Neutrosophic Sets and Systems {Special Issue: Neutrosophic Advancements And Their Impact on Research in Latin America}, Vol. 62, 2023

University of New Mexico

Neutrosophy Analysis of Medical Ethics and Bioethics

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Abstract. The current situation of medical ethics and bioethics in Ecuador highlights the need to address the complexity of decision-making in the field of health. Under a neutrosophic approach, the situation of medical ethics and bioethics in Ecuador was explored to define the neutrosophic subsets of elements that affect the formation of values and the development of medical ethics and bioethics in Ecuador. The results reveal the need for training health professionals in issues of medical ethics and bioethics. Therefore, projects and study plans that respond to the promotion of effective ethical practices must be approved. Without leaving aside the fact that supervision and accountability mechanisms must be created to guarantee compliance with ethical and bioethical principles among health professionals. Furthermore, the need for constant evaluation is highlighted to ensure that ethical policies evolve and adjust to changing values and objectives. In conclusion, the neutrosophic approach provides a holistic and adaptable perspective to address medical ethics and bioethics in Ecuador, by recognizing indeterminacies and promoting effective ethical practices.

Keywords: Neutrosophy, health, medical ethics, bioethics.

1 Introduction

Medical ethics and bioethics constitute crucial fields in the area of medicine and health care in Ecuador [1]. These disciplines are responsible for establishing the ethical and moral guidelines that should guide health professionals in making clinical decisions and considering issues related to the life and health of patients [2] [3]. However, in the Ecuadorian context, the application and compliance of ethical standards in medical practice often face complex challenges and dilemmas [4] [5].

In Ecuador, as anywhere else, medical ethics is a complex issue that involves diverse perspectives. On the one hand, some argue that health care should be accessible to all citizens, regardless of their ability to pay, raising questions of distributive justice. Others argue that physicians have a responsibility to make difficult decisions, such as the allocation of limited resources, which can lead to ethical conflicts.

The Ecuadorian health system has gone through significant changes in recent decades. These include the implementation of the Universal National Health System, which has had an impact on the way healthcare is provided. The fight for equity in access to health care and the distribution of health resources raises ethical questions.

Another notable aspect to consider is the presence of conflicts of interest in the field of medicine. In Ecuador, doctors may face situations where they must balance the interests of their patients with economic or institutional interests. These conflicts raise ethical issues related to professional integrity and impartiality.

Bioethics also raises questions in Ecuador, particularly with regard to medical research. Patient participation in clinical trials and obtaining informed consent raises ethical questions about the protection of the rights and autonomy of research subjects.

The introduction of advanced medical technologies [6-18], such as genomic medicine, telemedicine, and artificial intelligence [7], raises ethical issues related to patient privacy [8-19], clinical decision-making, and equity in access to these technologies [9-20].

Ethical decision-making in everyday clinical practice is also an important topic in Ecuadorian bioethics. Physicians face ethical dilemmas when determining end-of-life, limiting therapeutic effort, and providing patient care in resource-limited situations. Therefore, the main objective of this study is:

I. Analyze the subsets of elements that affect the formation of values and the development of medical ethics and bioethics in Ecuador using a neutrosophic approach.

Among the specific objectives are:

i. Analyze and group into subsets the elements of medical ethics and bioethics in Ecuador.
ii. Determine which of the subsets has greater relevance in the development of medical ethics and bioethics in Ecuador.
iii. Propose actions according to the levels of indeterminacy obtained to promote medical ethics and bioethics in health centers in Ecuador.

2 Materials and methods

2.1 Neutrosophic Statistics and Delphi

The neutrosophic Delphi method is appropriate for obtaining information from experts based on their knowledge of the sector, capacity, and ability to analyze the items consulted. So, it is suitable in the "complex, dynamic and indeterminate areas of knowledge of the Neutrosophic Set (NS), characterized by the three membership functions". Furthermore, its use is recommended in studies in which indeterminacy is shown in the information on previous empirical evidence.

In the development, after the different rounds applied in a neutrosophic Delphi method, the responses of the panelists are analyzed based on Single-Valued Neutrosophic Numbers (SVNNs). Thus, the objective of the neutrosophic Delphi method is to achieve the greatest possible consensus among the panelists involved. The proposed phases define questions to obtain criteria and agreed answers to be evaluated by the Coordinating Group.

