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Neutrosophication of Statistical Data in a Study to Assess the Knowledge, Attitude and Symptoms on Reproductive Tract Infection among Women

Somen Debnath*

Department of Mathematics, Umakanta Academy, Agartala-799001, Tripura, India; somen008@rediffmail.com.

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Abstract

Statistics mainly concerned with data that may be qualitative or quantitative. Earlier we have used the notion of statistics in the classical sense where we assign values that are crisp. But in reality, we find some areas where the crisp concept is not sufficient to solve the problem. So, it seems difficult to assign a definite value for each parameter. For this, fuzzy sets and logic have been introduced to give the flexibility to analyze and classify statistical data. Moreover, we may come across such parameters that are indeterminate, uncertain, imprecise, incomplete, unknown, unsure, approximate, and even completely unknown. Intuitionistic fuzzy set explain uncertainty at some extent. But it is not sufficient to study all sorts of uncertainty present in real-life. It means that there exists data which are neutrosophic in nature. So, neutrosophic data plays a significant role to study the concept of indeterminacy present in a data without any restriction. The main objective of preparing this article is to highlighting the importance of neutrosophication of statistical data in a study to assess the symptoms related to Reproductive Tract Infections (RTIs) or Sexually Transmitted Infections (STIs) among women by sampling estimation.

Keywords: Neutrosophic statistics, Neutrosophic data, Sample size, Sexually transmitted disease.

1 | Introduction

Nowadays the concept of vagueness or ambiguity or uncertainty is very common in solving different real- life problems. Zadeh is the pioneer of introducing fuzzy sets in his work given in [18], which is recognized by the Mathematical fraternities and researchers from all over the world, as the most efficient tool to handle the vague concept in a systematic manner. So many theories and results have been introduced since then and it has been successfully implemented in various fields. To realize the importance of non-membership value it has been extended by introducing the intuitionistic fuzzy set initiated by Atanassov given in [1].

Corresponding Author: somen008@rediffmail.com

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Still, all these theories are not sufficient to express the indeterminacy involves in solving problems, which led to the introduction of the neutrosophic set proposed by Smarandache given in [13]. The Neutrosophic set enables us to handle incomplete, inconsistent, uncertain, and even unknown data. Since the introduction of the neutrosophic set theory, a lot of theories have been developed, some of them are given in [4], [5], [7], [10], [14], [15], [17].

Statistics mainly dealt with numerical data and by embedding this idea it has been used successfully in various applications of mathematics, economics, biology, psychology, probability, etc. By statistics, we simply mean classical statistics. In real life environment, due to indeterminacy involved in data, we cannot always get numerical data in exact form but sometimes we need to approximate them, which laid the foundation of neutrosophic statistics, introduced by Smarandache [16], as an extension of classical statistics. If any data is denoted by the symbol d then the neutrosophication of the same data is denoted by N_d and its set-theoretic representation is in the form $<T_d, I_d, F_d>$, where T_d, I_d and F_d are used to represent the true value, indeterminate value and the false value respectively of the given data. Under the neutrosophic environment, the statistical data may be partially known, partially unknown, and may be completely unknown and it is due to the incomplete knowledge or information as far as the problem is concerned. Unlike classical statistics where data are known (crisp values), in neutrosophic statistics there exists some indeterminacy (approximate the crisp values) in the data. If there is no indeterminacy then we say that neutrosophic statistics coincides with classical statistics. In neutrosophic statistics, a sample size cannot be denoted by a single value but it can be represented by an interval. For example, in neutrosophic statistics, we consider an approximate sample size as $n= [40, 80]$ i.e. between 40 and 80.

