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Management of Indeterminacy in the Analysis of Knowledge about Reproductive Tract Infections in Women

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Abstract. The research aims to assess the level of knowledge about reproductive tract infections among women to apply statistical analysis of the probability of indeterminacy. The main methods and techniques used were: theoretical, analytical-synthetic, and inductive-deductive, while within the empirical are the survey, measurement, and statistical-mathematical. The sample was calculated using neutrosophic statistics and python interval arithmetic library. The results achieved are evaluated quantitatively and qualitatively, where the validity of the same was demonstrated since there was a level of significance equal to or less than p 0.05.

Keywords: analysis, indeterminacy, infections, reproductive tract, neutrosophic sampling

1 Introduction

Infections of the female genital tract, in addition to the physical and emotional problems that they cause in patients, constitute an economic loss of appreciable proportions to the health system, both in women in industrialized countries and the female population of developing countries [1], [2]. On the other hand, female genital tract infections are an important health problem in medicine and one of the main reasons for consultation in Primary Health Care in women of reproductive age [1],[2].

Factors that may explain the higher frequency of these infections include induced abortion, which in developing countries is an important cause of serious and fatal infectious diseases; the increase in gynecological and obstetric diagnostic examinations, fostered by advances in health systems these days.

This condition can be associated with the invasion and multiplication of pathogenic microorganisms in the vagina from external or internal sources. The germs that are part of the normal microbiota intervene, which by different factors modify the acidic pH of the vagina, which normally remains between 3.5 and 4.5.

The alteration of the pH produces the imbalance of the vaginal microenvironment, with the consequent decrease or disappearance of the protective effect of the lactobacillary microbiota. The change produced facilitates the rapid and uncontrolled growth of harmful biological agents and the formation of metabolic wastes such as flow, inflammation, and irritation of the vaginal walls. The changes produced are frequently associated with bacterial vaginosis, trichomoniasis, and vaginal candidiasis [2], [3].

A study by the World Health Organization shows that more than 90% of deaths are concentrated in low- and middle-income countries, where access to timely detection and treatment services is very limited [4]. That is why it becomes a serious health problem.

The clinical manifestations of female genital tract infections are many and varied, from simple vaginitis to septic shock, with a series of intermediate and progressive conditions such as endometritis, salpingitis, Tubo-ovarian abscesses, pelvic peritonitis, and peritonitis, as well as complications during pregnancy, postpartum and the puerperium [1], [2].

The importance of personal hygiene in women is indisputable since contact with urine, sweat, and vaginal secretion, in addition to the poor ventilation in that area, favor that the humidity generated does not evaporate completely, reasons for which they make the vagina more susceptible to infections [5], [6]

Several researchers agree that the lack of sexual hygiene can be the cause of sexually transmitted infections and when these are repeated, cause cervical cancer (CCU) [7], [8]. This pathology is the main cause of death from

gynecological cancer in Ecuador. That is why there is a need to enhance knowledge among females of different reproductive ages.

Bacterial vaginosis (BV) is a polymicrobial clinical entity resulting from the replacement of the normal vaginal microbiota of Lactobacilli spp. Producers of hydrogen peroxide due to high concentrations of anaerobic bacteria such as Prevotella spp., Mobiluncus spp., Bacteroides spp., Peptoestreptococcus spp., Peptococcus spp., Gardnerella vaginalis, and Mycoplasma hominis. In women with BV, the concentration of G. vaginalis is 100 to 1 000 times higher than in women without this disease and is considered its main causative agent.

Another vaginal infection is trichomoniasis. This condition is among one of the most common sexually transmitted STIs. Its causative agent is Trichomonas vaginalis, a flagellated protozoan parasite that infects the male and female urogenital tracts. Risk factors involved include having multiple sexual partners and having unprotected sexual contact. [9]

There are numerous investigations carried out on this subject, among them the following stand out: Cutié and collaborators in their study obtained a positivity of 49.2% in the samples taken at best with some type of symptom of reproductive tract infections. [1]

On the other hand, Ortiz et al. identified 50.3% [10], while Gallardo and others did it for 87% [11]. A question that denotes that the positivity of samples in women with some reproductive tract infection is increasing every day.