The composition of the group presented in the expert panel must guarantee the heterogeneity and significance necessary to address the research object of the study. For the final selection of experts by the coordination group, the neutrosophic expert competence coefficient (K_N) is used. Its calculation is done based on the following definition:

Definition 1. Let X be a universe of discourse. A Single-Valued Neutrosophic Set (SVNS) A over X is an object of the form as described in the following equation:

$$A = \{\langle x, u_A(x), r_A(x), v_A(x)\rangle : x \in X\} \quad (1)$$

Where $u_A, r_A, v_A : X \to [0,1]$, satisfy condition $0 \leq u_A(x), r_A(x), v_A(x) \leq 3$ for all $x \in X$. $u_A(x), r_A(x)$ and $v_A(x)$ denote the true, indeterminate, and false membership functions of x in A, respectively. So let it be expressed as A = (a, b, c), where a, b, c $\in \{0,1\}$ and satisfies $0 \leq a + b + c \leq 3$ for the modeling of the method.

Let A = (a, b, c) be an SVNN, the scoring function S of an SVNN, based on the true membership degree, the indeterminate membership degree, and the false membership degree, is defined by the following Equation:

$$S(K_N) = \frac{1 + a - 2b - c}{2} \quad (2)$$

Where $S(K_n) \in \{-1; 1\}$ and where after applying equation (1), it is obtained:

$$K_N = \{\langle x, u_K(x), r_K(x), v_K(x)\rangle : x \in X\}$$

In this coefficient, two factors were averaged, the knowledge coefficient (K_{cn}) and the argumentation coefficient (K_{an}).

$$K_N = \frac{1}{2}(K_{aN} + K_{cN}) \quad (3)$$

Where S (K_{an}) and S (K_{cn}) $\in \{-1; 1\}$ and where after applying equation (1), it is obtained:

$$K_{aN} = \{\langle x, u_{Ka}(x), r_{Ka}(x), v_{Ka}(x)\rangle : x \in X\}$$
$$K_{cN} = \{\langle x, u_{Kc}(x), r_{Kn}(x), v_{Kn}(x)\rangle : x \in X\}$$

The so-called neutrosophic knowledge coefficient is determined by the information that the expert himself presents about the object of study, defined through a self-assessment process on a scale to establish knowledge of the topic analyzed and object of study (see Table 1).

Table 1: Linguistic terms used to determine $K_{aN,}K$ and evaluate the proposed criteria. Source: own elaboration.

Linguistic term	SVNN
Full knowledge of the subject of study (FK)	(1,0,0)
Very very good in the subject of study (VVGK)	(0.9, 0.1, 0.1)
Very good in the subject of study (VGKS)	(0.8,0,15,0.20)
Good in the subject of study (GK)	(0.70,0.25,0.30)
Moderately good in the subject of study (MGK)	(0.60,0.35,0.40)

Linguistic term	SVNN
Knows the topic of study (K)	(0.50,0.50,0.50)
Moderately poorly knows the subject of study (MBK)	(0.40,0.65,0.60)
Poorly knows the topic of study (BK)	(0.30,0.75,0.70)
Barely knows the topic of study (VBKS)	(0.20,0.85,0.80)
Very very poor knowledge of the topic of study (VVBK)	(0.10,0.90,0.90)
No knowledge of the study topic (NK)	(0,1,1)

The neutrosophic argumentation coefficient that evaluates the criteria through linguistic terms SVNN with consensus of expert opinion substantiation, (see Table 2), from the weighted sum of values obtained in a series of influence elements determined by the Coordinating Group on the experience obtained through its activity and practice.

For the evaluation and validation of questionnaires using the Delphi method, the scale of the neutrosophic Torgerson model was used, to achieve greater objectivity in the treatment of information that allows the assessment of the criteria used by the judges of each panel of experts of each item individually (see Table 2).

Table 2: Linguistic terms used in the neutrosophic Torgerson model. Source: own elaboration.

