



# Neutrosophic Study of Knowledge about Hemiplegia

Alex Gabriel Lara Jacome<sup>1</sup>, Mercedes Isabel Guamán Guamán<sup>2</sup>, Kenia Mariela Peñafiel Jaramillo<sup>3</sup> and Kathya Verónica Suaste Pazmiño<sup>4</sup>

<sup>1</sup> Universidad Regional Autónoma de Los Andes, Matriz Ambato. Ecuador. E-mail: [ua.alexlara@uniandes.edu.ec](mailto:ua.alexlara@uniandes.edu.ec)

<sup>2</sup> Universidad Regional Autónoma de Los Andes, Matriz Ambato. Ecuador. E-mail: [ua.mercedesguaman@uniandes.edu.ec](mailto:ua.mercedesguaman@uniandes.edu.ec)

<sup>3</sup> Universidad Regional Autónoma de Los Andes, Matriz Ambato. Ecuador. E-mail: [ua.keniapenafiel@uniandes.edu.ec](mailto:ua.keniapenafiel@uniandes.edu.ec)

<sup>4</sup> Universidad Regional Autónoma de Los Andes, Matriz Ambato. Ecuador. E-mail: [ua.kathyasuaste@uniandes.edu.ec](mailto:ua.kathyasuaste@uniandes.edu.ec)

**Abstract.** In this research, an analysis of the knowledge of a group of university medical students about hemiplegia is carried out, using neutrosophic tools. Since derived from the theoretical study carried out, it was evidenced that there were few studies linking both branches of knowledge. That is why the present research had as the objective to carry out a neutrosophic evaluation of the knowledge of hemiplegia in medical students at the Autonomous Regional University of the Andes in the Republic of Ecuador. Theoretical, empirical, and statistical mathematical methods were used. These allowed to give a certain level of validity to the results obtained.

**Keywords:** neutrosophic model, neutrosophic sample, hemiplegia, university students.

## 1 Introduction

Several diseases and accidents affect the human brain, including stroke, which generically represents a group of disorders that include cerebral infarction, cerebral hemorrhage, and subarachnoid hemorrhage. *Ictus* is a Latin word which, like its Anglo-Saxon counterpart, "stroke", means "blow" and perfectly describes the abrupt and sudden nature of the process. The terms cerebrovascular accident, cerebral attack, and apoplexy are synonyms [1].

A stroke occurs in the recesses of the brain. The symptoms of a stroke are easy to detect. These include the following: sudden numbness or weakness, especially on one side of the body, sudden confusion or problems with speech or understanding, and sudden vision problems. Derived from its consequences, there are several syndromes as is the case of Hemiplegia [2].

Paralysis of one side of the body (hemiplegia) is a common sign of these conditions, although it can also be triggered by other causes such as cerebral palsy and head trauma [3].

The paralysis or weakness experienced by the subjects may affect a hemiface, an arm, a leg, or an entire hemibody. This compromises their functional independence to perform daily activities [3].

Hemiplegia is a neurological syndrome that can be caused by different causes, such as: derived from cerebral palsy, a cranioencephalic trauma, or a cerebrovascular accident; characterized by the paralysis of the striated muscles of one hemibody, producing a picture of profound disability, which acts on the patient's psyche, it is also a nervous tissue injury characterized by the impossibility of actively performing movement or loss of voluntary mobility in a vertical half of the body.

Several researchers attach great importance to this disease and have carried out studies aimed at improving the social life of people who have suffered a cerebrovascular accident, where cognitive therapeutic exercises are used for the motor re-education of the hemiplegic.

Where all the authors consulted agree in stating the need for rehabilitation treatment as early as possible [4], [5].

That is why it is increasingly necessary to stimulate knowledge of this syndrome among medical students so that they can follow appropriate behavior in the different action protocols.

To achieve greater precision in the evaluation of knowledge, neutrosophy is used as a discipline, due to the various potentialities it possesses.

Under the arguments expressed above, the present study has the objective to carry out a neutrosophic evaluation of the knowledge about hemiplegia in medical students at the Autonomous Regional University of the Andes in the Republic of Ecuador.