As per the World Health Organization (WHO), STIs have a profound and great impact on sexual and reproductive health worldwide. STIs like herpes and syphilis can increase the risk of HIV acquisition. Mother to child transmission of STIs can result in low-birth-weight, neonatal death, prematurity, and congenital deformities. Low and middle-income countries rely on identifying consistent, easily recognizable signs and symptoms to guide treatment, without the use of laboratory tests. This is known as syndrome management. This approach allows health workers in rural areas to diagnose a specific infection based on observed syndrome (i.e. vaginal discharge, urethral discharge, abdominal pain, genital ulcers,etc). Rizwan et al. [9] conducted a study on assessed knowledge, attitude and, practices on STIs among married women aged 15-45 years in rural Haryana. Geetha [6] conducted a study on the prevalence of RTIs among rural married women in Tamil Nadu, India. Shingade et al. [12] conducted a study on treatment-seeking behavior for RTI/STIs among married women in urban slums of Mumbai, India. Sangeetha [11] study reproductive tract infections among pregnant women in the reproductive age group in Hubli, Karnataka, India. In 2019, Durai et al. [2] studied reproductive tract infection in rural India. Kafle et al. [3] discussed prevalence and factors associated with reproductive tract infection. Naderi et al. [8] conducted a study based on reproductive tract infection among women suffering from rheumatoid arthritis in India.

Reproductive tract infection (both sexually and non-sexually) of the reproductive tract is a colossal public health problem that is exceedingly prevalent worldwide. RTIs are one of the most prevalent health morbidities among women throughout the world especially, in developing countries. These are due to the infection of the reproductive system and the group of communicable diseases that are transmitted predominantly by sexual contact and caused by a wide range of bacterial, viral, protozoan, and fungal agents. Sexual diseases, whose mode of transmission is known, are largely preventable, but due to lack of knowledge about the sexual disease, it spreads rapidly in India as it has a large population. In Southeast Asia, young people do not typically have access to sex education and are poorly informed about how to protect themselves from unwanted pregnancies, STDs, and HIV/AIDS. Women suffer more adverse consequences from STDs than men because generally it is easier for STDs to be transferred from men to women.

About one-third of women from rural India had reported anyone new symptoms of RTI/STIs. Women especially in rural India have a lot of misconceptions regarding RTIs. They are submissive to men socially and economically and they have less control over their sexuality. Low-level of literacy and ignorance among rural women result in misconceptions about the illness. RTIs are often asymptomatic in women and may often go, undiagnosed, and untreated until complications like infertility supervene. Some of the common complications of RTI's include highly destructing, Pelvic Infertility Disease (PID), ectopic pregnancy, infertility, adverse outcomes of pregnancy, neonatal morbidity, and death. SIT's facilitate HIV transmission.

In India, steps are taken to reduce RTI/STI's but still, it is major problem affecting the reproductive age group of women. Despite all the efforts, inadequate knowledge and attitude on RTI/STI's and limited adherence to treatment are the major factors contributing to the success of RTI/STI's. Knowledge, attitude, and awareness about symptoms are essential to prevent and treat RTI/STI's during reproductive age group women.

Earlier crisp theory was introduced to assess data. But human theories do not always obey the crisp concept. That is two valued logic is no more an appropriate tool to emulate human thinking. Some theories are vague, imprecise, uncertain or fuzzy in nature. However, fuzzy data cannot define all sorts of uncertainty present in various fields. This leads to the introduction of neutrosophic data. With an aid of neutrosophic data we can explain uncertainty involved in a data. So, there is a need of neutrosophic data in a present study. The purpose of the study is to assess the knowledge, attitude, and self-reported symptoms on RTI/STI's among rural women where all the information related to RTI/STI's are indeterminate or neutrosophic in nature. Also, we approximate the sample size to make our study simple and concrete.

2| Neutrosophic Data

It refers to the kind of statistical data that contains some/complete indeterminacy and it is represented in the form of an interval. It is an extension of classical statistical data in which the data represented by a single definite numerical value. We have the following definitions:

Definition 1. [16]. A neutrosophic data is said to be discrete neutrosophic data if the values are isolated. For example $8+\mathfrak{I}_1$, where $\mathfrak{I}_1 \in [1, 3]$, $5+7\mathfrak{I}_2$, where $\mathfrak{I}_2 \in [2, 5], 17$, etc.

If the values form one or more intervals then it is called the continuous neutrosophic data. For example: *[0.1, 0.6]* or *[0.2, 0.8]* (not sure exactly).

Definition 2. [16]. A data is said to be quantitative neutrosophic data if it is numerical. For example: any value in the interval *[3, 8]; 23, 45, 67* or *34* (don't know exactly).