Linguistic term I	SVNN	Linguistic term II
Very Suitable (VS)	(0.92,0.1,0.12)	Essential (ES)
Fairly Suitable (FS)	(0.7,0.2,0.25)	Very Useful (VU)
Suitable (S)	(0.50,0.55,0.5)	Useful (U)
Poorly Suitable (PS)	(0.3,0.75,0.80)	Not useful (NU)
Not Suitable (NS)	(0.10,0.90,0.95)	Useless (UL)

To determine the consensus among the participants of the expert panel, the agreement coefficient was used. It is calculated using the following equation:

$$Cc = \left(1 - \frac{V_n}{V_t}\right) 100 \tag{4}$$

where: V_n is the number of negative votes cast by the judges and V_t is the number of total votes cast by the judges. Therefore, a level of consensus must be reached when the agreement coefficient Cc obtains a value greater than 75%, and the process is concluded. However, if the agreement coefficient does not reach a value greater than 75%, a new round of evaluation must be established to consider the appropriate assessments provided by the panel of experts.

3 Results

To carry out the study, the neutrosophic Delphi method is modeled. Given the characteristics of the study, it was decided to carry out a neutrosophic evaluation of the experts (academics, lawyers, doctors, economists, and psychologists). To do this, the neutrosophic expert competence coefficient of each expert is determined for panel selection (see Table 3). After selecting the panel of experts, the necessary information for the development of the study is provided by the coordinating group.

Table 3: Determination of the neutrosophic expert competence coefficient. Source: own elaboration.

Expert	Profile	Kc	Ka	K	Assessment
E1	Academic	(0.7;0.25;0.3)	(0.7,0.2,0.25)	(0.7,0.2,0.25)	HIGH
E2	Lawyer	(0.3;0.75;0.7)	(0.7,0.2,0.25)	(0.50,0.55,0.5)	MEDIUM
E3	Lawyer	(0.2;0.85;0.8)	(0.7,0.2,0.25)	(0.3,0.75,0.80)	LOW
E4	Lawyer	(0.5;0.5;0.5)	(0.7,0.2,0.25)	(0.50,0.55,0.5)	MEDIUM
E5	Lawyer	(0.4;0.65;0.6)	(0.50,0.55,0.5)	(0.3,0.75,0.80)	LOW
E6	Lawyer	(0.1;0.9;0.9)	(0.50,0.55,0.5)	(0.3,0.75,0.80)	LOW
E7	Lawyer	(0.1;0.9;0.9)	(0.50,0.55,0.5)	(0.3,0.75,0.80)	LOW
E8	Lawyer	(0;1;1)	(0.50,0.55,0.5)	(0.3,0.75,0.80)	LOW
E9	Psychologist	(0.9;0.1;0.1)	(0.50,0.55,0.5)	(0.50,0.55,0.5)	MEDIUM
E10	Psychologist	(0.9;0.1;0.1)	(0.50,0.55,0.5)	(0.50,0.55,0.5)	MEDIUM
E11	Lawyer	(0.4;0.65;0.6)	(0.50,0.55,0.5)	(0.50,0.55,0.5)	MEDIUM
E12	Lawyer	(0.1;0.9;0.9)	(0.50,0.55,0.5)	(0.3,0.75,0.80)	LOW
E13	Lawyer	(0.1;0.9;0.9)	(0.7,0.2,0.25)	(0.3,0.75,0.80)	LOW
E14	Doctor	(1;0;0)	(0.50,0.55,0.5)	(0.7,0.2,0.25)	HIGH
E15	Lawyer	(0.2;0.85;0.8)	(0.3,0.75,0.80)	(0.3,0.75,0.80)	LOW

