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Neutrosophic Analysis of the Self-Assessment of Pharmacology Knowledge in Medical Students

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Abstract. In this research, the results obtained from the linking of medical sciences and Neutrosophy are shown. All while the theoretical referents systematized in this work, denote a poor imbrication of neutrosophic contents in the investigations of medical students. For its development, one of the contents with a greater degree of complexity for students such as pharmacology is used. That is why this research has the objective to perform a neutrosophic analysis of the self-assessment of pharmacology knowledge in medical students. During the investigation, theoretical methods and techniques were used, such as the synthetic analytical and inductive-deductive, as well as empirical ones, where the survey and measurement stand out. While within the statistical mathematical ones, the frequency distribution was used, in addition to a specific neutrosophic model as a general guide for the investigation. The results obtained make evident the need to delve into some of the pharmacology topics in the investigated specialty, which generates future research areas.

Keywords: neutrosophic analysis, neutrosophic model, pharmacology, medicine.

1 Introduction

In the training of medical professionals, there are various subjects that converge and coexist with each other to achieve comprehensive training and a profile of basic skills that contribute to adequate professional performance once graduated. Well, in this profession a deep knowledge is required, because in the hands of these professionals is the life of various human beings.

That is why pharmacology is one of these, since it is the one that provides these professionals with knowledge on how to administer different medications, depending on the disease and the age of the patient. Therefore, students are required to specifically learn this subject.

Pharmacology is not an easy subject for students, it is very wide and varied, with a considerable part of memory to remember the names of medicines. It is not surprising that the use of cinema in his teaching is relatively recent. In most cases, films have been used to delve into the social aspects of drug use and the clinical research process and/or its ethical aspects [1],[2].

There are many contents of this matter, but according to the authors consulted, they agree that the following stand out: interpret the prescription of medications and follow the norms and administration guidelines, to obtain an optimal therapeutic response; identify the patient and inform him about the treatment, its effects and the techniques to be used, and when necessary, the student must be able to inform and instruct him about self-administration techniques; correctly handle medications in their forms of administration, knows and describes the techniques of preparation and administration of medications by different routes, as well as the forms and techniques of handling waste and adequately handling the information available about medicines and taking into account the benefit/risk ratio in their clinical use. Just to mention the main ones [3], [4], [5], [22].

There are several approaches and disciplines that have been integrated into the analysis and research of pharmacology, where physiology, biochemistry, clinical pathology, among others, stand out. However, in correspondence with the bibliographic search carried out, there are few studies that use the neutrosophic technique for the analysis and investigation of this medical discipline and therein lies the main problem of this research.

Hence the objective of this research is to carry out a neutrosophic analysis of the self-assessment of knowledge of pharmacology in medical students in the Autonomous Regional University of the Andes (UNIANDES) of the Republic of Ecuador.

2 Methodology

2.1 Study subjects

During the sample selection process, the following elements of classical statistics are considered, according to the criteria of [6], [7], [8], [24], [26], [27], [28].

- Ip = corresponds to the approximate proportion of the phenomenon in the reference population,

- q = refers to the proportion of the reference population that does not present the phenomenon (1 - p).

- (Z) = refers to the desired level of confidence, it is also indicative of the degree of confidence that the true value of the parameter in the population will be found in the calculated sample.

- (d) = is indicative of the absolute precision (d), which in turn is the desired width of the confidence interval on both sides of the true value of the difference between the two proportions (in percentage points).

- N = refers to the size of the reference population.

During the investigation some results were evaluated on the degree of a scale between 0 and 10. Intervals are also allowed. So, elements of neutrosophic statistics were used, which will be explained below.

In the investigation, a confidence level of 95%, z = 1.96, d = 0.05 and N = 321 will be used.

So, the neutrosophic sample is n = 175.12≈176.

In correspondence with the previously declared neutrosophic criteria, from a population of 321 students eligible for the study, 176 from the Autonomous Regional University of the Andes of the Republic of Ecuador were selected. Of these, 48 are male and 128 are female. All students have passed the third year of the medical degree.

2.2 Classical methods and techniques used

During the investigation, theoretical methods such as the synthetic analytical and the inductive-deductive were used. Both were useful in the work with the bibliographic sources and the data, since they facilitated the analysis of the results obtained.

Within the empirical ones, a survey with a Likert scale with three categories (Good), (Regular) and (Bad) was used. Where the university medical student had to carry out a self-assessment of his knowledge about pharmacology. Results are illustrated in the following section.

The measurement was also used, since values were attributed to each of the three categories mentioned above (Good, 5), (Regular, 3) and (Bad, 2). This facilitated a better analysis of the results presented.

Regarding the statistical methods, elements of descriptive statistics were used and, within this, the distribution of classical and neutrosophic frequencies. The combination of both offered an adequate level of validity to the results obtained in this investigation. [21]. [25]

2.3 Neutrosophic method

This section presents the neutrosophic model proposed in this work, which is schematically represented as shown in Figure 1. The model consists of four stages: data collection, Neutrosophication, conception of rules and Deneutrosophication. It led to an important scheme in the work with the data obtained, derived from the survey of students [9], [10], [20].
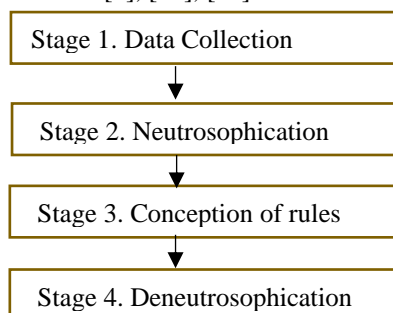

Figure 1. Neutrosophic model followed for the development of the research

2.4 Grouping procedure used in the research

For the presented study, three important components are established, which allow the development of self-assessment of medical students, these are:

Component 1. Knowledge about the objectives and essential categories of pharmacology

Component 2. Main medications by typical disease pattern

Component 3. Main dosages of medicines for children and adults

The analysis of the neutrosophic statistics will be carried out considering these components. For they are the basis for an adequate Neutrosophication of the data obtained in correspondence to Figure 1.