A categorical data is called qualitative neutrosophic data. For example a pen or pencil, black or white.

Definition 3. [16]. A data is said to be a univariate neutrosophic data if it consists of observations on a neutrosophic single attribute. In the case of two or more attributes, it is called multivariate neutrosophic data.

Definition 4. [16]. A table that contains categories, frequencies and, relative frequencies with some indeterminacies is called a neutrosophic frequency distribution table.

For example, number of failed subjects (when we do not know exactly) by students can be represented in the following neutrosophic frequency distribution *Table 1*.

Table 1. Neutrosophic frequency distribution.

Number of Failed Subjects	Neutrosophic Frequency	Neutrosophic Cumulative Frequency
0	60	[0.214, 0.316]
1	[40, 80]	[0.167, 0.348]
2	[60, 90]	[0.24, 0.41]
3	[30, 50]	[0.115,0.238]
Total 0-3	[190, 280]	

3| Methodology (Sampling Criteria)

The study was mainly designed to assess the knowledge, attitude, and self-reported symptoms on RTI/STIs among women at selected villages in South Tripura district, India. In this work, quantitative research is used where we have the indeterminacy in sample size. Sample individuals are asked questions and they reply voluntarily but sometimes they have a biased response which may influence the results and there may be some malicious people who might answer the opposite of the questions. The study is conducted in the 9 villages of Rural Health and Training Center (RHTC) at South Tripura district which covers 32 villages with a population of 13,992.

The population of these villages is 702,284,443,123,837,271,501,327 and 211, respectively. The number of outpatients attending RHTC is 120-150 patients daily. These villages are situated at a distance of 2-3 km from RHTC and the majority of the population is Hindu. By occupation, most of the village people are farmers. The target population for the study included married women in the age group of 15-49 years. They are willing to participate and able to speak and understand Bengali (non-Tribe) or Kokborok (Tribe) or English (official) languages and they live with their husband. The sample size is determined by the assumption that only 35.4% to 44.6% of the women are knowledgeable on RTI/STIs with the marginal error of 5% to 10% and 90% to 95% CI. Based on this assumption, the approximate sample size for the study is determined using the formula given by:

$_{approx} = \frac{^{2}pq}{min(d^2)}$, where = value corresponding to 90% to 95% level of significance ([1.64, 1.96]).

p =expected proportion of knowledge on maternal care among women ([0.354, 0.446]).

q =1- p = [1-0.446, 1-0.354] = [0.554, 0.646].

d =absolute precision= [0.05, 0.1].

Then, $_{approx} = \frac{[0.518, 1.123]}{min[0.0025, 0.01]}$ = [207,449].

The size of the sample size should be ranging from 207 to 449 based on our survey. So it is called a neutrosophic sample size. If both the values converge then it reduces to classical sample size.

The data are collected from the sample size of [207,449] (as there exists indeterminacy) to find out their knowledge, attitude, and self-reported symptoms on RTI/STIs. The study findings are arranged and presented in the following sections:

Section A: Distribution of women according to their background variables.

Section B: The knowledge, attitude and self-reported symptoms and score of women on RTI/STIs.

Section C: The correlation between the knowledge and attitude of women.

Section D: The association between the knowledge, attitude, self-reported symptoms, and background variables of women.

Distribution of women according to their Demographic variables shown in *Table 2*.

Table 2. Distribution of women according to their demographic variables.

Demographic Variable	N	%
Age (in years)	**[80,240]**	
18-26	110	[0.277,O.653]%
27-35	[17,99]	[0.245,0.531]%
36-45		[0.047,0.342]%
Educational Status		
No formal education	72	[0.16,0.348]%
Primary	[70,150]	[0.19,0.526]%
Upper primary	[30,90]	[0.077,0.337]%
High school	[20,82]	[0.051,0.304]%
Higher secondary	[10,50]	[0.024,0.202]%
Graduate	5	[0.011,0.024]
Occupational Status		
Unemployed/house wives	[120,250]	[0.376,0.742]%
Unskilled worker	25	[0.056,0.121]%
Skilled worker	20	[0.044,0.097]%
Clerical/shop owner/farmer	[37,149]	[0.11,0.72]%
Professional	5	[0.011,0.024]%
Type of Family		
Nuclear family	120	[0.267,0.58]%
Joint family	[50,280]	[0.229,0.64]%
Extended family	[37,49]	[0.085,0.224]%
Information about RTI/STIs		
Friends	[20,120]	[0.057,0.39]%
Family	45	[0.1,0.217]%
School/college	[20,40]	[0.047,0.176]%
Television	[35,80]	[0.087,0.317]%
Magazine	[20,70]	[0.05,0.272]%
Internet	[24,37]	[0.055,0.168]%
Hospital/clinic	35	[0.077,0.169]%
Others	[8,22]	[0.017,0.106]%