Expert	Profile	Kc	Ka	K	Assessment
E16	Psychologist	(0.9;0.1;0.1)	(0.3,0.75,0.80)	(0.50,0.55,0.5)	MEDIUM
E17	Lawyer	(0.5;0.5;0.5)	(0.3,0.75,0.80)	(0.3,0.75,0.80)	LOW
E18	Psychologist	(0.9;0.1;0.1)	(0.3,0.75,0.80)	(0.50,0.55,0.5)	MEDIUM
E19	Doctor	(1;0;0)	(0.50,0.55,0.5)	(0.7,0.2,0.25)	HIGH
E20	Economist	(0.6;0.35;0.4)	(0.50,0.55,0.5)	(0.50,0.55,0.5)	MEDIUM
E21	Lawyer	(0;1;1)	(0.50,0.55,0.5)	(0.3,0.75,0.80)	LOW
E22	Economist	(0.6;0.35;0.4)	(0.50,0.55,0.5)	(0.50,0.55,0.5)	MEDIUM
E23	Lawyer	(0.1;0.9;0.9)	(0.50,0.55,0.5)	(0.3,0.75,0.80)	LOW
E24	Lawyer	(0.5;0.5;0.5)	(0.50,0.55,0.5)	(0.50,0.55,0.5)	MEDIUM
E25	Doctor	(1;0;0)	(0.50,0.55,0.5)	(0.7,0.2,0.25)	HIGH
E26	Lawyer	(0.1;0.9;0.9)	(0.50,0.55,0.5)	(0.3,0.75,0.80)	LOW
E27	Academic	(0.7;0.25;0.3)	(0.3,0.75,0.80)	(0.50,0.55,0.5)	MEDIUM
E28	Lawyer	(0.4;0.65;0.6)	(0.50,0.55,0.5)	(0.3,0.75,0.80)	LOW
E29	Lawyer	(0.1;0.9;0.9)	(0.50,0.55,0.5)	(0.3,0.75,0.80)	LOW
E30	Economist	(0.6;0.35;0.4)	(0.50,0.55,0.5)	(0.50,0.55,0.5)	MEDIUM
E31	Doctor	(1;0;0)	(0.3,0.75,0.80)	(0.50,0.55,0.5)	MEDIUM
E32	Lawyer	(0;1;1)	(0.7,0.2,0.25)	(0.3,0.75,0.80)	LOW
E33	Lawyer	(0.3;0.75;0.7)	(0.7,0.2,0.25)	(0.50,0.55,0.5)	MEDIUM
E34	Lawyer	(0.3;0.75;0.7)	(0.50,0.55,0.5)	(0.3,0.75,0.80)	LOW
E35	Lawyer	(0.5;0.5;0.5)	(0.50,0.55,0.5)	(0.50,0.55,0.5)	MEDIUM
E36	Lawyer	(0.5;0.5;0.5)	(0.92,0.1,0.12)	(0.7,0.2,0.25)	HIGH
E37	Lawyer	(0.3;0.75;0.7)	(0.7,0.2,0.25)	(0.50,0.55,0.5)	MEDIUM
E38	Lawyer	(0.2;0.85;0.8)	(0.50,0.55,0.5)	(0.3,0.75,0.80)	LOW
E39	Lawyer	(0.3;0.75;0.7)	(0.50,0.55,0.5)	(0.3,0.75,0.80)	LOW
E40	Lawyer	(0.2;0.85;0.8)	(0.7,0.2,0.25)	(0.3,0.75,0.80)	LOW
E41	Lawyer	(0.5;0.5;0.5)	(0.50,0.55,0.5)	(0.50,0.55,0.5)	MEDIUM
E42	Economist	(0.6;0.35;0.4)	(0.50,0.55,0.5)	(0.50,0.55,0.5)	MEDIUM
E43	Lawyer	(0.3;0.75;0.7)	(0.50,0.55,0.5)	(0.3,0.75,0.80)	LOW
E44	Lawyer	(0.2;0.85;0.8)	(0.3,0.75,0.80)	(0.3,0.75,0.80)	LOW
E45	Doctor	(1;0;0)	(0.3,0.75,0.80)	(0.50,0.55,0.5)	MEDIUM
E46	Academic	(0.7;0.25;0.3)	(0.50,0.55,0.5)	(0.50,0.55,0.5)	MEDIUM
E47	Lawyer	(0.3;0.75;0.7)	(0.7,0.2,0.25)	(0.50,0.55,0.5)	MEDIUM
