day 185 and only the amount equivalent to the days he was able to register would be paid. [19], [20]

Due to this situation, it is pertinent to analyze and establish qualitatively and quantitatively this violation of the rights of affiliates. Well, it contradicts the constitutional norm regarding the right to sick pay, especially when they suffer from an illness that generates a situation of disability, due to the lack of registration of the medical certificate, within the first three days.

The EISS protects its policyholders with financial and assistance benefits against contingencies that affect their ability to work. In addition, it protects the obtaining of an income according to their usual activity in cases of illness, maternity, work risks, old age, death, and disability which includes disability and unemployment [5].

Affiliates with these health conditions and their families go through a process that, due to the severity of the disease, alters their social environment and the normal socioeconomic development of the family group. Well, they are emotionally impacted, to which are added the administrative procedures to enjoy a right, which is not consistent with the situation and the care that the EISS owes to its affiliates.

Based on the analysis, it is considered necessary to approach, through the modeling of neutrosophic statistics, and determine the causes of non-compliance with the monetary contribution for an illness that affects the violation of the rights to receive a subsidy and that contradicts the constitutional norm regarding priority and specialized care that people have, in order to prevent negative effects on members, as well as proposals for potential solutions.

## 2 Materials and methods

### 2.1 Neutrosophic Statistics

Neutrosophic probabilities and statistics are a generalization of classical and imprecise probabilities and statistics. The Neutrosophic Probability of an event E is the probability that the event E occurs [6], the probability that the event E does not occur, and the probability of indeterminacy (not knowing if the event E occurs or not) [7]. In classical probability  $n_{sup} \leq 1$ , while in neutrosophic probability  $n_{sup} \leq 3+$ .

The function that models the neutrosophic probability of a random variable x is called the neutrosophic distribution:

$$NP(x) = (T(x), I(x), F(x)),$$

Where T(x) represents the probability that value x occurs, F(x) represents the probability that value x does not

occur, and  $I(x)$  represents the undetermined or unknown probability of value  $x$ .

Neutrosophic Statistics is the analysis of neutrosophic events and deals with neutrosophic numbers, neutrosophic probability distribution, neutrosophic estimation, neutrosophic regression [8], etc. It refers to a set of data, which is formed totally or partially by data with some degree of indeterminacy and the methods to analyze them [9].

Neutrosophic statistical methods allow neutrosophic data (data that may be ambiguous, vague, imprecise, incomplete, or even unknown) to be interpreted and organized to reveal underlying patterns.

Finally, Neutrosophic Logic, Neutrosophic Sets, and Neutrosophic Probabilities and Statistics have a wide application in various research fields and constitute a novel study reference in full development [10], [11], [12].

Neutrosophic Descriptive Statistics comprises all the techniques for summarizing and describing the characteristics of neutrosophic numerical data.

Neutrosophic Numbers are numbers of the form  $N = a + bI$  where  $a$  and  $b$  are real or complex numbers, while "I" is the indeterminacy part of the neutrosophic number  $N$  [13], [14], [15], [21], [22], [23], [24].

The study of neutrosophic statistics refers to a neutrosophic random variable where  $X_l$  and  $X_u$  represent the lower and correspondingly higher level that the studied variable can reach, in an indeterminate interval  $[I_l, I_u]$ . Follow the neutrosophic mean of the variable ( $\bar{x}_N$ ) by formulating:

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

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

However, for the calculation of neutral squares (NNS) it can be calculated as follows.

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

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 value of the NCV, the more consistent the performance of the factor is than that of the other factors. The NCV can be calculated as follows.

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

### 3 Method development

A neutrosophic frequency distribution is a table showing absolute and relative frequencies, partial or total uncertainties. Indeterminacies occur primarily due to imprecise, unknown, or incomplete data related to absolute frequencies. The relative frequencies then become imprecise, incomplete, or may even be unknown.

The development of the study of the distribution of neutrosophic frequencies associated with the analysis of the right to the monetary contribution for illness.

No	Causes	Absolute neutrosophic Frequency	Neutrosophic Relative Frequency
1	ignorance	15	[0.179 , 0.214]
2	Inaccessibility to counseling services	[20,30]	[0.238 , 0.429]
3	Arrears in payments and non-payments to the contribution	25	[0.298 , 0.357]
4	Violation when applying the regulations that respond to the contribution for illness	[10,14]	[0.119 , 0.2]
	Total	[70,84]	[0.833 , 1.2]

**Table 1:** Causes of non-compliance with the monetary contribution for illness. Source: own elaboration.

As can be seen, for the cases of *ignorance* and *delays in payments and non-payments of the contribution*, the number of individuals who present these causes of non-payment of the contribution (15 and 25 times respectively) is known exactly. However, it is not possible to specify the number of times that have been observed that the causes are *inaccessibility to counseling services* and *violation when applying the regulations that respond to the contribution for illness*.