All the above findings can also be represented in the form of diagrams to visualize the information at a glance (the knowledge, attitude, and self-reported symptoms score of women's on RTI/STIs).

Distribution of level of knowledge on RTI/STIs $(approx = [207, 449])$ are given in *Table 3*.

Table 3. Distribution of level of knowledge on RTI/STIs.

Level of Knowledge on RTI/STIs	N	%
Adequate (76-100%)	0	0
Moderately Adequate (51-75%)	[120,180]	[0.308,0.674]%
Inadequate (0-50%)	[87,269]	[0.326,0.691]%

Distribution of level of women's attitude on RTI/STI $(_{approx} = [207, 449])$ are given in *Table 4*.

Table 4. Distribution of level of women's attitude on RTI/STIs.

Level of Attitude on RTI/STIs	N	%
Highly favorable (76-100%)	0	0
Favorable (51-75%)	[150,332]	[0.562,0.853]%
Unfavorable (<50%)	[57,117]	[0.146,0.438]%

Distribution of level of self-reported symptoms on RTI/STIs among women $(_{approx} = [207, 449])$ given in *Table 5*. Mean (M), Standard Deviation (S.D), and Coefficient of Variation (C.V) of knowledge and attitude on RTI/STIs $(_{approx} = [207, 449])$ are given in *Table 6*.

Table 5. Distribution of level of self reported symptoms on RTI/STIs among women.

Level of Self Reported Symptoms	n	%
No symptoms	60	[0.134,0.29]%
Mild symptoms (1-5)	[120,330]	[0.5,0.79]%
Severe symptoms (6-10)	[27,59]	[0.065,0.247]

Table 6. Knowledge and attitude on RTI/STIs $(_{approx} = [207, 449])$.

Knowledge And Attitude on RTI/STIs	Maximum Score	M	S.D	C.V= $\frac{S.D}{M} \times 100$	Range of C.V
Total knowledge	48	[14.3, 16.5]	[1.5,2.6]	[10.5,15.7]	5.2
General knowledge	6	[1.4, 2.6]	[0.45,0.88]	[32.1,33.8]	1.7
Signs and symptoms	15	[2.5, 3.5]	[1.1, 1.9]	[44, 54.2]	10.2
Prevention	10	[2.6,4.8]	[0.9,1.7]	[34.6, 35.4]	0.8
Complication	17	[3.4,5.6]	[1.4,2.6]	[41.1,46.4]	5.3
Total attitude	45	[28.6, 30.8]	[2.3, 3.6]	[8.04,11.68]	3.64

Table 6 shows that the signs and symptoms aspect has the highest range of C.V score and prevention has the lowest range of C.V score and the C.V score of total knowledge is [10.5, 15.7]. On the other hand, the C.V score of total attitude is [8.04, 11.68]. So it is well justified fact that less range of precaution leads to a wide range of signs and symptoms. Therefore, this preliminary study will help the health workers to take necessary steps to check the signs and symptoms by spreading awareness among the people so that they will be able to take preventive measures as necessary.

4| Limitation

Our study is limited to married women with age limit 15-49 years and they live with their husband. The assessment of attitude is limited for only one time and information on self-reported symptoms is obtained from the verbal response of the women and more importantly, here we use inclusion criteria for sampling estimation.