E48	Economist	(0.6;0.35;0.4)	(0.50,0.55,0.5)	(0.50,0.55,0.5)	MEDIUM
E49	Lawyer	(0.4;0.65;0.6)	(0.50,0.55,0.5)	(0.3,0.75,0.80)	LOW
E50	Lawyer	(0.4;0.65;0.6)	(0.3,0.75,0.80)	(0.3,0.75,0.80)	LOW
E51	Doctor	(1;0;0)	(0.7,0.2,0.25)	(0.92,0.1,0.12)	VERY HIGH
E52	Psychologist	(0.9;0.1;0.1)	(0.50,0.55,0.5)	(0.7,0.2,0.25)	HIGH
E53	Psychologist	(0.9;0.1;0.1)	(0.3,0.75,0.80)	(0.50,0.55,0.5)	MEDIUM
E54	Psychologist	(0.9;0.1;0.1)	(0.50,0.55,0.5)	(0.50,0.55,0.5)	MEDIUM
E55	Academic	(0.7;0.25;0.3)	(0.7,0.2,0.25)	(0.7,0.2,0.25)	HIGH
E56	Lawyer	(0.5;0.5;0.5)	(0.50,0.55,0.5)	(0.50,0.55,0.5)	MEDIUM
E57	Lawyer	(0.5;0.5;0.5)	(0.50,0.55,0.5)	(0.50,0.55,0.5)	MEDIUM
E58	Lawyer	(0.4;0.65;0.6)	(0.7,0.2,0.25)	(0.50,0.55,0.5)	MEDIUM
E59	Lawyer	(0.4;0.65;0.6)	(0.7,0.2,0.25)	(0.50,0.55,0.5)	MEDIUM
E60	Academic	(0.7;0.25;0.3)	(0.50,0.55,0.5)	(0.50,0.55,0.5)	MEDIUM
E61	Lawyer	(0.5;0.5;0.5)	(0.50,0.55,0.5)	(0.50,0.55,0.5)	MEDIUM
E62	Lawyer	(0.1;0.9;0.9)	(0.50,0.55,0.5)	(0.3,0.75,0.80)	LOW
E63	Lawyer	(0.5;0.5;0.5)	(0.50,0.55,0.5)	(0.50,0.55,0.5)	MEDIUM
E64	Doctor	(1;0;0)	(0.50,0.55,0.5)	(0.7,0.2,0.25)	HIGH
E65	Lawyer	(0.4;0.65;0.6)	(0.7,0.2,0.25)	(0.50,0.55,0.5)	MEDIUM
E66	Lawyer	(0.2;0.85;0.8)	(0.50,0.55,0.5)	(0.3,0.75,0.80)	LOW
E67	Lawyer	(0.1;0.9;0.9)	(0.50,0.55,0.5)	(0.3,0.75,0.80)	LOW
E68	Lawyer	(0.1;0.9;0.9)	(0.92,0.1,0.12)	(0.50,0.55,0.5)	MEDIUM
E69	Lawyer	(0;1;1)	(0.3,0.75,0.80)	(0.10,0.90,0.95)	VERY LOW
E70	Lawyer	(0.4;0.65;0.6)	(0.50,0.55,0.5)	(0.3,0.75,0.80)	LOW
E71	Lawyer	(0.2;0.85;0.8)	(0.7,0.2,0.25)	(0.3,0.75,0.80)	LOW
E72	Lawyer	(0.3;0.75;0.7)	(0.50,0.55,0.5)	(0.3,0.75,0.80)	LOW
E73	Lawyer	(0.3;0.75;0.7)	(0.50,0.55,0.5)	(0.3,0.75,0.80)	LOW
E74	Doctor	(1;0;0)	(0.7,0.2,0.25)	(0.7,0.2,0.25)	HIGH
E75	Doctor	(1;0;0)	(0.50,0.55,0.5)	(0.7,0.2,0.25)	HIGH
E76	Academic	(0.7;0.25;0.3)	(0.7,0.2,0.25)	(0.7,0.2,0.25)	HIGH
E77	Lawyer	(0.4;0.65;0.6)	(0.50,0.55,0.5)	(0.3,0.75,0.80)	LOW
E78	Economist	(0.6;0.35;0.4)	(0.7,0.2,0.25)	(0.7,0.2,0.25)	HIGH
E79	Lawyer	(0;1;1)	(0.7,0.2,0.25)	(0.3,0.75,0.80)	LOW