In the table, it can be read that, for the case of 2, this has happened between 20 and 30 times, but the exact information is not available, the same for the number of *Violation when applying the regulations that respond to the contribution for illness*. This indicates the existence of uncertainties related to frequencies. The last column reveals the relative neutrosophic frequencies associated with each event.

Since there is imprecise information, it is necessary to calculate the extremes (min. and max.) of the absolute or estimated frequencies.

$$\min_{fn} = 15 + 20 + 25 + 10 = 70$$

$$\max_{fn} = 15 + 30 + 25 + 24 = 84$$

Subsequently, to calculate the relative frequencies, their minimum and maximum values must be calculated for each of the results tabulated as individuals who report that cause of non-compliance. For this, the following formula will be applied:

$$\min_{fnri} = \frac{\min_{fni}}{\max_{fn}}, Y$$

$$\max_{fnri} = \frac{\max_{fni}}{\min_{fn}}$$

In the case of frequencies that do not present indeterminacy, it is true that:

$$\min_{fni} = \max_{fni} = fni$$

Therefore:

$$\min_{fnr0} = \frac{\min_{fn0}}{\max_{fn}} = \frac{15}{84} = 0.179$$

$$\max_{fnr0} = \frac{\max_{fn0}}{\min_{fn}} = \frac{15}{70} = 0.214$$

$$\min_{fnr15} = \frac{\min_{fn15}}{\max_{fn}} = \frac{20}{84} = 0.238$$

$$\max_{fnr15} = \frac{\max_{fn15}}{\min_{fn}} = \frac{30}{70} = 0.429$$

$$\min_{fnr20} = \frac{\min_{fn20}}{\max_{fn}} = \frac{25}{84} = 0.298$$

$$\max_{fnr20} = \frac{\max_{fn15}}{\min_{fn}} = \frac{25}{70} = 0.357$$

$$\min_{fnr30} = \frac{\min_{fn20}}{\max_{fn}} = \frac{10}{84} = 0.119$$

$$\max_{fnr30} = \frac{\max_{fn15}}{\min_{fn}} = \frac{14}{70} = 0.2$$

The value of the accumulated neutrosophic relative frequency was then obtained through the sum of the reported neutrosophic relative frequencies.

$$Frna = [0.179, 0.214] + [0.238, 0.429] + [0.298, 0.357] + [0.119, 0.2] = [0.833, 1.2]$$

### 3.1 Neutrosophic Statistical Analysis

To visually show the absolute neutrosophic frequencies, different types of graphs can be used, which must contain and differentiate the determined and the indeterminate part of the analyzed data. It can be represented by a column graph, the frequency of recording the causes of non-compliance as shown in Figure 1.

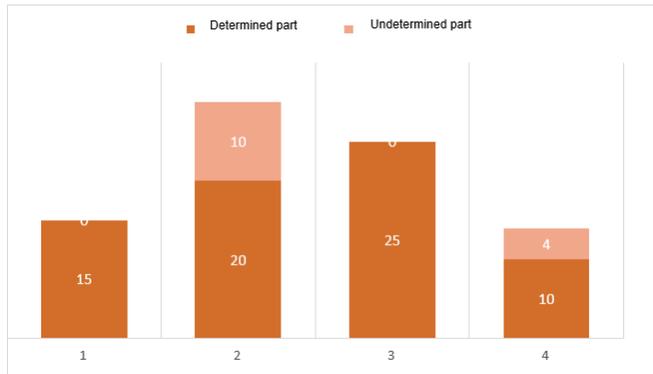


Figure 1: Neutrosophic column chart. Source: own elaboration.

The frequencies of having registered related to causes 2 and 3 are indeterminate with indeterminacy values of 10 and 4, respectively.

In this case, 15 specialists are selected from the neutrosophic sample and the possible causes of tax evasion are analyzed and modeled using a neutrosophic cognitive map. Indeterminacy is expressed with the question mark (?).

The identified causes are:

Node	Cause
N1	Ignorance
N2	Inaccessibility to counseling services
N3	Arrears in payments and non-payments to the contribution
N4	Violation when applying the regulations that respond to the contribution for illness

Table 2: Causes and nodes identified. Source: own elaboration.

N0 represents on the map the causes of not fulfilling the right to the monetary contribution for illness.

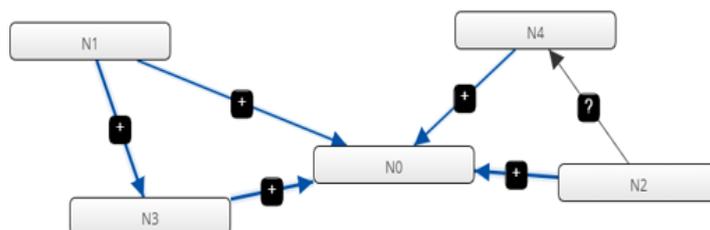


Figure 2: XYZ MCN graphical representation of the causes of non-compliance with the contribution. Source: own elaboration.