Authors such as Ortiz and Martínez applied a group of surveys and managed to identify that the average age of the patients with vaginal infections was 35 years, with a range of 17 to 74 years and the average age of initiation of the first sexual relations was of 17 years with a range of 12 to 36 years, which coincides with some authors who state that these clinical entities are more frequent in women who are fully sexually active [11], [12].

According to the bibliography consulted, during pregnancy, infection is more frequent in the third trimester of pregnancy. In this physiological period, high levels of estrogens and glucocorticoids are produced, which results in a reduction of vaginal defense mechanisms and a relationship between vaginal infection by Candidas spp., and early pregnancy complications such as the low birth weight fetus and prematurity [3].

On the other hand, the early initiation of sexual intercourse, use of intrauterine devices and vaginal douches, promiscuous sexual behavior, pregnancy, hormonal treatments, and suffering from diseases, such as decompensated diabetes mellitus or others that cause depression of the immune system, are factors that predispose women to vaginal infections; In this study, there was a relationship between the risk factors explored and the frequency of these clinical entities [13].

As can be seen in the researches consulted, reproductive tract infections in women are a serious health problem both personally and for a certain country. Within the fundamental perspectives of the different health systems (prevention, education, and treatment of diseases), it is undoubtedly the first two important pillars.

That is why tools are required to identify the level of knowledge about reproductive tract infections among women. Neutrosophic statistics, and especially neutrosophic probabilities, are used for this purpose. Which starts from the event E, has the probability that event E occurs, the probability that event E does not occur and the probability of indeterminacy (not knowing whether event E occurs or not). For example, in classical probability nsup ≤ 1, while in neutrosophic probability nsup $\leq 3^+$ [14].

Therefore, the objective of this work was to apply statistical analysis of the probability of indeterminacy in the assessment of the level of knowledge about reproductive tract infections among women.

2 Materials and Methods

2.1 Subjects under study

Neutrosophic statistics were used to calculate the population. As the total population that participates in the research is known, it is calculated using the following expression 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). It is an expression that makes evident the degree of confidence that will be had that the true value of the parameter in the population found in the calculated sample. The absolute precision (d). It 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 is population size.

In this case, data for calculation are: a confidence level of 90% ,z = 1.645, d = 0.1 and p = 0.4, N = [20,36].

Calculations on the neutrosophic sample were made on Google Collaboratory online using python interval arithmetic library (Fig 1.)

Figure 1. Neutrosophic sample calculation in Google Collaboratory

The result of the neutrosophic sample is n = [20, 36] indicates that the sample must be in values between 20 and 36 patients.

In the current study, participated 28 women of childbearing age, ranging in age from 22 to 40 with an average age of 33.6. They were all from the Guayas province of the Republic of Ecuador. Simple random sampling was performed using the random number technique.

2.2 Type of investigation

A descriptive cross-sectional study was carried out. The study complies with the postulates of the Declaration of Helsinki, where all patients signed informed consent. Where the data were tabulated and interpreted exactly as the members of the sample expressed them.

2.3 Instruments

The investigative logic was guided by the use of methods and techniques that are described below:

Analytical-synthetic: allowed to carry out a study about the theoretical and methodological foundations that support the management of indeterminacy in the analysis of knowledge about reproductive tract infections in women. It was used for the systematization, generalization, and specification of the processed information. It was useful in interpreting the empirical information obtained, as well as in preparing the proposal.

Inductive-deductive: it allowed to make inferences and generalizations about the management of indeterminacy in the analysis of knowledge about reproductive tract infections in women, as well as the interpretation of the data obtained, from which new logical conclusions are deduced.

Measurement: it was used to identify the transformations that occurred in the selected sample by using the survey applied to the women involved in the study.

Survey: It was carried out on 100% of the members of the study sample, as this was the instrument used to assess the women involved in the research regarding their level of knowledge about reproductive tract infections in women.

Questions:

1- Do you know which are the main reproductive tract infections in women?

2- What are its symptoms and signs?

3- What are the ways to prevent reproductive tract infections in women?

4- Do you know the complications that reproductive tract infections can cause among women?

Neutrosophic method used:

For the neutrosophic statistical analysis developed, the workflow of 5 activities was taken into account. Statistical analysis is based on a neutrosophic environment to model uncertainty. Therefore, the steps described above are presented below.