Expert	Profile	Kc	Ka	K	Assessment
E80	Lawyer	(0.5;0.5;0.5)	(0.7,0.2,0.25)	(0.50,0.55,0.5)	MEDIUM

The experts were grouped based on the defined neutrosophic level of importance (see Table 4). Due to the difficulty of the study, a competency assessment for the study was assigned to the experts who obtained an evaluation of *high* and *very high*. Therefore, the panel of experts is made up of 7 doctors, 1 psychologist, 3 academics, 1 economic, and 1 Lawyer for a total of 13 experts necessary for the modeling of the neutrosophic Delphi method.

Table 4: Evaluation of experts according to the competence coefficient. Source: own elaboration.

Profile	Very high	High	Medium	Low	Very low	Total
Lawyer	0	1	18	32	1	52
Economist	0	1	5	0	0	6
Academic	0	3	3	0	0	6
Psychologist	0	1	6	0	0	7
Doctor	1	6	2	0	0	9
Total	**1**	**12**	**34**	**32**	**1**	**80**

Interpretation of responses and evaluation of actions.

First phase: The panel of experts must analyze and determine what are the elements that affect medical ethics and bioethics in Ecuador.

Consolidation of responses: Based on the diversity of responses obtained, it is decided by the coordinating group to define five neutrosophic subsets (NS). Each subset refers to each element determined by the panel of experts. These are the neutrosophic subsets:

Neutrosophic Subset 1 (NS1): Legal and Regulatory Framework. For this subset, three groups of responses are defined:

- Part of the panel advocates that the legal framework in Ecuador establishes the basis for medical ethics and bioethics [10]. The 2008 Constitution and related laws recognize the right to health and the protection of patients' rights. The creation of research ethics committees reflects a commitment to ethics in medical research [11].
- Another party argues that, despite existing regulations and laws, the lack of uniformity in application and supervision can generate indeterminacy. The interpretation and application of ethical regulations may vary between institutions and regions.
- While to a lesser extent some experts consider that when ethical regulations are not applied effectively, they give rise to unethical practices, such as malpractice or lack of transparency in research.

Neutrosophic Subset 2 (NS2): Resources and Equity. For this subset, three groups of responses are defined:

- Some experts define that Ecuador faces challenges in the equitable distribution of health resources. Efforts have been made to promote equity in access to health care through the National Universal Health System.
- Another response analyzed upholds the lack of sufficient resources in some regions and the variability in the quality of medical care. Lack of resources can lead to difficult ethical situations, such as limiting therapeutic effort.
- Another response with opposition is manifested when a lack of resources translates into discrimination in healthcare. It is argued that some patients receive lower-quality treatment due to lack of resources.

Subset 3 (NS3): Education in medical ethics and bioethics. This subset was analyzed based on the preparation of the different study centers.

- In response, the experts indicated that progress has been made in education in medical ethics and bioethics in Ecuador. Examples were provided of several universities and training programs that offer courses and training in medical ethics and bioethics [12].

- However, there was some disagreement that the quality and scope of medical ethics education may vary in some regions. Because not all health professionals can receive adequate training in medical ethics and bioethics [13].
- As a third proposal, experts have alluded to the fact that on some occasions when health professionals do not apply ethical principles on a daily basis, it could lead to unethical practices.

Subset 4 (NS4): Technological development in medicine. For this subset, experts defend the following ideas:

- Technological advancement in medicine, such as genomic medicine, telemedicine, and artificial intelligence, has improved healthcare and research in Ecuador.
- It manifests itself in the need to establish clear regulations and guidelines for the use of these technologies and guarantee transparency in their application.
- It is declared when these technologies are used inappropriately, without respecting the privacy of patients, or without complying with ethical standards in research.

Subset 5 (NS5): Culture and Social Values. The experts say that:

- Cultural and social values in Ecuador [14], such as solidarity and respect for the family, influence medical ethics. The interaction of Western medicine and traditional indigenous medicine is also a relevant aspect to consider.
- The variability of values and beliefs in Ecuadorian society can give rise to different expectations and perspectives on medical care and ethical decision-making [15].
- Cultural beliefs clash with ethical principles, which can lead to difficult ethical dilemmas in clinical practice.