The Neutrosophication is performed from the data obtained, in order to define the variables and linguistic values, as well as the membership function to perform the Neutrosophication. The linguistic variables that were identified are the components that support the self-assessment process of university students, related to each component [9], [10], [11], [12], [19].

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 self-assessment of university students. This rule is based on the survey applied to the subjects selected in the sample of this research, considering the three components presented in this study.

The proposed neutrosophic model responds to a type of structure that is modeled based on the definition of a set of rules of the form:

If $X1 = A1$ and $X2$ and … $Xn = An$, then $Z = B$

Where, both the values of the linguistic variables of the antecedent ($X1, X2 … Xn$), and of the consequent (Z), are neutrosophic sets, in essence, linguistic results with associated semantics.

The 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 [13], [14], [15]. With the Deneutrosophication the value Y is determined, for the output variable, which has a maximum in its membership function B, if there is more than one maximum value in the membership function, the average of them is taken [16], [17], [23].

3 Results

In correspondence with the elements of the neutrosophic method followed in the present investigation, the *data collection* stage is obtained and shown in Table 1. Where the presentation of the data of each of the components is made in correspondence with the score by the students. After this, a more detailed analysis is carried out on the different levels located by the students.

Component 1		Component 2		Component 3	
Scale score	Number of students	Scale score	Number of students	Scale score	Number of students
5	25	5	15	5	28
3	66	3	81	3	79
3	85	3	80	3	69
Total	176		176		176

Table 1. Results obtained as part of the grouping procedure used.

In the Neutrosophication process, the following linguistic variables were identified:

component I: REAL
component II: REAL
component III: REAL

Neutrosophication
TERM CI = (0.85, 0) (0.9, 1) (1, 1)
TERM CII = (0.4, 0) (0.45, 1) (0.55, 1) (0.55, 0)
TERMS CIII = (0.5, 0) (0.55, 1) (0.75, 1) (0.8, 0)

Deneutrosophication
TERM Good = (0.3, 1) (0.4, 1) (0.45, 0);
TERM Regular = (0.4, 0) (0.45, 1) (0.5, 1) (0.55, 0);
TERM Bad = (0.85, 0) (0.9, 1) (1, 1);
METHOD: COG;
DEFAULT 0.3;
RANGE = (0.3 .. 1)

Then, an analysis is carried out for each of the categories of the Likert scale designed for this research. Which will be analyzed in correspondence with the three questions of the survey applied to the students.

Results of question 1 of the applied survey

Question 1	Good		Regular		Bad	
	Quantity	%	Quantity	%	Quantity	%
Could you please self-your knowledge about the objectives and essential categories of pharmacology	25	14.2	66	37.5	85	48.3

Table 2. Results of question 1 of the student survey

When performing an analysis of the students' self-assessment regarding question 1 of the applied survey. It is observed that only 25 for 14.2% selected the category with the highest score on the scale. On the other hand, the intermediate score was selected by 66 for 37.5%. While the majority 85 for 48.3% selected the low level. Question that reflects that we must continue working on this content.

Question 2	Good		Regular		Bad	
	Quantity	%	Quantity	%	Quantity	%
Could you self-assess your knowledge of the main medications by typical disease pattern?	15	8.5	81	46.1	80	45.4

Table 3. Results of question 2 of the student survey

Results of question 2 are shown in table 3. Where, as in the previous question, only a minority of students self-rated with the category with the highest score on the scale (15 for an 8, 5%). The intermediate category was the most selected (80 for 46.1%), although by one student with respect to the bad category, which was indicated by 80 for 45.4%.

Question 3	Good		Regular		Bad	
	Quantity	%	Quantity	%	Quantity	%
Could you please self-assess your knowledge about the main dosages of medicines for children and adults?	28	15.9	79	44.8	69	39.3

Table 4. Results of question 3 of the student survey

The results of question 3 are shown in table 4, where the minority of students selected the scale with the highest score in their self-assessment. This was reflected in 28 for 15.9% of the total number of students surveyed. On the other hand, most of the students indicated the regular category, since 79 of them self-assessed with this, it represents 44.8% of the total sample. While the bad category was selected by 69 students for 39.3%.

In general, the greatest difficulties of the students are in question 1 of the survey. Although, in general, this subject must continue to be deepened both in teaching and in research. Reason for which it is suggested to continue with this theme in experimental studies to transform the situation detected in this investigation. [18], [23]

Conclusion

In correspondence with the theoretical references consulted in this research, the lack of use of neutrosophic techniques in the self-assessment of university students in the content of pharmacology becomes evident, which generates the need to deepen this topic investigated from a neutrosophic perspective.

The interpretation of the results, through neutrosophic techniques, allows identifying the level of validity of the results obtained in the selected sample, which has generated the need to carry out investigations of a higher degree of complexity to transform the aspects detected in this investigation.

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