## 2 Methodology

### 2.1 Study subjects

In the selection of the sample, the considerations of [6] were considered. Who states that from the neutrosophic set, a generic element  $x$  belongs to the neutrosophic population  $P$  in the following way,  $x(v, i, f) P$ , which means:  $x$  belongs  $v\%$  to the population  $P$ ,  $f\%$   $x$  does not belong to the population  $P$ , while the percentage  $i$  of  $x$ , of the population  $P$ , is indeterminate (unknown, not clear, neutral: neither in nor out of the population).

Applying what is systematized by [7], [8], [9], [10], [17], it agrees that this procedure has a high degree of reliability in the sample studied.

- Where  $p$  = approximate proportion of the phenomenon under study in the reference population
- $q$  = proportion of the reference population that does not present the phenomenon under study ( $1 - p$ ). The desired confidence level ( $Z$ ). Indicates the degree of confidence that the true value of the parameter in the population is found in the calculated sample. absolute precision
- (d). It is the desired width of the confidence interval on either side of the true value of the difference between the two proportions (in percentage points).
- $N$  is population size. When making the corresponding calculations, it is determined that the sample must be between 10 and 31 individuals. The reason that led to the selection in correspondence with what is described below.

For the development of the research, a sample of 25 university medical students at the Autonomous Regional University of the Andes in the Republic of Ecuador was selected. Of this, 19 are female and 6 are male, with an average age of 23.8 years. All gave their consent to participate in the research. A selection was made using the raffle technique.

### 2.2 Classical methods and techniques used

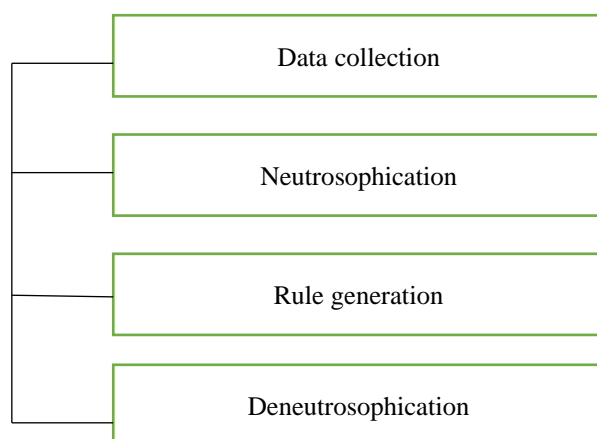
*Analytical-synthetic*: it allowed to carry out a study about the theoretical and methodological foundations that support neutrosophic evacuation. It was used for the systematization, generalization, and specification of the processed information. It was useful in interpreting the empirical information obtained. [18], [19], [20]

*Inductive-deductive*: it made it possible to make inferences and generalizations in the neutrosophic evaluation of the knowledge about hemiplegia in medical students at the Autonomous Regional University of the Andes in the Republic of Ecuador, as well as the interpretation of the data obtained, from which new logical conclusions are deduced. [23], [24], [25], [26]

*Survey*: It was carried out on all the university students of the study sample since this was the instrument used to collect the data derived from this neutrosophic study.

### 2.3 Neutrosophic method

The neutrosophic model proposed in this paper is presented in Figure 1. The model consists of four stages: Data collection, Neutrosophication, Rule generation, and Deneutrosophication.



**Figure 1.** Proposed neutrosophic model.

**First component:** Knowledge about the general characteristics of hemiplegia

This is the highest level of the hierarchy because to be able to perform an adequate treatment after graduation, it is essential to know what the characteristics, signs, and symptoms of this syndrome are.

**Second component:** Knowledge about the main pillars of treatment

This component is important because it is where the therapy to be followed with patients is defined and therefore it is an important aspect to be known by university medical students. This component includes physical therapeutic and educational treatment of comprehensive care for these patients.

**Third component:** Knowledge of treatment effectiveness evaluation techniques

This component is based on the different functional tests, clinical scales, and questionnaires that the student must know to evaluate the treatment received and if it is effective or not, this allows making adjustments in the treatment in correspondence with the patient's evaluation.