Step 1 Identification of the problem situation to be investigated

Step 2 Selection and development of instruments

Step 3 Application of the instruments

Step 4 Data analysis and interpretation

Step 5 Validation of the results

For the analysis of the behavior of the sample, we used the level of neutrosophic significance [15], [16], [17]. The level of neutrosophic significance α can be a set, not necessarily a crisp number as in classical statistics [18], [19]. A P Neutrosophic value is defined in the same way as in classical statistics: the smallest significance level at which a null hypothesis H0 can be rejected.

The distinction between the classical P-value and the neutrosophic P-value is that the neutrosophic P-value is not a crisp number as in classical statistics, but a set (in many applications it is an interval).

Neutrosophic P value = P z > z critical value when H0 is true where P (*) means classical probability calculated assuming that H0 is true, the probability of observing a test statistical value is more extreme than what was obtained.

2. 4 Statistical analysis used

Statistical analyzes were performed with SPSS v. 20 (SPSS Inc., Chicago, IL, United States). The data relating to descriptive statistics will be presented through the distribution of frequencies, while inferential statistics were used, particularly the non-parametric Chi-square test with Yates correction.

3 Results

When tabulating the results of the survey applied to the women who are part of this study, the results described below are corroborated by questions.

Figure 2 illustrates the results of question 1. Where it can be noticed that only a minority of 9 women for 32.2% stated that they knew about the main reproductive tract infections. On the other hand, the majority of the study sample considered the opposite, that is, no, this was reflected in 17 of them for 60.7% of the total women investigated. In contrast, 2 of them (for 7.1%) decided not to talk about it. As shown, there is ignorance of the majority of the investigated women about the main infections.

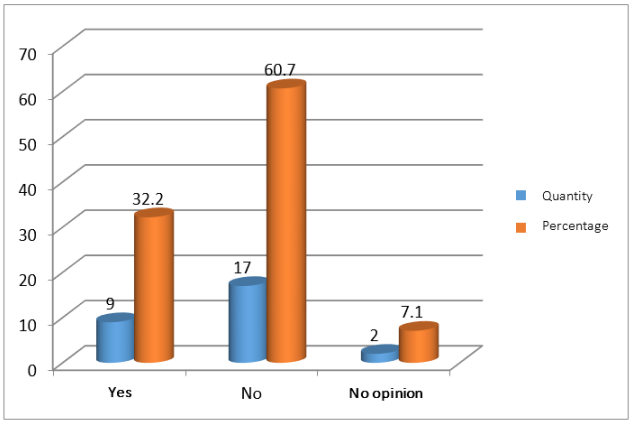

Figure 2. Results obtained in question 1 Source: Microsoft Excel for Windows processing results.

Figure 3 shows the results of question 2 on the content of women's knowledge about the symptoms and signs of reproductive tract diseases. Where, like the previous question, the minority of the sample under study knows the main signs and symptoms (8 for 28.5). Most of the women said they did not know them (18 for 64.4). While 2 for 7.1% did not have an opinion.

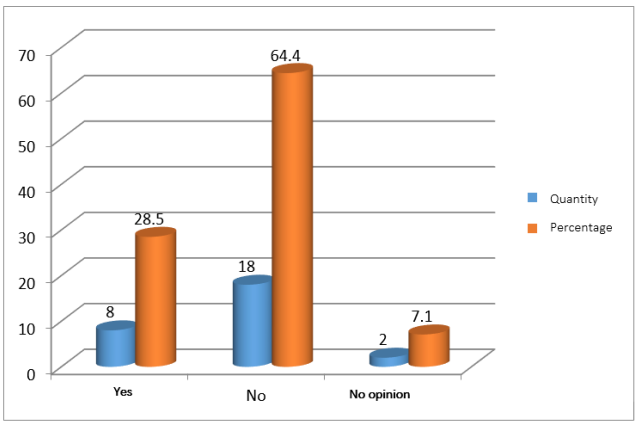

Figure 3. Results obtained in question 2. Source: Microsoft Excel for Windows processing results.