After defining the subsets, the coordinating group summarizes that there are ethical regulations and efforts are made to promote equity and advances in medical technology. However, greater effort is required to ensure the uniform application of ethical principles and the protection of patients' rights throughout the Ecuadorian health system [16]. In addition, the analyzed set of influential components in medical ethics and bioethics in Ecuador was determined.

Second round

The experts are asked the following question: What is the level of importance between each subset? It must consider those with the greatest impact on medical ethics and bioethics in Ecuador. To do this, it was requested to evaluate according to the Torgerson neutrosophic scale (see Tables 5 and 6), to determine the cut-off points and scale of the neutrosophic indicators (see Table 7).

Table 5: Criteria validation level. Source: own elaboration.

Expert	NS1	NS2	NS3	NS4	NS5
E1	(0.92,0.1,0.12)	(0.50,0.55,0.5)	(0.92,0.1,0.12)	(0.3,0.75,0.80)	(0.92,0.1,0.12)
E14	(0.50,0.55,0.5)	(0.3,0.75,0.80)	(0.3,0.75,0.80)	(0.7,0.2,0.25)	(0.92,0.1,0.12)
E19	(0.7,0.2,0.25)	(0.50,0.55,0.5)	(0.7,0.2,0.25)	(0.10,0.90,0.95)	(0.92,0.1,0.12)
E25	(0.7,0.2,0.25)	(0.7,0.2,0.25)	(0.92,0.1,0.12)	(0.7,0.2,0.25)	(0.10,0.90,0.95)
E36	(0.50,0.55,0.5)	(0.3,0.75,0.80)	(0.7,0.2,0.25)	(0.50,0.55,0.5)	(0.3,0.75,0.80)
E51	(0.10,0.90,0.95)	(0.10,0.90,0.95)	(0.3,0.75,0.80)	(0.7,0.2,0.25)	(0.3,0.75,0.80)
E52	(0.50,0.55,0.5)	(0.10,0.90,0.95)	(0.50,0.55,0.5)	(0.7,0.2,0.25)	(0.92,0.1,0.12)
E55	(0.92,0.1,0.12)	(0.50,0.55,0.5)	(0.3,0.75,0.80)	(0.7,0.2,0.25)	(0.10,0.90,0.95)
E64	(0.92,0.1,0.12)	(0.50,0.55,0.5)	(0.3,0.75,0.80)	(0.3,0.75,0.80)	(0.3,0.75,0.80)
E74	(0.10,0.90,0.95)	(0.92,0.1,0.12)	(0.92,0.1,0.12)	(0.3,0.75,0.80)	(0.10,0.90,0.95)
E75	(0.10,0.90,0.95)	(0.10,0.90,0.95)	(0.7,0.2,0.25)	(0.7,0.2,0.25)	(0.3,0.75,0.80)
E76	(0.92,0.1,0.12)	(0.3,0.75,0.80)	(0.7,0.2,0.25)	(0.3,0.75,0.80)	(0.92,0.1,0.12)
E78	(0.10,0.90,0.95)	(0.50,0.55,0.5)	(0.50,0.55,0.5)	(0.10,0.90,0.95)	(0.50,0.55,0.5)

Table 6: Relative frequency, neutrosophic cumulative probability. Own elaboration.

INDICATORS	(0.9;0.1;0.1)	(0.75;0.25;0.20)	(0.50;0.5;0.50)	(0.35;0.75;0.80)	(0.10;0.90;0.90)
Representation	**ES**	**VU**	**U**	**NU**	**UL**
NS1	0.3077	0.4615	0.6923	0.6923	1.0000
NS2	0.0769	0.1538	0.5385	0.7692	1.0000
NS3	0.2308	0.5385	0.6923	1.0000	1.0000
NS4	0.0000	0.4615	0.5385	0.8462	1.0000
NS5	0.3846	0.3846	0.4615	0.7692	1.0000

Table 7: Calculation of cut-off points and scale of neutrosophic indicators. Source: own elaboration.