By applying the rules of neutrosophic inference, a categorization is established, that is, the possibility of detecting a certain type of behavior pattern in the knowledge of medical students in correspondence to the subject under investigation.

This rule is based on the technique of the survey of university students, where they answer the question in correspondence with the three components described. That is why this same algorithm is followed for the analysis and interpretation of the results obtained in this investigation.

If  $X_1 = A_1 = X_1 = A_2 \dots \dots$  And  $X_n = A_n$  then  $Z = B$

Where, both the values of the linguistic variables of the antecedent ( $X_1, X_2 \dots X_n$ ) and the consequent ( $Z$ ) are neutrosophic sets, in essence, linguistic results with associated semantics.

Deneutrosophication performs the process of adapting the neutrosophic values generated in the inference, in this process the method of membership of the mean of the maximum is used [11], [14], [15], [21]. With deneutrosophication, the value  $Y$  is determined for the output variable, which has a maximum in its membership function  $X$ , if there is more than one maximum value in the membership function, the average of them is taken [12], [13], [16].

**3 Results**

The results obtained in the investigation for each of the questions are presented below.

Question 1	Good (5)	Regular (3)	Bad (1)
How do you rate your knowledge about hemiplegia and its main characteristics?	8 (32%)	10 (40%)	7 (28%)

**Table 1.** Results of question 1 of the survey

Table 1 shows the results of the question with the same number of the survey applied to the students. Where 8 of them, for a 32%, selected the category with the highest value on the scale used. On the other hand, most of the students selected the intermediate category, that is, this was reflected in 10 of them, for 40% of the study sample. While only 7 students, for 28%, selected the category of Bad, which reflects that in this component there is a knowledge of good in most of the students. [22]

Question 2	Good (5)	Regular (3)	Bad (1)
How do you rate your knowledge about the main pillars of treatment in hemiplegia?	6 (24%)	9 (36%)	10 (40%)

**Table 2.** Results of question 2 of the survey.

Table 2 shows the results of question 2 of the survey where only 6 students, for 24%, selected the category of Good. While 9, for 36%, Good and Bad were the most indicated, where they were 10 for 40%. These results denote that where there is greater difficulty in the students' knowledge is in the treatments to be used with these patients.

Question 3	Good (5)	Regular (3)	Bad (1)
How do you rate your knowledge about the different ways of evaluating the treatment of hemiplegia?	8 (32%)	9 (36%)	8 (32%)

**Table 3.** Results of question 3 of the survey

In Table 3, eight students marked the Good category, for 32%; while 9, for 36%, selected Regular and 8, for 32%, chose Bad. This is another component in which it is necessary to continue working with the students because there are still difficulties with some of them regarding the different forms of evaluation and follow-up of these patients.

Neurosophic evaluation techniques are used in correspondence with the model proposed in the present investigation. In the Neurosophication process, the following linguistic variables were identified:

- Component I: REAL
- Component II: REAL
- Component III: REAL

#### NEUTROSOPHY

TERM CI:= (0.85, 0) (0.9, 1) (1, 1)

TERM CII:= (0.4, 0) (0.45, 1) (0.55, 1) (0.55, 0)

TERM CIII := (0.5, 0) (0.55, 1) (0.75, 1) (0.8, 0)

In the inference of neurosophic rules, the 3 components and the 3 linguistic values (Good, Regular, Bad) were considered. Subsequently, the deneurosophication process was carried out.

To perform the deneurosophication, the center of gravity is used, which implies the value to be obtained for the components selected for the present investigation.

#### DENEUTROSOPHICATION Component I

TERM mb:= (0.3, 1) (0.4, 1) (0.45, 0);

TERM ba:= (0.4, 0) (0.45, 1) (0.5, 1) (0.55, 0);

TERM me:= (0.5, 0) (0.55, 1) (0.75, 1) (0.8, 0);

TERM al := (0.75, 0) (0.8, 1) (0.85, 1) (0.9, 0);

TERM ma:= (0.85, 0) (0.9, 1) (1, 1);

METHOD: COG;

DEFAULT := 0.3;

RANGE (: = 0.3 .. 1);

#### Conclusion

The analysis of the theoretical and methodological references on neurosophic evaluation of the knowledge of hemiplegia in medical students at the Regional University of the Andes in the Republic of Ecuador shows the existence of different bibliographic sources of the subject, however, tools are required that promote neurosophy as a useful discipline for medical sciences.