NCM with weights is represented in Table 3.

	N0	N1	N2	N3	N4
N0	0	0	0	0	0
N1	0.75	0	0.25	0	0
N2	0.5	0	I	0	I
N3	0.75	0	0	0	0
N4	0.25	0	0	I	0

Table 3: Neutrosophic adjacency matrix. Source: own elaboration.

The nodes are subsequently classified. The following measures are used in the proposed model based on the absolute values of the adjacency matrix

- Outdegree  $od(v_i)$  is the sum of the rows in the neutrosophic adjacency matrix. Reflects the strength of the outgoing relationships  $(c_{ij})$  of the variable.

$$od(v_i) = \sum_{j=1}^N c_{ij} \tag{6}$$

- Indegree  $id(v_i)$  is the sum of the columns reflects the strength of outgoing relations ( $c_{ij}$ ) of the variable.

$$id(v_i) = \sum_{j=1}^N c_{ji} \tag{7}$$

- Total centrality (total degree  $td(v_i)$ ), is the sum of the indegree and the outdegree of the variable.

$$td(v_i) = od(v_i) + id(v_i) \tag{8}$$

The measures of centralities are calculated. The Outdegree and Indegree measurements are presented in Table 4.

Node	Outdegree	Indegree
N0	0	2.25
N1	1	0
N2	0.5+I	0.25
N3	0.75	0
N4	0.25	I

**Table 4:** Centrality measures. Source: own elaboration.

Nodes are classified according to the following rules:

- Transmitting variables have positive or indeterminate outdegree and zero indegree.
- The receiving variables: Have an indeterminate or positive indegree, and zero outdegree.
- Ordinary variables: Have a degree of indegree and outdegree other than zero.

Then, the nodes are classified:

In this case, nodes P1, E1, and T2 are transmitters, S1 is the receiver and T1 is ordinary.

	Transmitter	Receiver	ordinary
N0		X	
N1	X		
N2			X
N3	X		
N4			X

**Table 5:** Node classification. Source: own elaboration.

The total grade was calculated (Equation 8). The results are shown in Tables 5 and 6.

	td
N0	2.25
N1	1
N2	0.75+I
N3	0.75
N4	0.25+I

**Table 6:** Total degree. Source: own elaboration.

Static analysis in NCM initially results in neutrosophic numbers of the form  $(a+bI)$ , where  $I =$  indeterminacy). That is why a neutralization process is required, as proposed by Salmerón and Smarandache  $I \in [0,1]$ , and is replaced by its maximum and minimum values.

	Td
N0	2.25
N1	1
N2	[0.75, 1.75]
N3	0.75
N4	[0.25, 1.25]

**Table 7:** Deneutrosophication of centrality values. Source: own elaboration.

The total grade was calculated (Equation 9). Finally, the mean of the extreme values are processed to obtain a single value.

$$\lambda([a_1, a_2]) = \frac{a_1 + a_2}{2} \quad (9)$$

Then,

$$A > B \Leftrightarrow \frac{a_1 + a_2}{2} > \frac{b_1 + b_2}{2} \quad (10)$$

The results are shown in Table 8.

	Td
N0	2.25
N1	1
N2	1.25
N3	0.75
N4	0.75

**Table 8:** Centrality using the mean of the extreme values. Source: own elaboration.

The order obtained is as follows:

$$N_0 > N_2 > N_1 > N_3 \sim N_4$$

Nodes trusting third parties and ignorance are the main factors. Therefore, it can be said that the governing institutions should focus on minimizing the negative effects of *inaccessibility to counseling services and ignorance*, as the main nodes that activate the neutrosophic network in non-compliance with the monetary contribution due to illness. Therefore, as a strategy to consider, the tax policy should be aimed at improving the perception that taxpayers have about the fulfillment of their obligations to the monetary contribution for illness. So that those people with a critical health situation can have the right to more equitable health. The governing bodies must make use of the current tax legal framework to increase the penalty rates for tax noncompliance. In addition to optimizing information systems to make taxpayers understand that the country and society need the commitment of all its citizens.

## Conclusion

The governing bodies should focus on improving collection systems to mitigate the budget deficit. To achieve this, mechanisms and ways to control collections for the monetary contribution due to illness must be implemented. Access to technology constitutes an opportune means to inform society and give attention to those people entitled to the monetary contribution for illness. The neutrosophic statistical analysis and specifically the neutrosophic statistics can be used to determine the possible causes and non-compliance with the monetary contribution for illness. Failure to comply with formal duties constitutes one of the causes of non-contribution by taxpayers, an indeterminate element in the analysis of the study. Even though several taxpayers affirm that they were not aware or did not have accessibility to consulting services, it is a cause to be analyzed by the corresponding organisms.

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