5 | Conclusions

The study is conducted under a neutrosophic environment in which there exists some or complete indeterminacy to assess the knowledge, attitude, and self-reported symptoms among women on RTI/STIs in selected villages of South Tripura District in India by assuming an approximate sample size and it is predicted as per our survey report is concerned. We also find the C.V score of knowledge and attitude. Current findings underscore the urgent need for culturally relevant and effective reproductive health education for rural women. Specifically, community-based interventions targeting these women in improvised environments should be implemented to reduce the extreme health disparity gap in the lives of women in rural areas. In the future, the same study can be conducted as a compared study between urban and rural women. A similar study can be conducted on female health workers to improve preventive and primitive health services and enhance the literacy of women which helps to improve reproductive health.

Conflicts of Interest

Declare no conflict of interest.

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References

[1] Atanassov, K. (1986). Intuitionistic fuzzy sets. *Fuzzy sets and systems*, *20*, 87-96.

[2] Durai, V., Varadharajan, S., & Muthuthandavan, A. R. (2019). Reprductive tract infections in rural India-a population based study. *Journal of family medicine and primary care*, *8*, *3578-3583.*

[3] Kafle, P., & Bhattarai, S. S. (2016). Prevalence and factors associated with reproductive tract infections in Gongolia village, Rupandehi district, Nepal. *Advances in Public Health.* https://doi.org/10.1155/2016/8063843

[4] Maji, P. K. (2013). Neutrosophic soft set. *Annals of fuzzy mathematics and informatics*, *5*, *157-168*.

[5] Maji, P. K. (2012). A neutrosophic soft set approach to a decision making problem. *Annals of fuzzy mathematics and informatics*, *3*, 313-319.

[6] Mani, G., Annadurai, K., & Danasekaran, R. (2013). Healthcare seeking behaviour of symptoms of reproductive tract infections among rural married women in Tamil Nadu-A community based study. *Online journal of health and allied sciences*, *12*, *1-4*.

[7] Mitra Basu, T., & Mondal, S. K. (2015). Neutrosophic soft matrix and its application in solving group decision making problems from medical science. *Computer communication and collaboration, 3(1), 1-31.*

[8] Naderi, J., Chopra, A., & Relwani, R. (2020). Reproductive tract infection among women suffering from rheumatoid arthritis in India: a clinical-based, cross-sectional study. *Jundishapur journal of microbiology, 13.* DOI:10.5812/jjm.97176

[9] Rizwan, S. A., Rath, R. S., & Vivek, G. (2015). KAP study on sexually transmitted infections/Reproductive tract infections (STIs/RTIs) among married women in rural Haryana. *Indian dermatology online journal*, *6*(1), 9-12.

[10] Sahin, M., Alkhazaleh, S., & Ulucay, V. (2015). Neutrosophic soft expert sets. *Applied mathematics, 6(1)*, 116-127.

[11] Sangeetha, S. (2012). A study of reproductive tract infections among pregnant women in the reproductive age group, in Urban Field Practice Area in Hubli, Karnataka, India. *Annals of tropical medicine and public health*, *5*(3), 209-*213.*

[12] Shingade, P. P., Kazi, Y., & Madhavi, L. H. (2015). Treatment seeking behavior for sexually transmitted infections/reproductive tract infections among married women in urban slums of Mumbai, India. *South east asia journal of public health*, *5*(2), 65-70.

[13] Smarandache, F. (2005). Neutrosophic set-a generalization of the intuitionistic fuzzy sets. *International journal of pure and applied mathematics*, *24*(3), 287–297.

[14] Smarandache, F. (1998). *Neutrosophy, neutrosophic probability, set and logic*. American Research Press.

[15] Smarandache, F. (2001). Preface: an introduction to neutrosophy, neutrosophic logic, neutrosophic net, and neutrosophic probability and statistics. *Proceeding of the first international conference on neutrosophy, neutrosophic logic, set, probability and statistics.* https://dl.acm.org/doi/proceedings/10.5555/779586

[16] Smarandache, F. (2014). Introduction to neutrosophic statistics. Zendo. DOI: 10.5281/zenodo.8840

[17] Tas, F., Topal, S., & Smarandache, F. (2018). Clustering neutrosophic data sets and neutrosophic valued metric spaces. Symmetry, *10*(10). https://doi.org/10.3390/sym10100430

[18] Zadeh, L. A. *(1965).* Fuzzy set. *Information and control*, *8*, *338-353.*