The interpretations of the results offer validity to the research developed since the use of neutrosophic tools allowed to carry out an adequate neutrosophic evaluation of the knowledge of hemiplegia in medical students at the Regional University of the Andes in the Republic of Ecuador.

In accordance with the results obtained, it is necessary to continue delving into the subject of hemiplegia, particularly in the different treatments and forms of evaluation and follow-up of patients.

## References

- [1] E. Díez-Tejedor. Nomenclatura de las Enfermedades Cerebrovasculares. *Rev.Ecuat.Neurol*, 3 (11). 2001
- [2] M. Knight. Presentación del programa de pacientes hemipléjicos, y de los resultados del diagnóstico realizado en la clínica Prosur, Arima, Trinidad y Tobago. 2015
- [3] J. Coll. Programa de ejercicios físicos terapéuticos para la rehabilitación de pacientes hemipléjicos en la atención primaria de salud (p 31). Tesis de Doctorado. ISCF “Manuel Fajardo, La Habana, Cuba. 2012
- [4] M Knight. La cultura física terapéutica: una mirada desde la rehabilitación de pacientes con accidentes cerebrovasculares en Trinidad y Tobago, *Rev Acción* (5). 2014
- [5] M. Oddy, Humphrey, M., y Uttley, D. Stresses upon the relatives of head injured patients. *British Journal of Psychiatry*, 133. PP 507-513, 1978
- [6] MY. Leyva Vázquez, & Smarandache, F. Neutrosófia: Nuevos avances en el tratamiento de la incertidumbre. *Infinite Study*. 2018
- [7] MY. Leyva-Vázquez, Smarandache, F., & Ricardo, J. E. Artificial intelligence: challenges, perspectives, and neutrosophy role. (Master Conference). *Dilemas Contemporáneos: Educación, Política y Valores*, 6(Special). 2020
- [8] Smarandache, F. P., & Pramanik, S. D. *Conjuntos y Sistemas Neutrosóficos* (Vol. Vol.1). Nuevo Mexico: Biblioteca Del Congreso, Washington DC, Estados Unidos. Obtenido de <http://fs.unm.edu/NSS/NSS-2-2014.pdf>, 2013
- [9] A. Palacios, Jesús Estupiñán Ricardo, Iyo Alexis Cruz Piza, y Marcia Esther España Herrería. «Phenomenological Hermeneutical Method and Neutrosophic Cognitive Maps in the Causal Analysis of Transgressions against the Homeless». *Neutrosophic Sets and Systems* 44: 147-56. 2021
- [10] D. M. Ramírez Guerra, Y. M. Gordo Gómez, L. J. Cevallos Torres, F. G. Palacios Ortiz. Social sports Competition Scoring System Design Using Single Value Neutrosophic Environment. *International Journal of Neutrosophic Science (IJNS)*, Vol. 19, No. 01, PP. 389-402, 2022
- [11] NB Hernandez, M.B.R. Cueva, and B.N.M. Roca, Prospective analysis of public management scenarios modeled by the Fuzzy Delphi method, 2018
- [12] NB Hernández, R.O. Guerrero, and W.A. Quiñonez, UNIVERSIDAD Y PLANIFICACIÓN ESTRATÉGICA EN EL ECUADOR. *Revista Didasc@ lia: Didáctica y Educación*. ISSN 2224-2643, 2016. 7(2): p. 171 -180.
- [13] J. Estupiñán, Diego Fernando Coka Flores, Jorge Alfredo Eras Díaz, y Karina Pérez Teruel. «An Exploration of Wisdom of Crowds using Neutrosophic Cognitive Maps». *Neutrosophic Sets and Systems* 37 (1): 2, 2020.
- [14] K. L. Baque Villanueva, A. M. Izquierdo Morán, & D. A. Viteri Intriago. “Estructura metodológica de plan estratégico para mejorar las ventas en las Mipymes del cantón Quevedo”. *Universidad y Sociedad*, Vol. 14 Num. 2, pp- 66-74, 2022.