Ind.	ES	VU	U	NU	UL	$\overline{x}$	N -$\overline{x}$	$\overline{N}$	SVNN	Order
NS1	-0.50	-0.10	0.50	0.50	3.50	0.78	**-0.09**	**-0.09**	(0.50,0.55,0.5)	**2**
NS2	-1.43	-1.02	0.10	0.74	3.50	0.38	**0.31**	**0.31**	(0.3,0.75,0.80)	
NS3	-0.74	0.10	0.50	3.50	3.50	1.37	**-0.68**	**-0.68**	(0.7,0.2,0.25)	**1**
NS4	-3.50	-0.10	0.10	1.02	3.50	0.20	**0.49**	**0.49**	(0.3,0.75,0.80)	
NS5	-0.29	-0.29	-0.10	0.74	3.50	0.71	**-0.02**	**-0.02**	(0.50,0.55,0.5)	**2**
Cut points	**-1.29**	**-0.28**	**0.22**	**1.30**	**3.50**	**0.69**	**=N**			

The determination of the degree of neutrosophic relevance of each dimension analyzed by the experts indicates that *subset 3* (NS3*), education in medical ethics and bioethics*, represents a degree of representativeness or *very useful* according to the classification obtained from the cut-off points. Therefore, work must be done to enhance medical ethics and bioethics in health professionals in Ecuador. To this end, the solution actions are proposed for each response presented in the analyzed subset:

- Strengthening training and education programs in medical ethics and bioethics is essential. This includes required courses in ethics for medical students and practicing health professionals.
- Evaluate and improve the quality and coherence of training programs. An accreditation body can be created to ensure that programs meet established ethical standards.
- Implement oversight and accountability mechanisms to ensure that health professionals comply with ethical principles in their daily practice. Sanctions may be applied in case of ethical breach.

In addition, the subsets *NS1 legal and regulatory framework* and *NS5 culture and social values* with secondary impact on medical ethics and bioethics in Ecuadorian health professionals were selected within the classification as *useful*. Ultimately, choosing the subset most effective in advancing medical ethics and bioethics in Ecuador depends on judgment and balance, as well as adaptability and willingness to address ongoing challenges.

Finally, consensus among the participants of the expert panel must be determined. To this end, the coordinating group considered such a level of consensus to have been reached, thus producing the conclusion of the process (see Table 8). Therefore, the consensus among the responses for the five subsets analyzed is met.

Table 8: Coefficient of agreement between the participants of the Expert Panel. Source: own elaboration.

Expert	NS1	NS2	NS3	NS4	NS5
E1	YES	YES	YES	YES	YES
E2	YES	YES	YES	YES	YES
E3	YES	YES	YES	NO	YES
E4	YES	NO	YES	YES	YES
E5	YES	YES	YES	YES	YES
YES	**5**	**4**	**5**	**4**	**5**
NO	**0**	**1**	**0**	**1**	**0**
Coefficient	**100**	**80**	**100**	**80**	**100**

Conclusion

The neutrosophic analysis of medical ethics and bioethics in Ecuador reveals the complexity of these fields in the context of medical care in the country. There are multiple perspectives, challenges, and ethical dilemmas that healthcare professionals must address. Health policy, conflicts of interest, medical research, advanced technology, and clinical dilemmas are principles that contribute to this complexity. To advance in these fields, a multidisciplinary approach that takes into consideration the different opinions and ethical values that converge in the Ecuadorian health system is essential. Furthermore, continued dialogue and ethical reflection are needed to find solutions

that respect patients' rights and promote the quality of medical care in Ecuador.

The analysis of the neutrosophic Delphi method has defined that the greatest problems that affect the development of medical ethics and bioethics in Ecuador are found in the NS3, NS1, and NS5 subsets. Among them stands out the *education in medical ethics and bioethics*. Additionally, solution actions were identified to address deficiencies in medical ethics and bioethics in Ecuador. From a neutrosophic perspective, the need to establish clearer standards and protocols is recognized. So that effective sanctions and supervision are carried out to guarantee ethical and bioethical compliance.

Policies and practices in medical ethics and bioethics are not static, they evolve and must adapt to new circumstances and challenges. Reflection and constant feedback are essential to ensure that policies and practices remain aligned with the ethical values and objectives of bioethics in Ecuador. Addressing these issues requires a continued commitment to medical ethics and bioethics, as well as improving training and ethical oversight in the Ecuadorian health system.

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Received: October 29, 2023. **Accepted:** December 18, 2023