Figure 4 makes it evident that once again the minority of the women in the study are those who know the ways to prevent reproductive tract infections. This is reflected in that 10 of them for 34.7% indicated the *yes* option in the applied survey. While most of them 16 for a 57.1% consider not knowing them, this is an aspect that should be deepened in future research because the best treatment to deal with these diseases is prevention. On the other hand, only 2 women for 7.1% decided not to give their opinion and left the questionnaire blank.

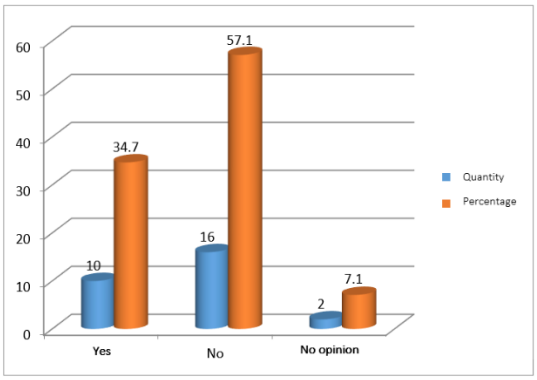

Figure 4. Results obtained in question 3. Source: Microsoft Excel for Windows processing results.

The last question of the survey (4) is represented in figure 5, where it is revealed that only 5 women for 17.9% of the total under study showed knowledge of the complications that reproductive tract infections may cause. While they *did not know about this*, the majority of the sample (21 for 75%) and only 2 for 7.1 did not have an opinion on the subject.

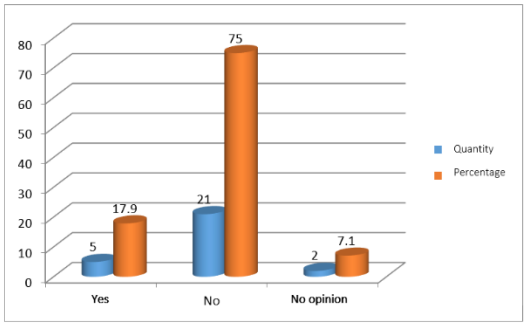

Figure 5. Results obtained in question 4 Source: Microsoft Excel for Windows processing results.

Results shown in each of the questions in the survey make it clear that intervention type research is required to enhance the knowledge of women regarding this topic. That is why it is suggested to develop brochures that illustrate the basic contents of reproductive tract diseases, to increase health education for this population group.

Study validation

For the validation of the study, three specific moments were taken into account, the first one directed to the hypothesis statement, the second to the application of the Chi-square test, and the third to the confirmation or not of the hypothesis.

Moment 1. State the statistical hypotheses that respond to the proposed objectives

Statistical hypothesis: H0: $\mu = \mu 0$

H0: Women do know about reproductive tract infections

H1: $\mu \neq \mu 0$

Ha: Women don't know about reproductive tract infections

Moment 2

The results obtained are shown in table 1. For which the data were processed with the statistical package SPSS v. 20 (SPSS Inc., Chicago, IL, United States). The results obtained through this are presented below.

Contrast statistics				
	Main infections	Symptoms and	Ways to	Complications
Chi-square	12,071[a]	14,000[th]	10,571[a]	22,357[a]
gl	2	2	2	2
Next asympt.	, 002	.001	, 005	, 000
a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 9.3.				

Table 1. Results obtained with the application of the nonparametric test of chi-square with Yates correction. Source: results of the processing of the SPSS statistical package v.20

Moment 3

The analysis of frequency, carried out through the Chi-square test with Yates correction, shows the existence of a significant difference. Well, as shown in table 1, in the content of the four questions of the survey, values equal to or less than 0.05 were obtained. Which denotes that the null hypothesis (Ho) is rejected.

Conclusion

The analysis of the theoretical and methodological references on the level of knowledge about reproductive tract infections in women shows the existence of different bibliographic sources on the subject, however, tools that promote a current assessment of this problem are required.

The methodological logic followed was based on the general methods of science for the statistical analysis of the level of knowledge about reproductive tract infections in women. Neutrosophic sampling was calculated using python

The interpretation of the results offers validity to the research carried out, since using statistical analysis, particularly the non-parametric Chi-square test with Yates correction, which allowed the validation of the results obtained in this study.

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