- [15] I E. Montenegro Bósquez, D. F. Granja Zurita, M. R. Aguilar Martínez, & D. P. Gordillo Cevallos. “Las aclaraciones a testigos por parte de los jueces penales en las audiencias de juicio, un análisis desde el estándar de prueba”. *Universidad y Sociedad*, Vol. 14 Num. 2, pp- 51-56, 2022.
- [16] L. A. Llerena Ocaña, & L. A. Lombardo Bajaña. “Aplicación web para la gestión administrativa en la estrategia plan vacunarse”. *Universidad y Sociedad*, Vol. 14 Num. 2, pp- 40-45, 2022.
- [17] Romero Fernández, A. J., Álvarez Gómez, G. A., & Estupiñán Ricardo, J. “La investigación científica en la educación superior como contribución al modelo educativo”. *Universidad Y Sociedad*, vol. 13 no. S3, pp 408-415, 2021
- [18] Rodríguez, M. D. O., León, C. A. M., Rivera, C. D. N., Cueva, C. M. B. R., & Ricardo, C. J. E. “Herramientas y buenas prácticas de apoyo a la escritura de tesis y artículos científicos”. *Infinite Study*, 2019.
- [19] Leyva Vázquez, M. Y., Estupiñán Ricardo, J., Coles Gaglay, W. S., & Bajaña Bustamante, L. J. “Investigación científica. Pertinencia en la educación superior del siglo XXI”. *Conrado*, vol. 17 no. 82, 2021.
- [20] Ricardo, J. E. (2018). “Estrategia de Gestión en la Educación Superior; pertinencia e impacto en la interrelación de los procesos académicos, de investigación científica y de vinculación con la sociedad en el periodo enero 2016-mayo 2018 en la Facultad de Ciencias Jurídicas, Sociales y de la Educación de la Universidad Técnica de Babahoyo en Ecuador”. *Infinite Study*, 2018.
- [21] Estupiñán Ricardo, J., Leyva Vázquez, M. Y., Marcial Coello, C. R., & Figueroa Colin, S. E. “Importancia de la preparación de los académicos en la implementación de la investigación científica”. *Conrado*, vol. 17 no. 82, pp 337-343, 2021.
- [22] Ramos Sánchez, R. E., Ramos Solorzano, R. X., & Estupiñán Ricardo, J. “La transformación de los objetivos de desarrollo sostenible desde una dinámica prospectiva y operativa de la Carrera de Derecho en Uniandes en época de incertidumbre”. *Conrado*, vol. 17 no. 81, pp 153-162, 2021.
- [23] Acuña, B. P., & Von Feigenblatt, O. F. “La lengua y la literatura en el aula del futuro enmarcado en el aprendizaje personalizado. In *Aprendizaje personalizado y education maker: Nuevos paradigmas didácticos y otras aproximaciones*”

- (pp. 13-24). Ediciones Octaedro, 2022.
- [24] A. Miranda Anchundia, J. I. Castillo González & M. B. Sánchez Villacís. “Procedimiento quirúrgico para la despigmentación gingival”. *Universidad y Sociedad*, vol. 14 no. S3, pp 257-261, 2022.
- [25] G. A. Andrade Olvera, M. A. Zambrano Olvera, & C. E. Paucar Paucar. “La custodia de los menores y el principio de igualdad”. *Universidad y Sociedad*, vol. 14 no. S3, pp 248-256, 2022.
- [26] M. E. Gaspar Santos, G. N. Rivera Segura & M. A. Zambrano Olvera. “Las cárceles ecuatorianas y la seguridad para individuos privados de libertad”. *Universidad y Sociedad*, vol. 14 no. S3, pp 238-247, 2022.

**Received:** August 25, 2022. **Accepted:** October 20, 2022